REDUCING INPUTS TO IMPROVE PROFITS: Good Or Bad Idea?

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ABSTRACT

In low price years like 2009, alfalfa growers scramble to find ways to improve profitability and often consider reducing inputs. However, many inputs are closely linked to yield or forage quality and cutting back could reduce overall profitability. Here, we consider several of the inputs where it may be feasible to cut costs and alternatively identify inputs that should not be reduced or eliminated. Seeding rates can be reduced in many cases provided the seedbed is optimum. However, growers should not cut corners when it comes to selecting an adapted high-yielding variety. Weed control in seedling alfalfa is critical but lower rates may be used in some cases when treatments are applied early. Similarly, weed control in established alfalfa is cost effective, and weedy hay is difficult to sell in a depressed market, but it may be feasible to use soil active herbicides alone without a contact herbicide when applied early in the season. Soil or plant tissue analysis is more important than ever in low price years to assess the fertility status of fields to predict the level of response to fertilizers. A reduced rate or skipping a year may be feasible. Irrigation water is closely linked to yield and other than by improving uniformity, opportunities to reduce irrigation without reducing yield are limited. While it is critical to examine costs in a low-priced year, some expenditures are clearly worthwhile since they result in improved profitability.

Key Words: alfalfa, *Medicago sativa*, economics, stand establishment, fertilization, weed control, irrigation

INTRODUCTION

The 2009 alfalfa production season has been one of the most challenging on record. Most people did not expect the record high prices of 2008 to continue indefinitely, but who at that time would have predicted that the price would plummet more than $100 per ton. Prices received in 2009 were equal to prices of decades ago but input prices (such as fertilizer, crop protection chemicals, fuel, energy, etc.) were more reflective of current-day prices. Additionally, sales have been sluggish, especially for mediocre quality hay. In many short-season areas of the Northwest, there were days or even weeks of rain at the time of first cutting resulting in an abundance of rain-damaged and over-mature alfalfa, which also tends to drag the price down. All in all, the 2009 alfalfa production season has been one that many producers would prefer to forget.

Growers will be preparing for the next season with caution given the shortage of cash for investment and the mediocre outlook for prices in the near future. A common approach, when faced with this situation, is to pull back on inputs. It is wise to carefully scrutinize inputs, especially in years when profit margins are slim; however, reducing inputs can lower yield and

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ultimately diminish profit. Rather than indiscriminately reducing inputs, it is critical to carefully examine each input to determine which are truly cost effective and which are less critical and could be reduced or postponed. Our objective in this article is to evaluate some of the inputs involved in alfalfa production and make a value judgment where a savings could and could not be made.

STAND ESTABLISHMENT

Stand establishment is unquestionably one of the most critical aspects of alfalfa production. The goal is to achieve a dense vigorous stand of alfalfa that will remain productive for a minimum of 3 to 4 years—and much longer than that in some production areas. Hence, don't scrimp on inputs that are likely to detract from your ability to achieve this goal. This said there may be some opportunities to reduce inputs if the producer is willing to accept a little more risk.

Deep Ripping. Deep ripping is perhaps the most costly of all stand establishment operations. The degree and depth of ripping or subsoiling necessary to establish a stand of alfalfa is not readily apparent. There is no set formula for all sites, and the degree of ripping required depends on the specific soil conditions at a site. One of the best ways to asses the need for deep ripping is to dig a backhoe pit prior to removing an old alfalfa stand and carefully examine the soil profile, root distribution and the presence of any visible impediments to root growth. If roots proliferate unimpeded to at least 3 to 4 feet deep, deep tillage is likely unnecessary. Moderate tillage that fractures subsurface impediments down to 12 to 14 inches is generally sufficient to break up compacted layers from equipment traffic.

No Till. No-till seeding of alfalfa may be another potential cost-saving measure. Because the alfalfa is seeded directly into the residue of the preceding crop, it reduces the number of field operations required to establish a stand and can lower costs. No-till seeding of alfalfa is not common in the West, but is used in other parts of the county and is very popular in some major alfalfa producing countries like Argentina, where no-till seeding of alfalfa after corn is common. There are risks associated with a no-till seeding. Alfalfa seed is very small which makes no-till seeding more problematic than it is with small grains or many other crops because precise seeding depth is critical. Emergence falls off considerably when seed is placed either too deep or too shallow. Crop residues from the preceding crop and unlevel terrain can make no-till seeding difficult. No-till seeding of alfalfa is most common following a small grain crop because the crop is usually planted flat and because the residue is finer and easier to deal with. No-till seedings are not appropriate for all soil types and are riskier than establishing a stand using conventional tillage techniques. No-till seedings have worked well on sandy soils where the soil surface remains fairly loose and achieving a firm seedbed is problematic. Wind soil erosion can also be a concern on these sites and the small grain stubble helps hold the soil in place. No-till seedings are more difficult in heavier soil and in situations where heavy equipment was used to harvest the previous crop.

