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Growing and Managing Successful Food Plots for Wildlife in the Mid-South

THE UNIVERSITY of TENNESSEE

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Photos by the author except where noted.
Cover photo taken by Charlie Fritts in one of the demonstration fields used to recommend forages for white-tailed deer.
Design by Gary Dagnan

Growing and Managing Successful Food Plots for Wildlife in the Mid-South

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Planting food plots is an excellent way to improve available nutrition, increase the carrying capacity and concentrate wildlife on your property. Food plots do not take the place of habitat management in general, but are intended to augment the quantity and quality of food occurring naturally in an area. Whenever habitat improvement is desired, other management practices (e.g., timber management, prescribed burning and discing) should be implemented as well. Food plot plantings should depend upon which wildlife species you want to attract and the seasonal requirements of those species. Not all wildlife species benefit from all food plot plantings. Certain food plot mixtures provide benefit to different wildlife species. For example, doves do not get much benefit from a clover patch planted for white-tailed deer.

INITIAL CONSIDERATIONS

It is important to take the proper steps when preparing wildlife food plots. The process for planting food plots is really no different than farming — with wildlife as the objective. The most important consideration is matching the planting to the appropriate soil type and moisture regime in an area where wildlife will be attracted. Start by identifying locations on the property where the targeted wildlife species are often found. Then look for suitable sites for planting. The best sites are generally flat, where more moisture is retained, nutrient levels are higher and it is easier to operate equipment. Soil moisture is critical. It is very important to plant when adequate soil moisture is present to improve seed germination and establishment. In addition, the best time to plant is just prior to a rain event. When it is dry for an extended period after planting, germination and growth are usually less than desirable. Therefore, planting by a certain date is of little concern unless there is projected rainfall.

Successful plantings result when soils are amended with lime and fertilizer at rates recommended from a soil test. The next step is proper seedbed preparation and seeding depth (see Appendix 1). Drilling or covering seed too deep is a common reason for crop failure. While grains (e.g., corn and milo) can be drilled or disced approximately 1 inch deep, small-seeded species (e.g., clovers and alfalfa) should be covered no more than ¼ inch. Germination of cool-season grains (e.g., oats, wheat and rye) is generally better if the seed are lightly disced-in (especially oats). Establishing mixtures of small grains (and other relatively large seed) and small-seeded species is best accomplished by the following procedures:

It is impossible to know how much lime or fertilizer is required without collecting a soil sample and having it tested. Without question, it is the best $6 – 10 that can be spent on food plots.

1. Prepare seedbed by plowing and/or discing or tilling (lime and fertilizer should be incorporated into soil at this time if you have not done so already).
2. Sow large seed (e.g., oats, winter peas, cowpeas) onto prepared seedbed.
3. Lightly disc seed into plot, covering approximately 1 inch deep.
4. Firm the seedbed with a cultipacker (this is an especially important step for really small seeds, such as ladino clover).
5. Sow small seed (e.g., clovers, alfalfa, etc.).
6. Cultipack seedbed once again to ensure firm seed-to-soil contact and improve germination rate.

A cultipacker is the best implement to firm a seedbed prior to sowing small seed (e.g., ladino white clover) and to establish firm seed-to-soil contact after sowing. The use of a cultipacker leads to more satisfactory results than dragging some object (e.g., a log, chain or section of woven fence) across the field behind a tractor.

When planting legumes, either buy pre-inoculated seed or treat the seed with the appropriate inoculant prior to sowing. Information concerning proper inoculation is detailed in Appendix 3. Proper inoculation helps ensure crop success and can save on fertilizer costs.

Another critical consideration is weed control. Weed pressure varies tremendously in different areas and from site to site. It is advantageous to know the general weed composition in the seedbank (seed occurring naturally in the top few inches of soil). This can determine what should be planted based on the herbicides that can be used to control those weeds. Herbicide recommendations are provided with several of the recommended seed mixtures, under ***Managing Forage Plots*** and in Appendix 4.

Planting success and use of forage plots should be monitored using exclusion cages. These cages allow you to observe how much forage is being consumed by wildlife over time and to estimate the success of your planting, especially if deer are overgrazing a plot as soon as the plants germinate. Exclusion cages (approximately 4 feet in diameter and 4–5 feet tall) can be made of chicken wire wrapped around four stakes driven into the ground.

