FIGURING THE COST OF FERTILIZER

Simple mathematics can tell you when it's a waste of money to apply additional fertilizer.

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In most crops, fertilizer inputs are measured against yield; for important purchases, the cost is evaluated against return. This doesn't work in turfgrass management, for the simple reason that there is no measurable yield.

Sod producers sometimes try to compare growth rate and turf quality to fertilizer cost to determine when applying more fertilizer becomes a waste of money. But few growers are satisfied with the procedure.

Turfgrasses readily respond to nitrogen (N) fertilizers because N is frequently deficient. Usually a dramatic color response is followed by rapid growth. Once the turf color is as green as it can get, increasing the N rate continues to increase the turf's growth rate. At some point, however, the turf growth rate no longer increases as fast as the increase in nitrogen. That is when it is no longer cost-efficient to increase the N application rate.

Weighing clippings

One way to measure turf growth rate is to weigh the clippings removed at mowing. In Fig. 1, the clipping yield increases with increased nitrogen up to 4 lbs. per 1,000 sq. ft. when the rate actually causes a reduction in the clipping yield, therefore, a reduction in growth. Before that point the growth rate increase slows down with increased nitrogen.

For example, the growth rate increase in going from 0.5 to 1.0 lb. N is several times that measured going from 1.0 to 2.0 lbs. N. This means that fertilizer costs increase significantly for the small gain in growth rate.

In Fig. 2, the root and rhizome dry matter yield of Kentucky bluegrass drops off very significantly from 0 N to 0.75 lbs. 1,000 sq. ft./month. Over 0.75 lbs. the rate of root and rhizome growth nearly stops. Eventually, the roots reduce in number and length.

There are agronomic as well as economic upper limits to nitrogen fertilizer applications.

FIGURE 1.

CLIPPING YIELD RESPONSE TO NITROGEN

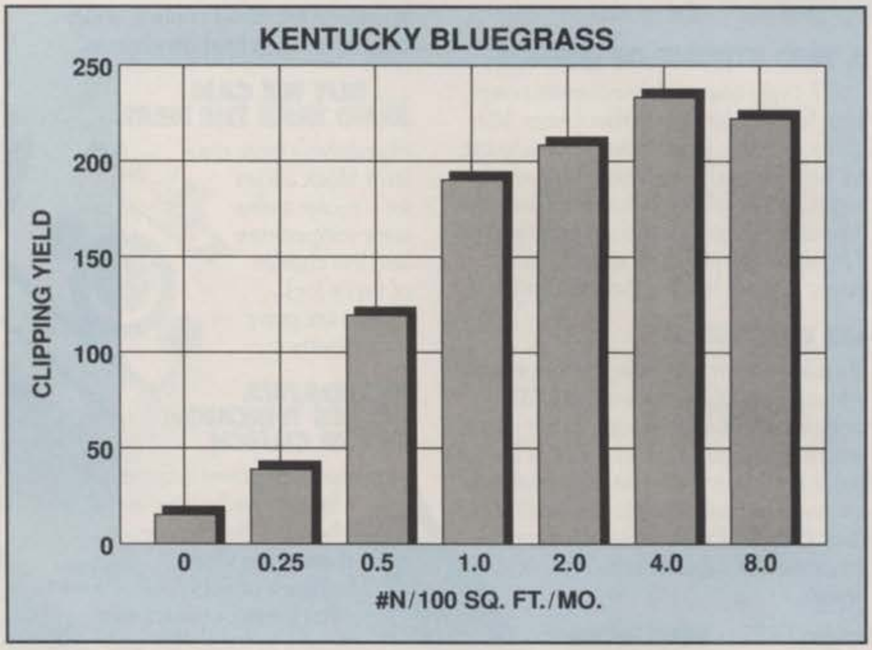


FIGURE 2.