Seeding Rate. There is a surprisingly wide range of seeding rates used by alfalfa producers in the West. Seeding rates range from as low as 10 pounds per acre to as high as 40 pounds per acre for some growers in the Central Valley of California. However, *how much seed is actually needed*? One pound of alfalfa seed per acre equates to approximately five seeds per square foot. So four pounds of alfalfa seed per acre would result in 20 plants per square foot, the number of

plants considered to be an adequate stand. However, only about 60 percent of the seeds typically germinate and emerge and 40 to 60 percent of the emerged seedlings may die in the first year. The percentage of plants that die during the first year increases the higher the seeding rate. The standard recommendation for California has been to seed 15 to 20 pounds per acre for drilled seedings and 20 to 25 pounds per acre for broadcast seedings to provide a cushion of insurance. Many states recommend lower seeding rates. When alfalfa prices are low and growers are searching for areas to cut costs, we believe it is feasible to reduce seeding rates without risking the success of the alfalfa planting provided the seedbed is properly prepared and effective seeding equipment is used. When Roundup Ready alfalfa was available with its higher seed costs, many growers realized it was possible to reduce seeding rates without jeopardizing productivity. Most studies conducted by alfalfa researchers suggest that there is little benefit to seeding over 10 pounds of pure live seed per acre. A seeding rate of 10 to 15 pounds is probably sufficient, especially when seeding with the press wheels found on some of the newer drills and more precise seeding depth. However, be sure to pay particular attention to depth control and soil preparation to assure high rates of stand success.

Coated vs. Raw Seed. Sometimes growers can select between raw seed and coated seed. The coating comprises about one-third of the weight of coated alfalfa seed so there is less seed per pound. The coating is primarily made of inert materials which may also contain fungicides, Rhizobia bacteria and sometimes fertilizers. Seed coating is used for several reasons but a common reason is simply to extend seed supplies when seed is in short supply. Coatings are also used to provide a fungicide or Rhizobium bacteria in close proximity to the seed to enhance seedling survival and development. Coated seed has not been found to be consistently better than raw seed in research trials. Large losses from diseases can occur but are rare and in most cases seed coatings do not appear to significantly improve stand density. Therefore, unless seedling diseases are common in your area you may be willing to assume some risk and forgo coated seed and plant raw seed at a lower rate (as noted in section above) to save on seeding cost.

Planting a Less Expensive Variety. Is it a good idea to buy the cheapest alfalfa seed? The price of alfalfa seed can vary greatly, especially between a top yielding new variety with improved germplasm and an older public variety (like Vernal or Moapa 69) or a VNS (variety not stated) bag of seed. The potential savings for a grower can be as much as $30 per acre or more. However, this is an example where being ‘penny wise’ is likely to be ‘dollar foolish’, at least in most cases. Improved alfalfa varieties are worth hundreds of dollars more per acre in potential yield compared with older, unimproved seed, or seed of questionable origin. This has been shown consistently in University variety trials throughout the United States. Remember that it only takes less than 1 tenth of a ton yield increase each year to pay for even a $2/pound increased seed price, an amount that is easily surpassed by many improved lines. Figure 1 shows that the yield increase in the first year alone was enough to more than cover the cost of an improved variety using data from an alfalfa variety trial in Tulelake CA. The returns over the life of a stand can be significant. An improved variety can result in as much as $900 per acre higher returns over three years, as shown using data from the Central Valley of California (Figure 2). If you want to save money during seeding, adjust your seeding rate downward and do a more careful job (seeding time, weed control, etc.), but select a top-yielding variety with high resistance to diseases, insects, and nematodes—it’s worth the price.