There are many commercial food plot mixtures available. Some are worth what they cost; some are not. Most commercial blends contain quality seed that can produce quality food plots if planted correctly at the appropriate time on the appropriate site. Most contain some combination of the plants listed in Appendix 1. Be aware, however, that some commercial blends contain odd mixtures. Many commercial blends contain both large seed and small seed – seed that require different seeding depths. Some commercial blends contain plant species suited for moist areas as well as species suited for dry areas. Some contain seed for both warm-season plants and cool-season plants. These mixtures are largely a waste of money because much of the seed is destined to fail, wherever and whenever it is planted. Keep in mind, however, whether you decide to mix your own planting or buy a commercial blend, the planting procedures outlined above are critical to success. Do not be misled by advertisements stating all you have to do is spread the seed on the ground with no preparation necessary. This usually leads to disappointment.

Before planting, consider food plot placement, size, shape and distribution carefully. Although

Exclusion cages should be erected to monitor the success of forage plots. This photo represents an extreme example of deer over-grazing a food plot. If the appropriate herbicides had not been used, this plot would have been covered by weeds. When that happens, most people think their planting efforts failed, when in fact, the culprit might be too many deer and/or not enough forage across the area.

size, shape and distribution may vary somewhat for different wildlife species (as described below), food plots should not be placed where they are visible from public roads. This only advertises your work and increases opportunities for poachers.

Nearly an infinite number of planting combinations could be used in food plot mixtures. The mixtures listed in this publication (rates are per acre) have produced successful food plots in the appropriate soil types and moisture regimes for the wildlife species listed. Although only five species or groups of wildlife are listed, many other species may benefit from food plots (e.g., rabbits, groundhogs, squirrels, raccoons, ruffed grouse, cardinals, blue jays, sparrows, goldfinches and bluebirds).

WHITE-TAILED DEER

Ideally, food plots for deer should constitute 2 to 5 percent of a management area (your property), with a mixture of warm- and cool-season forage plots and grain plots incorporated into your food plot program. However, research has shown that as little as 1 percent of the land area in high-quality forage plots produces measurable benefits to deer. It is important to plant warm- and cool-season plots in different fields or different sections of a field. That is, don't take away available food in preparation to plant something else. For example, iron-clay cowpeas provide nutritious forage until the first frost, which is usually in mid-October. If the plot is mowed, disced and planted to clovers in early September, forage is taken away when it is needed most (late summer). Likewise, arrowleaf clover provides quality forage through late June. If a plot of arrowleaf clover is disced in May to plant jointvetch and/or cowpeas, a prime food source is removed during a period when it is really needed (just before fawning and during early antler development).

Separate acreage should be devoted to both warm -and cool-season forages where white-tailed deer is a focal species. Separate fields can be planted or half of a field dedicated to warm-season and the other half to cool-season forages. In this photo, crimson clover has been planted as a border around a patch of corn. Deer and turkeys love this arrangement!

Half of this plot is managed in ladino white clover, while the right half is being planted to a warm-season mixture. Providing year-round quality forage for whitetails is important.

Generally, forage plots for deer are between ¼ and two acres. Several smaller plots (two acres or less each) are usually better than fewer larger plots because several smaller plots can be spread out over the management area, encompassing more deer home ranges, thus benefiting more deer. The determining factors for the minimum and maximum food plot size are shade effect, deer density and distance to cover. Food plots should be large enough and wide enough to allow most plantings at least four hours of direct sunlight. If forage plots are over-grazed, additional habitat management, larger plots and/or an increased antlerless harvest are needed (see ***Quality Deer Management: Guidelines for Implementation***, PB 1643).

For optimum use, plots should be positioned in areas where deer feel comfortable and travel regularly. Usually, this is where two or more habitats meet – where brushy cover and mature woods meet, where a brushy creek bottom flows through an old-

This is one of the demonstration fields that has been used to determine germination and growth rates, deer preference, resistance to grazing, nutritional quality and herbicide recommendations for a wide variety of forages since 1999. Forages are planted in 0.10-acre cells. Yield and consumption are monitored through stationary and mobile exclusion cages, placed at random within each cell at the end of each month.

field or where an odd corner of an agricultural field is not planted. For hunting purposes, deer will most often move into a food plot during daylight hours where cover is no more than 50 yards away.

The following forage plot mixtures for white-tailed deer were developed after five years of experimentation where many forages were compared side by side with respect to germination, growth, deer preference, resistance to browsing and nutritional quality (see Appendix 2).

