# Economics of supplemental feeding and food plots for white-tailed deer

*Gary L. McBryde*

**Abstract** To answer the questions, "Would it be advisable to implement supplemental feeding?" and "Would it be better to feed or plant food plots?" I performed a comparative economic analysis of food plots and feeders for white-tailed deer (*Odocoileus virginianus*) If increased deer visibility is the goal, feeders are most economical/ha. If least cost/unit dry matter of supplemental feed consumed is the goal, then food plots usually are the most economical. There are 2 exceptions: first, if the initial investment on machinery for food plots cannot be met, and second, if expected food plot yields are <3,168 kg/ha dry matter. Considering all costs, however, food plots would not be profitable under most of today's lease rates. An added pitfall of food plots is that by increasing herd levels above normal carrying capacities, additional supplemental feeding may be needed during a drought to protect the herd, the range, or both.

**Key words** economics, food plots, management, *Odocoileus virginianus*, supplemental feeding, white-tailed deer

Management of free-ranging big game herds throughout the United States is increasing and frequently includes food plots or supplemental feeding (Payne and Bryant 1994). Providing additional feed to white-tailed deer (*Odocoileus virginianus*) was practiced by 47% of 7,399 lease operators surveyed in Texas (Thigpen et al. 1990). Studies of feeding programs have shown limited or no effect on deer herds (Davis 1990). For example, Johnson et al. (1987) found in eastern Louisiana that yearling buck weights increased slightly with access to winter food plots. Keegan et al. (1989) found 11% of the food deer consumed was from summer food plots with little evidence of either increased antler size or body weights. Similarly, Johnson and Dancak (1993) stated that food plot programs were not justified based on biological effects. Zaiglin and DeYoung (1989) indicated fawn survival increased from supplemental feeding throughout the year, estimated to cost several hundred dollars for each surviving fawn. Rideout (1992) reported annual food plot expenses were \$123.50-\$247.10/ha. Kroll (1991) reported similar costs for food plots and costs of \$150/deer/year with supplemental feeding. Considering sources of income to pay for feeding, Steinbach et al. (1987) reported average lease rates in the Rio Grande Plains region of Texas at \$4.42/ha. The average value in Texas was \$5.41/ha (Thigpen et al. 1990), with a high of \$18.50/ha (Damuth 1993).

Although financial case studies of deer management are limited, livestock studies (McGrann et al. 1989) have shown that the control of individual cost items in a management plan are critical for sustainable management. If managers fail to learn about these cost items, sustainable management is jeopardized. I examined semi-intensive practices that can threaten income and wildlife when more economical and extensive management options may be more appropriate. In particular, management plans were described for food plots and supplemental feeding and their associated variable and fixed cost items for free ranging deer herds. My objectives were to: (1) determine conditions under which each activity would be most cost-effective (yield the greatest response/dollar spent) and (2) identify minimum lease rates that would be profitable.

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## Methods and data

Standard capital budgeting techniques (Boehlje and Eidman 1984) were used to develop costs for food plots and supplemental feed on an annual basis. This process involved identifying equipment and activities in production and marketing and associating a cost or revenue to each item. The supplemental feed budget was based on a feeding program described by ranchers that was designed to condition deer to visit the feeders regularly. The feeding program is labor intensive, but ranchers using the program felt it maximized deer feed consumption by reducing weather loss and excluding other wildlife from the feed. Feed costs were $5.00/22.7 kg (50 pound) sack (bulk purchasing) and were on a per-sack basis to provide a management unit price comparison. Supplemental feed cost calculations were based on the use of 6 feeders, $189 each, on a density of 1/202.4 ha (1/500 acres). The feed bins hold 90.7 kg (200 pound) and deliver 2.276 kg/day (5 pound/day). All durable equipment was assumed to have a life of 10 years. I estimated pick-up truck depreciation applicable to feeder tending at $63.96/year. This cost was spread over the feed provided by the 6 feeders to yield a per-sack cost. Feeder maintenance cost $10.00/year. Labor cost $7.00/hour (including social security taxes). Fencing around the feeders to limit javelina (or collared peccary, *Tayassu tajacu*) access was $144.80.