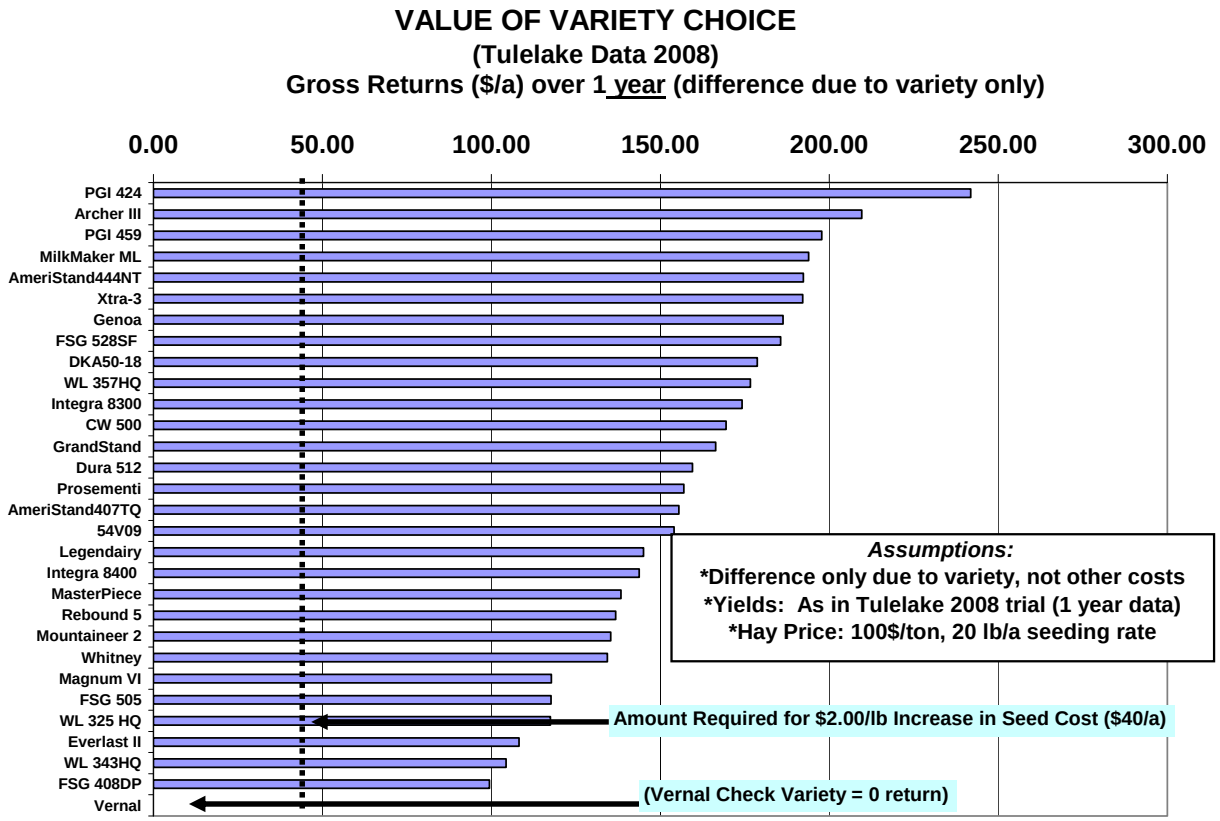

Figure 1. Comparative gross returns ($/A) of varieties planted at the Tulelake Research and Extension Center, Tulelake, CA considering only one year of production, data from UC alfalfa trials.

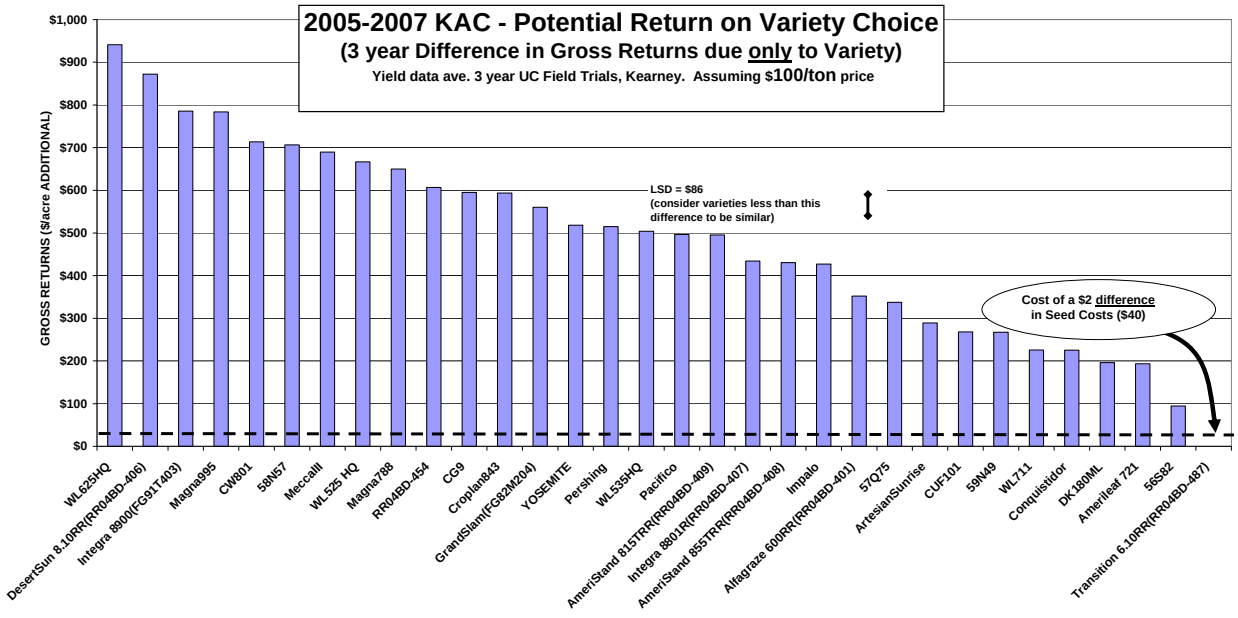

Figure 2. Comparative gross returns ($/A) of alfalfa varieties planted at the Kearney Agricultural Center, Fresno, CA, considering only the 3 year differences in production compared with the lowest-yielding variety. Dotted line represents a $2.00/lb increase in seed cost at a 20 lb/A seeding rate.