When grown on the proper site and soil amendments are added as recommended, all of these forage mixtures exceed the nutritional demands of white-tailed deer while the forages are actively growing. Depending upon growth stage, expect crude protein levels to exceed 20 percent, with total digestible nutrients constituting more than 65 percent of the forage.

Warm-Season Forage Plots

Warm-season forage plots provide nutrients necessary for lactation, fawn growth and antler development. Warm-season plots are excellent areas to hunt during the early season before mast (acorns) becomes available. Warm-season plots should be planted after danger of frost and before the overly dry conditions of summer prevail. Planting usually occurs mid-April through early June. Quality warm-season forages should be available through summer until the first frost of autumn.

Warm-season forage mixture for uplands or bottomlands

20# iron-clay cowpeas
10# Quail Haven re-seeding soybeans
6# lablab
5# peredovik sunflowers

Approximate price per acre: $69; without lablab or Quail Haven soybeans: $42

Soybeans may be the all-time favorite warm-season forage of white-tailed deer, but they do not tolerate browsing well, especially when young. Unless a large field is planted to soybeans and/or the deer density is relatively low (fewer than 20 deer per square mile), soybeans are not recommended for food plots. Usually, deer eat soybean plants soon after germination and there is little or no forage left in the plot. The exception to this is the re-seeding soybeans (e.g., Quail Haven), which withstand browsing pressure quite well.

Iron-clay cowpeas and lablab provide excellent forage for deer, especially in late summer/early fall when the palatability of natural forage (forbs) is decreased. Iron-clay cowpeas, lablab and re-seeding soybeans withstand browsing pressure relatively well and grow on a wide variety of sites, including drought-prone areas with heavy clays. This combination is recommended for sites that are droughty and/or clayey, as well as bottomland sites. When planted on bottomland sites, American jointvetch and alyceclover may be added to this mixture, if desired.

This is what a warm-season forage plot should look like in late summer – plenty of nutritious forage climbing over sparse sunflowers. Forage availability is not a problem where deer populations are kept in check with the habitat. Weed management is relatively easy in warm-season plots. Techniques are outlined in the section ***Managing Forage Plots*** on page 22.

Although deer may browse newly appearing heads of sunflowers, sunflowers are not added to this mixture as a forage, but for substrate the cowpeas, lablab and re-seeding soybeans can climb and grow upon later in the season, allowing the legumes to produce additional forage per acre. If you cannot find lablab or re-seeding soybeans, or feel they are too expensive (approximately $3.50–$5.00 per pound), just increase the rate of cowpeas appropriately (60 pounds per acre).

Warm-season forage mixture for bottomlands

7#	American jointvetch (*Aeschynomene*)
7#	alyceclover
2#	rape
20#	buckwheat

Approximate price per acre: $50

This photo shows the warm-season mixture for bottomlands. It is important to include buckwheat and a forage rape with this mixture because the jointvetch and alyceclover are relatively slow to get established. The buckwheat and rape will fade out later in the summer when the jointvetch and alyceclover begin to produce considerable forage.

This mixture is recommended for bottomland sites with loamy soils. In this mixture, buckwheat germinates very quickly, providing soil stabilization and available forage soon after planting. Although the Brassicas (e.g., forage rapes) are considered cool-season plants, they also can produce abundant forage through spring and early summer in a bottomland field where it is relatively cool and moist. The high expense of this mixture is attributable to American jointvetch, which usually costs from $3.50 to $5.00 per pound.

Cool-Season Forage Plots

Cool-season plots produce forage during the cooler months. A large mast crop (acorns and beechnuts) will influence use by deer. Cool-season forage plots should provide plenty of digestible energy through winter, enabling deer to enter spring in good shape. Forage high in protein (16–18 percent) is needed during March, April and May for maximum antler growth and reproductive demands. If planted before mid-September with adequate rainfall, annual cool-season forage plots should begin providing quality forage for grazing by mid-October, persisting until the plants die the following spring/early summer. Perennial cool-season plots are slower to establish. Therefore, an annual cool-season grain (e.g., oats or wheat) should be added to perennial forage mixtures (see ***The Need for an Annual Cool-Season Grain***, on page 10). If planted in the fall, perennial cool-season forages begin to produce substantial forage the following March.