ROOT AND RHIZOME RESPONSE

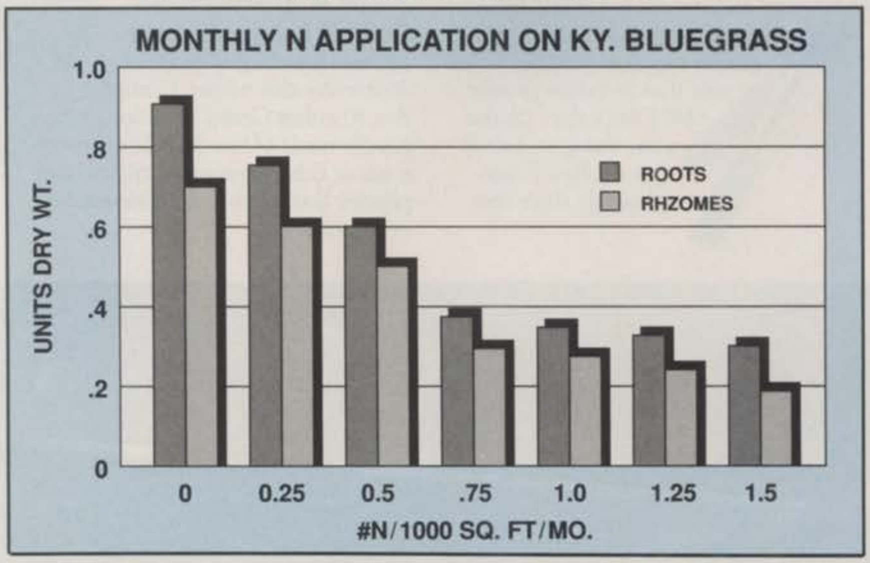


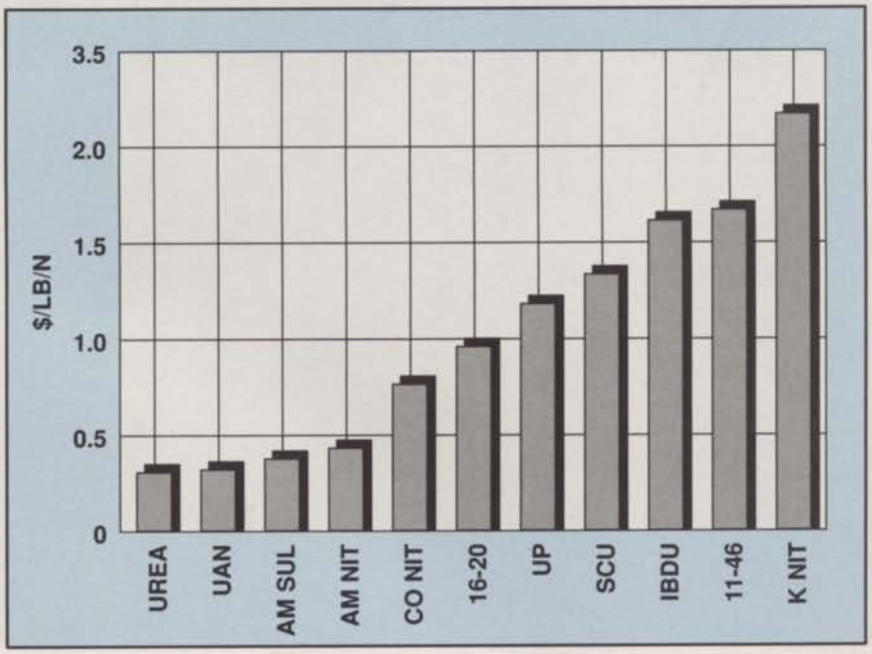
FIGURE 3.

COMPOSITION OF FERTILIZER MATERIALS

MATERIAL	NITROGEN % (N)	PHOSPHORUS % (P205)	POTASSIUM $ (K20)	LBS. N/TON	$/TON	$/LB/N
AMMONIUM SULFATE	21	0	0	420	$150.00	$.36
AMMONIUM NITRATE	33.5	0	0	670	$288.50	$.43
MONOAMONIUM PHOSPHATE	11	40	0	220	$360.00	$1.64
AMMONIUM PHOSPHATE- SULFATE	16	20	0	320	$299.60	$.94
CALCIUM NITRATE	15	0	0	300	$224.25	$.75
UREA	45	0	0	900	$260.00	$.29
UREA FORMALDEHYDE	30	0	0	760	$890.00	$1.17
ISOBUTYLIDENE DIUREA (IBDU)	31	0	0	620	$1000.00	$1.61
UREA AMMONIUM NIRATE SOLUTION	32	0	0	640	$190.00	$.30
POTASSIUM NITRATE	13	0	45	260	$560.00	$2.15
SINGLE SUPER PHOSPHATE	0	20	0	0	$253.00	
TRIPLE SUPER PHOSPHATE	0	45	0	0	$349.00	
SULFUR COATED UREA	35	0	0	700	$930.00	$1.33
WHALE GUANO	9.5	6.5	2	190		

FIGURE 4.