Weed Control. It may be tempting to consider eliminating chemical weed control sometime over the life of an alfalfa stand; however, the seedling phase is not the time. Weeds always compete with alfalfa for light, nutrients, water and space but this competition is especially intense in seedling alfalfa. Weeds not only reduce the quality of the first harvest of a seedling alfalfa field but dense weed infestations can thin alfalfa stand density reducing the long-term productivity of the stand. Also, weeds left uncontrolled will set seed and cause problems for years to come. Chemical weed control in seedling alfalfa is almost always economically justified.

The key to effective weed control in seedling alfalfa is proper weed identification. No single herbicide controls all the weed species that may be encountered in a seedling alfalfa field so herbicide tank mixes might be necessary. Most growers rely completely on postemergence herbicides for weed control in seedling alfalfa. This allows proper weed identification before selecting the herbicides. Common treatments include Raptor (imazamox) alone to more elaborate tank mixes such as Pursuit plus Select (imazethapyr plus clethodim) or Raptor plus Pursuit plus 2,4–DB. When you figure a price reduction in the neighborhood of at least $20 per ton for weedy seedling alfalfa and a first cutting yield of 1.5 to 2.0 tons, the cost of the herbicide is often covered by the difference in price alone, not counting the improvement in alfalfa vigor, stand density and the reduction in the weed seed bank.

Cutting back on seedling weed control practices to cut costs is shortsighted if it results in a significantly reduced level of weed control. However, there may be ways to achieve nearly perfect weed control at a lower cost. The importance of proper weed identification cannot be overstated because proper weed identification improves herbicide selection. If tank mixes are not needed this may be an area to cut costs. Treating at the optimum time is another way to cut costs. Simply stated, small weeds are easier to kill so treat at the minimum alfalfa growth stage stated on the label. Oftentimes growers wait to treat until it is obvious that weeds are a problem but by that time it is ordinarily too late. By treating early it may be feasible to use the middle rate stated on the label rather than being forced to apply the highest label rate.

FERTILIZATION

Of all the different inputs involved in alfalfa production, fertilizer is perhaps the first one that growers consider eliminating when hay prices fall. However, oftentimes the growers that consider not fertilizing in low-price years are the ones that can least afford to do so. They are typically the ones that may have scrimped in the past and the fertility level of their field is low enough that fertilizer is important even in a low price year. Growers that have fertilized most years and have maintained at least adequate fertility levels may be able to cut back or skip fertilizing for a year.

Soil and tissue testing. The importance of either soil testing or plant tissue testing to determine the fertility status of your fields cannot be overstated—especially in a low price year. Many growers fertilize using a recipe or “cookbook” approach. They settle on continually applying a fixed amount of fertilizer that seems to have worked in the past. Eventually this approach results in over- or under-fertilization because the current fertility status of the field is not evaluated. A “prescription” fertilizer program using soil analysis or plant tissue analysis is far more cost

effective because fertilizer application rates are tailored to the actual needs of the field, avoiding the costs associated with over fertilization or lost yield due to under fertilization.

Sometimes growers make the decision not to fertilize with a certain nutrient because the price of the fertilizer containing that nutrient is too expensive and fertilize with another nutrient instead. For example, even though a field is extremely low in potassium a grower may decide not to fertilize with potassium because the cost of muriate of potash is too high but fertilize with sulfur instead because gypsum is less expensive. It is important that growers recognize the *Law of the Minimum*. This principle, established by the German scientist, Justus von Liebig in the 19th century, states that if one of the essential plant nutrients is deficient, plant growth will be poor even when all the other nutrients are abundant. In other words, yield is limited by the most deficient plant nutrient. So growers must identify the most limiting nutrient using soil or plant analysis and fertilize with that nutrient first because it does little good to fertilize with another nutrient that is not the most limiting.

Economics. The obvious question when considering a fertilizer application is whether the yield response will justify the cost of the fertilizer application. The yield increase needed to cover the cost of the fertilizer (and the application) for varying application rates of 11-52-0 at three alfalfa hay prices is shown in Figure 3. A yield increase of at least 0.4 tons per acre is needed to cover the cost of a 100 pound per acre application of P_2O_5 at a hay price of $120 per ton. Can a yield increase of this magnitude be expected? The answer is definitely yes—yield increases in excess of a ton per acre are feasible. Figure 4 shows response to applied phosphorus fertilizer at two deficient sites in the intermountain area of California. A soil test or plant tissue test is needed to predict whether a yield response of this magnitude is feasible.