Food plot costs were calculated from yield data and tillage dates in Beals et al. (1993) from Starr County, Texas. In their study, no stand failures occurred and dry matter yields averaged 3,920 kg/ha. Tillage operations were based on a 100-horsepower tractor. In mid-October a 3.05 m offset disk was used to plow the old crop. Immediately after disking, they deep plowed with a 5-shank chisel. In early December a field cultivation was applied to reduce weeds and evaporation. A second cultivation followed 45 days later. Lablab (*Lablab purpureus*) was planted with a 6-row planter in late February. At planting time, a grass pre-emergent herbicide was incorporated next to the legume seed. The lablab was row-cultivated when it reached 10 cm, about 45 days after seeding. Land clearing cost $440.80/ha, and a cattle exclusion fence cost $556 based on 6.1 hectares. Both items were depreciated over 25 years. The last cost was lost cattle-lease income at $12.30/ha.

Cost-effectiveness of supplemental feeding versus food plots was calculated by finding the cutoff price for feed on a per-sack basis. If the cost of providing feed (delivery plus feed costs) was above the cutoff price, food plots provided more feed at less dollar invested. Alternately, if the cost of supplemental feeding on a per-sack basis was below the cutoff price, feeders were more cost-effective. In the calculation I assumed that only 25% of the forage (Hamilton et al. 1989) in the food plot is consumed, although higher use values have been reported (Blair et al. 1987). Under free-ranging extensive management, however, I believe the lower value is more accurate. The cutoff point varied based on food plot yield and the consumption efficiency of each feeding program. The effect of these factors on cost-effectiveness was examined by analyzing 3 food plot yields (3,360, 3,920, and 4,480 kg/ha) and 3 feeder consumption efficiencies (60, 80 and 93%).

I examined profitability of food plots using the previously described costs in a linear program model similar to Glover and Conner (1988). The model contains alternate ranch activities and selects those activities that maximize ranch income. The General Algebraic Modeling System (Brooke et al. 1992) was used to build the model based on a representative ranch of 809.4 hectares (2,000 acres). The deer herd model included 2 separate growth and survival parameters for the deer herd. I assumed the deer herd would have higher growth rates and better survival if food plots were planted. The parameter values were different for each year up to 3 years of age. For example, if planting food plots maximized ranch income, the survival parameters used for the herd for fawn crops was 70% versus 60% and the death loss in the third year was 10% versus 15%. These parameters lead to higher densities when food plots are available. Planting food plots required capital, which was charged a 4% interest rate. Calf and steer production was considered an optional use of land planted into food plots. The sale value and the cost of production for weaned calves and stockers are from Pena (1992). An initial herd of 145 deer was assumed, or 1 deer/5.6 ha. Harvested yearling doe and bucks were valued at $100/head. The value of a mature buck was varied to study how values of mature bucks affected the area planted in food plots for maximum profits. Based on the total value of deer harvested, I calculated per-hectare hunting lease rates for comparison.

## Results and discussion

Under the assumptions stated for a supplemental feed program, the costs expressed on a 22.7 kg or per-sack basis are $6.47 without labor or $18.36 including labor (Table 1). Annually, this is $4,020.84 or $3.31/ha for the supplemental feeding of deer. Besides direct benefit to the herd, greater visibility of deer might be a valuable marketing tool as hunters

Table 1. Itemized annual estimated costs and percents on a 22.7 kg (50 lb) sack basis (1993 cost) for supplemental feed for white-tailed deer in south Texas.

| Item | Cost ($) | Percent |
|---|---|---|
| Feed | 5.00 | 27.2 |
| Feeder depreciation | 0.52 | 2.8 |
| Pick-up truck depreciation | 0.29 | 1.6 |
| Fencing depreciation | 0.39 | 2.1 |
| Feeder maintenance | 0.27 | 1.5 |
| Labor | 11.89 | 64.8 |
| Total | 18.36 | 100.0 |

may be willing to pay more for the lease. If the rancher thinks supplemental feeding will result in a $3.31/ha increase in the deer-hunting lease rate, a feeding program would break even. In contrast to supplemental feeding, food plots require a large initial investment in equipment approaching $65,000 or access through leasing to a tractor and 5 field implements. Planting food plots cost $242.80/ha (Table 2).