COST OF NITROGEN IN FERTILIZER



Fertilizers are produced with a wide range of nutrient content. The nutrient analysis of a fertilizer is always shown as three numbers on a label representing the primary nutrients, nitrogen (N), phosphorus (P) and potassium (K), and always in that order. The numbers represent the percent by weight. Any other nutrients in the fertilizer will be shown elsewhere on the label.

Remembering analysis

A fertilizer analysis of 10-5-8 means that 10 percent of the material's weight is N, 5 percent is P and 8 percent is K. If the fertilizer is in a 50 lb. bag, 5 lbs. is N (50 lbs. x 10% N = 5 lbs. N), 2.5 lbs. is P (50 lbs. x 5% P = 2.5 lbs. P) and 4 lbs. is K (50 lbs. x 8% K = 4 lbs. K).

In Fig. 3, the composition of several commonly-used fertilizer materials is shown with the amount of nutrients present. The pounds of N contained in a ton of fertilizer is shown along with the cost of a ton of the fertilizer. In the last column, the cost of N per pound has been computed.

Ammonium sulfate (21-0-0) is listed at $150 per ton and urea (45-0-0) is $260.

Even though a ton of ammonium sulfate is less expensive than a ton of urea, the ammonium sulfate N is 36 cents per pound and the urea N is 29 cents. There is over twice as much N in urea (45%) than in the ammonium sulfate (21%).

A turf manager who has 50,000 sq. ft. of turf wants to apply one pound of N per 1,000 sq. ft. So it will take 237.45 lbs. of ammonium sulfate at a cost of $85.50.

$$\text{lbs. fert./1000 sq. ft} = \frac{\text{1.00 lb. N/1000 sq. ft.}}{\text{.21 lb. n/lb. fert.}} = 4.75$$

lbs. fert./50,000 sq. ft. = 50 × 4.75 = 237.5

$/50,000 sq. ft = 237.5 × $.36 = $85.50

It will take 110 lbs. of urea to put one pound per 1,000 sq. ft. on 50,000 sq. ft. of turf at a cost of $31.90.

$$\text{lbs fert./1000 sq. ft} = \frac{\text{1.00 lb. N/1000 sq. ft}}{\text{.45 lb. N/lb. fert.}} = 2.2$$

lbs. fert./50,000 sq. ft. = 50 × 2.2 = 110

$/50,000 sq. ft. = 110 × $.29 = $31.90

In this example, even though the cost of urea is considerably higher per ton than ammonium sulfate, it is significantly less expensive to use. The turf manager is looking at $85.50 to fertilize the area with ammonium sulfate or $31.90 to use urea.

In Fig. 4, the cost of nitrogen per pound is shown graphically for several fertilizers as a comparison. Soluble fertilizers are the least expensive. Slow-release materials and those containing other nutrients are at the other end of the scale.

Fertilizer cost is an important factor in the buying decision. Unfortunately, getting the right fertilizer is not always as simple as using the cheapest N source.

Ammonium sulfate provides sulfur as well as nitrogen. IBDU is a slow-release nitrogen source, which means a steady supply of N to the plants and few applications. Urea has a high N analysis so the turf manager handles less material. Monoammonium phosphate has available phosphorus. All of these are important considerations in choosing a fertilizer material.

Break-even analysis

In any business enterprise, at some point in the income and cost relationship there is no profit or loss. That is the point at which the operation will break even (BE). Obviously, one of the goals of a business is to operate at a profit, which is above the BE.

(Public organizations target break-even and do not wish to perform above that.)

The relationship of the BE to costs and fee revenue (sales) for a turf facility is shown graphically in Fig. 5. In this example, it is assumed that the information represents one year. Variable costs (VC) are the costs that are the most closely related to fee revenue.

Certain costs depend on the level of activity at that facility. Activities such as lawns serviced, rounds of play, number of games played, or sod sold affect supplies, labor hours, fuel and deliveries. These are variable costs.

When the activity level increases, the fee revenue increases and the VC increases to meet the demand. When fee revenues go down, the VC must also go down, often a major management challenge.

Fixed costs (FC) are fixed for more than one year. They do not change regardless of the fee revenue or level of activity. FC includes management salaries, office rent, mortgage payments and equipment installments.

Graphing profit

The FC are shown as a straight line in the graph since they do not change. FC plus VC are the total costs. Therefore, the VC are on top of the FC and the graph shows the VC line starting at the FC. Fee revenue begins at zero and goes up since it has to total costs. The point where the VC line crosses the fee revenue line is the BE. Notice how the two lines rapidly spread after the BE. This shows how quickly profits (revenue surplus) can build if VC are kept under control. If VC are allowed to increase, the BE will slide higher on the fee revenue curve.