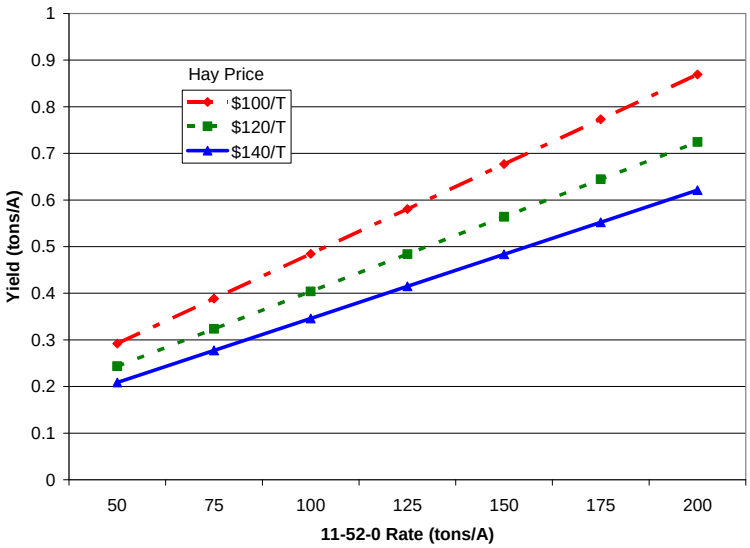

Figure 3. Seasonal yield increase needed to cover the cost of an application of 11-52-0 at three hay price levels. (Assumes a cost of $400 per ton for 11-52-0 and an application cost of $10/A. Does not include increase in harvest cost with higher yield.)

Reduced rate. If your soil or tissue test indicates that a field is clearly deficient, then a full application rate is justified. However, if your field falls into the upper end of the marginal category, or the lower end of the adequate category, and you plan a maintenance application, it is feasible to apply a rate that is two-thirds or three-quarters of a typical rate when hay market conditions are poor. The greatest response is from the initial increments of fertilizer and the rate

of return declines as the soil fertility level approaches adequate to high levels (Figure 4). Therefore, in a high price year it is easier to recover the cost of fertilizer through increased yield and peak profitability occurs near maximum yield. However, in a low price year the point of maximum economic yield occurs at a lower fertilizer rate. Provided your field is not real deficient, reduced rates may be fine for a year or two when hay prices are low. A word of caution though—after applying reduced rates successively for more than a year, the soil can become depleted and it may take high rates to return soil fertility to acceptable levels. Skipping a year or fertilizing with a lower rate can help reduce costs in the short term during low-priced years but is not a sustainable long-term solution.

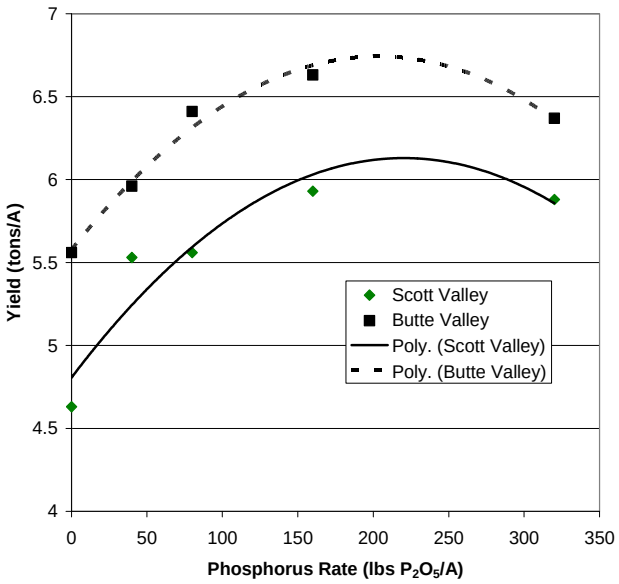

Figure 4. Annual yield response to applied phosphorus fertilizer at two locations in the Intermountain Region. Results show a typical fertilizer response curve.

Site specific fertilization. Growers typically rely on a single soil or plant tissue analysis to guide fertilization practices for the entire field. However, most fields are not uniform; it is not uncommon for there to be two-fold difference in soil nutrient levels in a single field. Using a single sample to represent a whole field virtually ensures that large portions of the field are over- and under-fertilized. Site specific management involves applying a variable rate of fertilizer across the field to account for differences in soil fertility levels. This approach can lower fertilizer input costs and improve yield because areas of the field receive the appropriate rate of fertilizer rather than an average rate. This subject is covered in detail in another paper in these proceedings (Biscaro et al. 2009).