Cool-season annual mixture for uplands

10#	crimson clover
5#	arrowleaf clover
20#	Austrian winter peas
25#	oats, rye or wheat

Approximate price per acre: $29

Crimson and arrowleaf clover are recommended for just about any site, but especially those that are too dry during the summer to support perennial clovers. Both crimson and arrowleaf re-seed really well, which allows them to be maintained for years without re-seeding. It is important to include both of these in an annual clover mix because crimson germinates and establishes quicker than arrowleaf, but arrowleaf persists about two months longer than crimson.

If you are planting on poor ground and/or don't want to spend too much money, this is the mixture to use. This annual mixture is as close to a foolproof food plot as it gets! Plus, there is no mixture that will attract deer and turkeys any better than this one. Crimson and arrowleaf clover are both adapted to a wide variety of soil types and do well even on dry hills and ridgetops. Both are excellent re-seeders, which enables these plantings to be managed year after year without re-seeding, providing the appropriate herbicides and management techniques are used (see ***Plot maintenance* — Annual cool-season forage plots** on page 25). Both crimson and arrowleaf clover are important components in this mixture. Crimson clover germinates and begins to produce quality forage faster than arrowleaf. Arrowleaf clover, however, flowers and dies at least six weeks later than crimson clover (late June/early July), thus extending the period of production for this mixture

Cool-season annual "shooter's" plot

100# oats (approximately 3–4 bushels)
Approximate price per acre: $25

If you are primarily interested in attracting deer to an area to make them more visible and facilitate hunting, planting a plot of oats will do the job. No cool-season plant attracts deer more than a lush stand of green oats – that is one reason why oats are recommended in every cool-season forage mixture listed for white-tailed deer. Don't think, however, you can just disc over a field, sow the oats and deer will come. It is still important to get the pH between 6.0 and 6.5, adjust P and K levels to medium, if not high; and add 100–200 pounds of ammonium nitrate per acre as the plot is getting established. When the soil is amended correctly, a stand of oats is quite nutritious (test plots contained 26.5 percent crude protein with 70.5 percent total digestible nutrients – 23 March 2003).

It is important to plant a variety of oats that is relatively winter-hardy, such as Mitchell, Coker 227, Arkansas 833 or Harrison. As the oats mature in the spring, palatability and digestibility will decrease substantially. At this time, the plot can be disced under in preparation for an annual warm-season planting or left fallow for planting the following fall. Another option is using a burndown herbicide (e.g., Roundup) to prepare the field for planting a warm-season plot with a no-till drill. This technique conserves soil moisture and may reduce "downtime" between cool-season and warm-season production. Yet another option is allow the oats to stand through the summer (making the seed available for wildlife), spray incoming weeds as appropriate and disc in late August. At this time, you might allow the oats to re-seed (oats re-seed quite well if seed production is adequate and if a substantial amount of seed remain after wildlife feed on the plot) or re-plant the plot in a cool-season mixture.

Cool-season perennial mixture for uplands

4# ladino white clover
5# red clover
4# berseem clover
1# chicory
1# rape
25# oats or wheat
Approximate price per acre: $48
Without chicory and berseem clover: $32

This is an excellent perennial mixture; however, do not expect to retain ladino clover on exposed sites that become excessively dry during the summer. The cool-season annual mixture is much better suited to those sites. Regal ladino is well adapted to clayey sites and Osceola ladino is adapted to clay or sandy loams. There are several other varieties of ladino clover to choose from as well, including Advantage, California, Durana and others. Some are better adapted to wet conditions; some better adapted to drier conditions. All are excellent for-

Perennial clovers can be maintained longer on sites that are relatively moist through the year. Excessive drying during the summer will thin stands, sometimes to the point that re-seeding is necessary. Always include an annual (e.g., oats and rape) in perennial clover mixtures to provide quick growth, soil stabilization and available forage soon after planting.

ages for deer. The most important consideration is matching the planting to the site. Expect high use of this plot for several years, provided the plot is managed correctly (i.e., annual top-dressing with lime and fertilizer and weed control). Red clover and chicory will tolerate dry conditions fairly well (especially chicory). Chicory, however, makes this mixture relatively expensive (chicory usually costs $8–10 per pound), but it does not have to be included. If chicory is not included, the seeding rate of red clover and ladino clover should be increased