Comparing the cost-effectiveness of the methods when it cost $242.80/ha to plant food plots yielding 3,920 kg/ha, the cost of feed plus the delivery charge would have to be <$5.23/sack before feeders would be more cost-effective (Fig. 1, top). Assuming a lower yield of 3,360/ha increases the cutoff price of feed to $6.10. At the calculated feed delivery cost of $6.47/sack excluding labor, the food plot yields would have to be <3,169 kg/ha before feeders were competitive if 93% of the feed was consumed from the feeders. As the feed consumption efficiency declines, the cutoff point declines rapidly (Fig. 1, bottom). For example, at 60% efficiency, feed plus delivery cost would need to be <$3.37 to be more cost-effective than food plots that yield 3,920 kg and cost $242.80/ha to establish.

Table 2. Itemized annual estimated food plot costs (1993 basis) and percent/ha for supplemental feeding of white-tailed deer in south Texas.

| Item | Cost ($) | Percent |
|---|---|---|
| Tractor depreciation | 29.40 | 12.1 |
| Implement depreciation | 16.80 | 6.9 |
| Land clearing and fence depreciation | 72.30 | 29.8 |
| Repairs | 17.40 | 7.2 |
| Interest on capital | 8.20 | 3.4 |
| Fixed cost sub-total | 144.10 | |
| Herbicide | 4.80 | 2.0 |
| Labor | 35.60 | 14.6 |
| Fuel | 17.10 | 7.0 |
| Lablab seed | 41.20 | 17.0 |
| Operating cost sub-total | 98.70 | |
| Total | 242.80 | 100.0 |

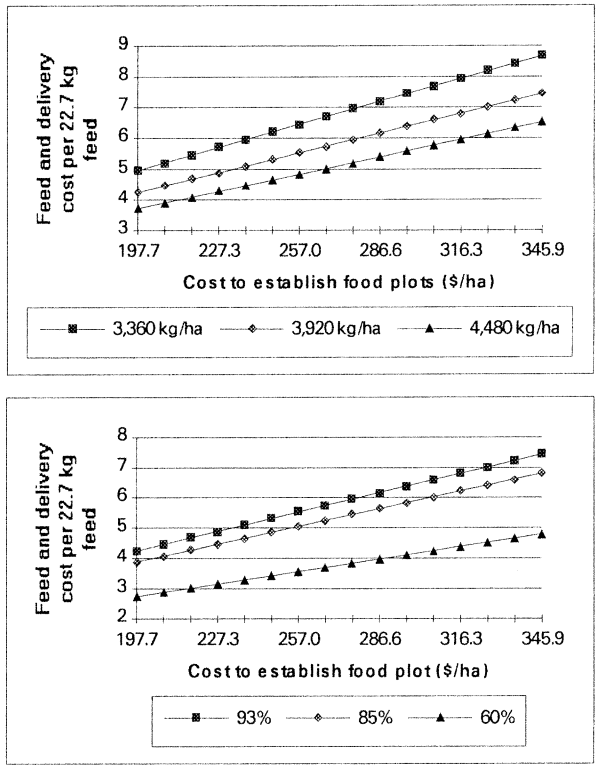


Fig. 1. Cutoff prices for determining cost effectiveness of supplemental feeding versus food plots for white-tailed deer. For a given food plot establishment cost ($/ha), food plots are more cost effective if the cost of providing 22.7 kg (50 lb) of supplemental feed is above the line. Top: cost effectiveness at 3 food plot yield levels. Bottom: cost equivalence at 3 levels of feed consumption efficiency with food plot yield constant at 3,920 kg/ha.

Under most circumstances, food plots are more cost effective than feeders. Exceptions include drought management strategies that need a dependable source of feed or when conditions preclude food plot yields >3,169 kg/ha. Feeders would also be cost effective when a rancher does not have the capital to invest in tractor and implements yet feels the value of feeding would be above the $3.31/ha feed cost.