The BE is useful for much more than determining the organization's profitability. It can be used to establish the actual cost of expenditures. The BE can be used to determine the actual cost to the organization of any supply purchase, new employee hire or equipment purchase.

In Fig. 6, the BE shown graphically in Fig. 5 is computed. The example uses the BE to cost out the purchase of a load of fertilizer.

The VC and FC are computed as percent of fee revenue by dividing each by the fee revenue dollars (shown as thousands).

$$BC\% = \frac{VC}{\text{Fee Revenue}} = \frac{764.5}{1300} = 58.81\%$$

$$FC\% = \frac{FC}{\text{Fee Revenue}} = \frac{415.5}{1300} = 31.96\%$$

The marginal ratio (MR) is a ratio of fee revenue to variable costs. It shows what is needed to cover the fixed costs and profit (surplus). The MR is calculated by subtracting the VC as percentage of fee revenue from 100 percent, which represents all sales.

$$MR = 100\% - VC\% = 100 - 58.81 = 41.19$$

The BE is calculated by dividing the FC by the MR.

$$BE = \frac{FC = 415.5}{MR \quad .4119} = 1008.7$$

This facility would have to make $1,008,700 in fee revenue to break even. Fee revenue over that level begins to accumulate profit.

A load of fertilizer costs $5,000. By dividing the fertilizer cost by the MR the manager can determine how many dollars in fees must be made to pay for the fertilizer.

$$\text{Fees Needed} = \frac{\$5{,}000}{.4119} = \$12{,}138.87$$

It would take more than $12,000 in fees to pay for a $5,000 load of fertilizer. The true cost of expenditures can get to be quite high if variable costs are not controlled.

The actual cost of fertilizer is often inexpensive when compared to the benefits it can provide an operation.

FIGURE 5.

BREAK EVEN ANALYSIS TURF FACILITY

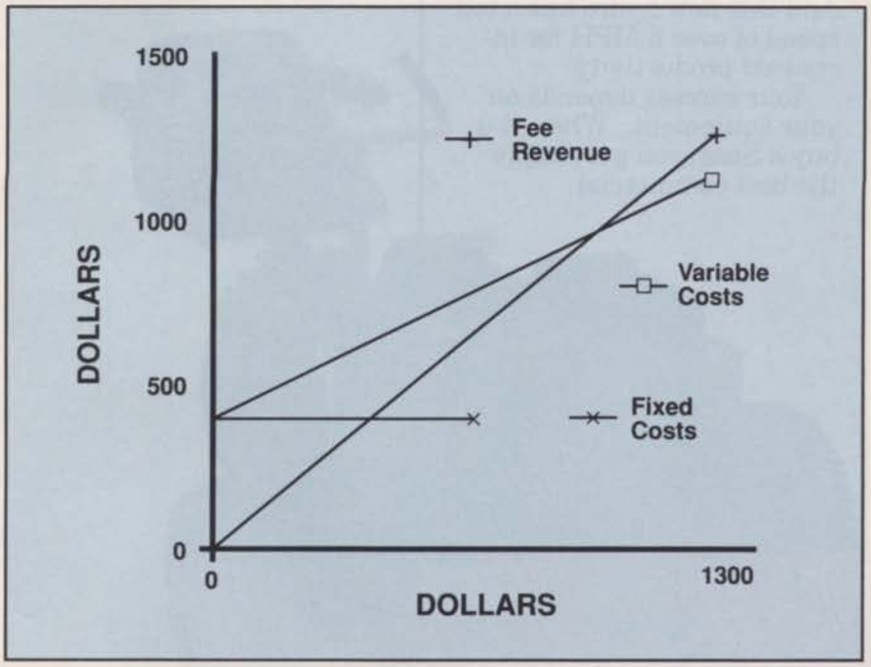


FIGURE 6.

BREAK EVEN ANALYSIS TURF FACILITY

	DOLLARS (1000)	AS% Of Fee Revenue
FEE REVENUE	1300	
VARIABLE COSTS	764.5	58.81
FIXED COSTS	415.5	31.96
MARGINAL RATIO*		41.19
BREAK EVEN (FC/MR)	1008.7	

* MARGINAL RATIO = % FEES AVAILABLE TO COVER FIXED COSTS AND PROFIT AFTER DEDUCTING % REQUIRED FOR VARIABLE COSTS (MR = 100% − VC%)

TRUCK LOAD FERTILIZER @ $200/TON	$5000.00
FEES NEEDED TO BUY FERT. (COST/MR)	$12,138.87

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