Selecting the appropriate fertilizer. While always a wise practice, it is especially important in low-price years for producers to select the most cost-effective fertilizer materials. Rather than just considering the cost per ton of the fertilizer or the cost of a "typical" application, purchase fertilizer materials based on their cost per pound (often referred to as unit by growers) of the actual nutrient needed. For example, when purchasing a phosphorus-containing fertilizer, select the fertilizer that is cheapest per pound of phosphate (P_2O_5). In most cases this will be 11-52-0. Some growers apply complete mixed fertilizers or even foliar fertilizers. These fertilizers are typically not cost effective. Alfalfa removes large quantities of nutrients from the soil and it is usually more expensive to apply those quantities with a liquid foliar fertilizer or a complete blend that often contain nutrients that are not deficient. Research trials have not shown an economic yield advantage with foliar fertilizers or special blends compared with granular fertilizers.

WEED CONTROL IN ESTABLISHED STANDS

Weed control is a continual battle for alfalfa producers and most growers in the West use herbicides each year to control weeds. It is tempting to forgo herbicide applications to save money in a down year but is this really a wise practice? The answer obviously depends on the weed infestation level and the type of weeds present in a field. Unfortunately, even if a grower has employed an effective weed management strategy in the past, the weed seed bank is so vast that if weeds are left uncontrolled for a year, the weed infestation is sufficient to reduce the quality of the hay.

Economics of winter and summer weed control. Judging by the hay market reports, the reduction for hay infested with winter annual weeds is at least $15 to $30 per ton. The larger discount is for higher weed infestations and less palatable weeds like cheatgrass. The discount would be greater still for weeds like hare barley or poisonous weeds like common groundsel. The price reduction also climbs if the weed infestation drops the forage quality of the hay into a lower category. Typical weed control costs including the application for winter dormant treatments are in the neighborhood of $24 to $32 per acre depending on the herbicide program used. First cutting yields are typically at least a ton and a half in many warmer growing season areas and 2 tons or greater in the Intermountain West. Hence, weed control is generally economical even in low price years. Not only is weedy hay severely discounted, it may be extremely difficult to sell at all when hay sales are sluggish and buyers can purchase other hay at low prices.

Summer grasses are a problem in some alfalfa production areas, especially the Central Valley of California. Hay market sources show that alfalfa hay with a little grass is often discounted $15 to $20 per ton within a hay grade. If the presence of grassy weeds causes the hay quality to drop a grade or two, the penalty would be much greater. Considering the fact that summer grasses can infest nearly all the summer and early fall cuttings (in excess of 5 tons per acre per year) in warmer growing season areas, an application of Prowl (pendimethalin) or Treflan (trifluralin) to control summer grasses is likely to be economical.

Opportunity to lower costs. There may be some opportunities to reduce weed control costs. Just like with seedling alfalfa, it is essential to know the weeds that will be present in your field to select the proper herbicides. Knowing the weeds that infest your fields helps with the selection of the proper herbicide and rate. Many producers apply winter dormant weed control treatments late in the season and are forced to use tank mixes of a soil residual herbicide (such as Velpar, Karmex, Sencor or Chateau) with Gramoxone (paraquat) to control large emerged weeds. Some growers could potentially save money on their weed control program by applying herbicides earlier in the season when the weeds are tiny or not yet emerged and using the soil residual herbicide alone. Again, this requires an understanding of the weeds present and their susceptibility to herbicides to determine if the soil residual herbicide alone can control the weeds.

Many producers rely on pest control advisors, crop consultants or agricultural chemical suppliers to develop a weed management program for them. These consultants select an herbicide program that gives them confidence they can achieve nearly perfect weed control because their

reputation is on the line. It is conceivable that less expensive programs could be developed using lower rates, less expensive herbicides or fewer herbicides in the tank mix. However, there is some risk of not accomplishing 100% weed control when whittling down the rate or using less expensive herbicides. While this is potentially a way to reduce costs, growers must work with their weed management consultants and be willing to assume some of the risk if the weed control is less than perfect.

INSECT CONTROL

Not just in poor market years but in all years, the decision to apply an insecticide to control insect pests should be based on integrated pest management (IPM) practices and economic thresholds. Base treatment decisions on insect counts noting the presence of beneficial insects rather than treating on a calendar basis. Even in poor price years, an insecticide application is generally warranted when pest populations reach or exceed the economic threshold. Generic forms of many insecticides are available—which is an option to reduce the cost of treatment in poor price years. It does not take much of a yield increase to justify the cost of many insecticide treatments even in a low price year. Oftentimes the yield increase needed is only one tenth of a ton per acre and the potential yield decrease caused by some insects far exceeds that value.