Using the linear program model to examine profitability of food plots, at lease rates <$35/ha, <1 ha planted would maximize profits (Fig. 2). With continued increases in lease rates, the profit-maximizing amount of food plots planted increases rapidly. Why must lease rates be so high before land is planted? Assuming a break-even price of about $7.40/ha and an opportunity cost of $12.30 from a cattle lease, at about $19.70/ha, food plots start to generate revenue to the rancher. In fact, this is when prices start to induce plantings, but only very small amounts. The answer to why price increases are slow to cause land to be planted is the inefficiency of trophy buck manage-

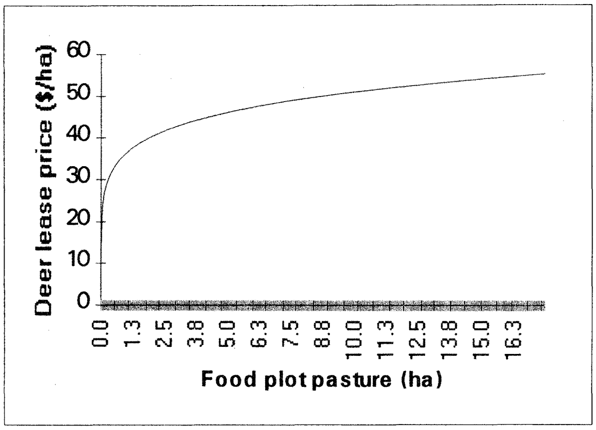


Fig. 2. Profit-maximizing food plot hectares to plant given a lease rate ($/ha) calculated using a linear program maximizing ranch income for a 809.4-ha (2,000 acre) ranch.

ment (DeYoung 1989, 1990). Producing mature bucks takes >3 years, and the number of mature bucks is small relative to the overall deer herd. Consequently, to increase the number of mature bucks takes a proportionally larger increase in the inventory of younger growing males. Both characteristics of the biology of the system are expensive. Nonetheless, the hope of a high lease rate acts as a powerful incentive to draw ranchers into planting food plots.

The nature of the profitability of food plots has 2 important features (Fig. 2). Food plots are risky. If a lease rate is expected and the market changes, resulting in a lower lease rate, excess costs of planting result. For example, if ranchers made planting decisions based on the expectation of a lease rate of $49/ha but received $42/ha, they would have overplanted and accrued additional costs (Fig. 2). Based on the shape of the curve, at higher lease rates, overplanting errors can be quite large if the lease rate falls. Secondly, Fig. 2 implicitly assumes a yield of 3,920 kg/ha of dry matter. A dry year would mean insufficient forage was available for the herd. Based on the average yield (which would be wrong due to drought) that was used to calculate the profit-maximizing hectares to plant, an excess amount of land was planted. Consequently, not only must the rancher bear added cost, but the size of the deer herd is above expected range carrying capacity. The rancher must decide to let the deer herd suffer, the range deteriorate, or both. Installing feeders is not the most cost effective solution, but it may be the only short-term solution to correct forage shortfalls caused by drought and exacerbated by the food plots.

As the value of deer leases increases, ranchers face stronger economic incentives to switch from extensive ecological management practices to intensive agronomic practices. To do so is to face greater risk not only in income, but with respect to overusing native forage. Errors in matching range carrying capacity with deer numbers initiates a management response that increases supplemental feeding, which may reduce profits and overuse range resources. Risk and uncertainty are important considerations in the ranching business, and how food plots and supplemental feeding affect variation in income and the range resource are topics deserving additional research.

*Acknowledgments.* I thank W. E. Cohen, T. E. Fulbright, and F. S. Guthery for suggestions on earlier drafts.

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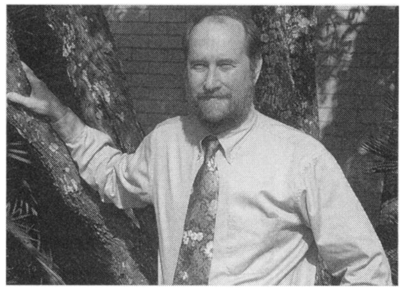

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*Associate Editor: Feldhamer.*