Another option to carefully consider in low price years is to cut the crop early instead of applying an insecticide. The viability of this approach depends on the growth stage of the alfalfa and how much time is left until the desired cutting date. Ordinarily, if the pest population is above the threshold and there are at least two weeks before cutting, an insecticide treatment is advisable. Yield and quality are inversely related meaning that as yield goes up with advancing maturity, quality goes down. The yield penalty from cutting too early may be too severe and an insecticide application may be more economical in the long run. Another factor to keep in mind with early cutting is that while cutting controls most pests, this is not always the case. Alfalfa weevil, a common pest in California and other Western states, can occasionally survive a cutting and congregate under the windrow causing serious damage.

EQUIPMENT

A common reaction when hay prices fall is to cease purchasing new equipment. It is difficult to quantify whether this is a justified response or not. It depends on the age and status of your equipment and how long it has been since you purchased new equipment. If you have relatively new equipment in good condition chances are you can postpone purchasing new equipment until market conditions improve. Other considerations are the ability a ranch has to repair their equipment, the number of acres farmed and the effect downtime for equipment repairs may have on the profitability of the farm as a whole. It is not just a question of whether the job can be accomplished with existing equipment. New equipment is generally more reliable, more efficient and has features not present on older models. Generally it is best to purchase new equipment as needed on a regular basis so that not all the equipment needs replacing the same time. Repairing old equipment may be cost effective in the short term but there comes a time when the cost of maintaining old equipment exceeds its value.

IRRIGATION

Irrigation water is critically important for alfalfa production in the West and therefore, there is very little dryland alfalfa in this region. However, in very low price years can overall profitability be improved by reducing the amount of water applied? There are two basic approaches to deficit irrigation of alfalfa. One involves making the same number of cuttings per season but reducing the amount of applied water for each cutting. The other approach involves ceasing irrigation early and forgoing a cutting or several cuttings. Ordinarily, these practices are not considered economical but when prices are as low as they have been this year, this question deserves another look.

Reduced irrigation amount. This strategy involves applying less water throughout the season than the crop actually requires for full yield. Numerous studies have shown that alfalfa yield increases in a linear fashion as evapotranspiration (ET) increases. The relationship between ET and yield varies between environments but the relationship is linear (Figure 5). What this means is that yield increases with every increment of ET up to full ET for the crop. After that point, yield remains constant.

However that doesn't mean that every additional drop of irrigation water results in higher yields. Unlike the relationship between yield and ET, the relationship between yield and applied water is not quite linear. Irrigation systems are imperfect. Because irrigation systems are not completely uniform, some portions of the field receive more than what is needed and other areas less than ET due to the non-uniformity of water applications.

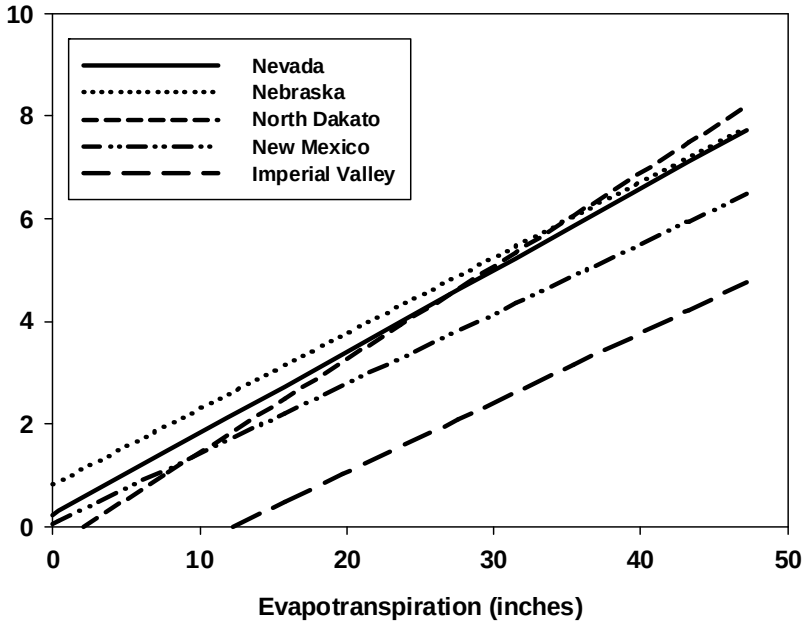

Figure 5. Relationship between alfalfa yield and evapotranspiration (ET) for various locations in the West.

In years when the alfalfa price is high and/or water is inexpensive, it is typically economical to apply enough water so that very little of the field is deficit irrigated, even though some areas of the field will be over-irrigated. However, when the alfalfa price is low and/or water price is high, it may be economical in some situations to allow parts of the field to receive less than full ET. Determining exactly what that quantity is can be difficult. The main point is that severe deficit irrigation (where no area of the field receives full ET) is not economical because the yield penalty is too great.

The key during low-priced years is to increase your level of irrigation management. The key to maximizing profit is to know how much water your irrigation system applies, identify the amount needed to satisfy ET and account for inefficiencies in the irrigation system, and apply only that amount and not more. This is done through soil moisture monitoring and/or weather-based irrigation scheduling. Improving irrigation efficiency can also improve profits by reducing the amount of applied water needed to ensure that at least most of the field is receiving enough water to satisfy peak ET.

Irrigation cutoff. This strategy involves partial season irrigation—irrigation ceases part way through the season and subsequent cuttings are foregone. Alfalfa yield in most areas declines the second half of the growing season compared with the first half. In addition, all or nearly all of the crop's water needs must be met with irrigation because there is very little rainfall during the second half of the growing season.

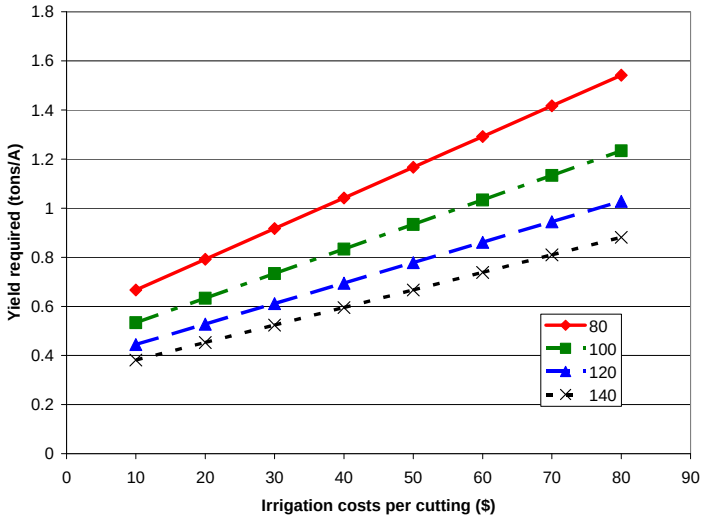

Figure 6. Yield required to justify irrigation and harvesting costs for a single cutting at various prices of alfalfa hay, and costs for water applications.

When prices are low, growers are tempted to quit irrigating and end the production season early. Considerable research has been conducted to evaluate the feasibility of early-season irrigation termination. The results have shown that this practice is agronomically feasible—yield is reduced but in most locations stand loss does not occur and yield rebounds fully the following year. So, is partial season irrigation cost effective in poor market years? It is difficult to give a set answer that applies for all situations and locations. The answer obviously depends on the cost of water, the anticipated yield and the alfalfa price.

An evaluation of a study conducted in the Blythe area of California indicated that at relatively low water prices ($50 per acre foot or less); full irrigation is the most profitable for crop prices greater than about $95/ton. However, at crop prices less than $95/ton, terminating irrigations for 105 days during the last part of the summer and during the fall becomes more profitable.

The question is how much yield is required to cover the cost of irrigation and harvest costs (Figure 6). In theory, this partial budget analysis is sufficient because other costs are primarily fixed costs or inputs that have already been supplied (like fertilizer applications or pest control that are done earlier in the season). Figure 6 shows the minimum yield required for a cutting to cover harvest and irrigation costs at various hay prices and irrigation costs. Harvest costs were assumed to be $43.35 per acre, which are the total harvest costs calculated by Klonsky *et al* for a sickle-bar swather and small three-tie bales. Your harvest costs may be lower or higher so this analysis should be adjusted accordingly. For example, if the total irrigation costs for a cutting

are $50 per acre (this is the acre feet of water used for a cutting multiplied by the cost of the water plus irrigation labor costs) and the hay price is $100 per ton, a yield of nearly 1.0 ton per acre is needed to break even. In most areas, irrigation costs per cutting are less than $50. Hence, under most conditions it is still profitable to irrigate for many if not all of the summer cuttings even when the price is only $100 per ton. However, the economics might be different if the water not used for irrigation was sold for another use, or used to irrigate a more profitable higher value crop.

CONCLUSION

While it is tempting to eliminate nearly all inputs during a time of low or negative profitability, this strategy rarely makes sense. Reducing inputs often results in lower production or quality, which can diminish overall profitability. The key in low price years is to examine each input and identify the appropriate level that results in maximum economic yield rather than maximum yield. The inputs we identified that might be reduced are deep tillage (depends on the site conditions), seeding rate (as long as the seedbed is in excellent condition), herbicide rate or the need for a tank mix (provided application timing is optimum and weeds properly identified), short-term reduction in fertilizer applications (along with careful monitoring), and possibly a slight reduction in irrigation so that not quite as much extra water is applied to account for non-uniformity in the irrigation system. While high levels of management are important in all years, they are especially critical in low-price years. Reducing inputs often results in an increased level of risk and a need for a higher level of management.

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