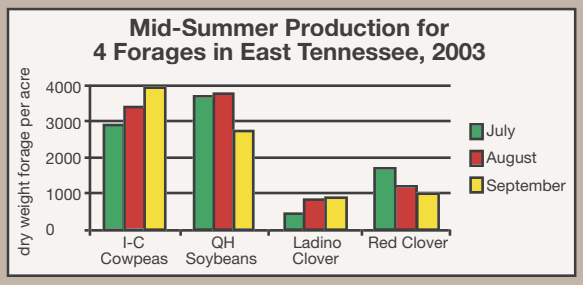
Berseem clover is an annual that can be added to a perennial clover mix. Berseem germinates and grows relatively quickly, providing forage much sooner than perennial clovers.

Red clover is classified as a biennial clover and has real potential as forage for white-tailed deer (see sidebar). When grown with perennial white clovers (e.g., ladino), red clover enables the plot to produce substantial forage longer through the summer than if white clovers were grown alone.

Red Clover – not just for cattle!

Red clover should be considered seriously by anyone planting a perennial cool-season forage plot for white-tailed deer. Red clover is classified as a biennial clover (with several varieties available); however, with proper management, it can be retained in a food plot for several years along with other clovers, such as ladino white clover. Red clover is more tolerant of dry conditions and very productive where soils have been amended properly. In recent years, red clover has gotten bad publicity by some companies that sell commercial food plot mixtures, calling red clover "cattle clover." Their claim is that red clover is too stemmy to be considered as a deer forage. These claims are wrong. Red clover does produce relatively large stems, but this is not what deer eat. Deer eat the foliage produced on the ends of the stems!

In side-by-side tests with many other forages over a five-year period, red clover has consistently been a high-preference plant for whitetails. In addition, its ability to produce extremely high-quality forage through the summer months has been remarkable. During the summer of 2003, red clover (Red Gold variety) was preferred by deer and produced more biomass (only foliage was sampled, not stems) over all other perennial cool-season forages (e.g., Advantage ladino white clover, Puna chicory, white-dutch clover, birdsfoot trefoil). Only certain warm-season forages out-performed red clover during this period.



Monthly production for 4 forages during summer 2003 from experimental plots in East Tennessee where wild white-tailed deer fed at will. Production was measured by collecting forage from mobile exclusion cages placed randomly at the end of each month within plots.

one pound each. Berseem clover is an annual clover added to this mixture because it germinates and grows relatively quickly and is a high-preference plant for deer. Rape is included because of its ability to withstand cold winter weather and provide forage even after hard frosts and snows when clovers are often "wilted down." This is often a critical time for deer when forage availability is quite low.

Cool-season perennial mixture for relatively dry sites

7#	alfalfa
4#	red clover
3#	chicory
2#	birdsfoot trefoil
25#	oats or wheat

Approximate price per acre: $73

This is a perennial plot for upland areas that are prone to becoming quite dry during summer. Expect stand thinning to occur during prolonged dry periods; however, with proper management, the stand can be retained and invigorated. Exposed sites that become excessively dry should be planted with the cool-season annual mixture. Alfalfa is sensitive to acid soils and low fertility and alfalfa weevils can become problematic. To maintain alfalfa, the pH should be raised to 7.0, both macro- (phosphorus and potassium) and micronutrients (especially sulfur and boron) need to be applied and insecticides will be necessary to combat alfalfa weevil infestations (1–2 pints of Furadan® or 1–2 pints of Lorsban® or 4–8 ounces of Pounce® per acre).

Chicory is rated as a relatively high-preference plant for whitetails (see Appendix 2). Chicory is tolerant of moderately dry conditions and makes an excellent addition to perennial clover plots, especially on those sites that become dry enough during the summer to stress clovers.

Alfalfa requires considerable management effort. Not only are soil amendments needed, but alfalfa weevils are often problematic. Control is usually necessary in the spring — recommendations are provided in the text.

Nonetheless, this forage mixture should persist for many years if top-dressed annually according to a soil test and sprayed for weevils and weeds when necessary. This mixture is not cheap (alfalfa costs approximately $3.50 per pound; chicory costs approximately $8.50 per pound; birdsfoot trefoil costs approximately $5.50 per pound); therefore, it is important to realize the management effort needed to retain this stand before planting.

Cool-season perennial mixture for moist bottomland sites

5#	alsike clover
4#	ladino white clover
2#	rape
25#	oats or wheat

Approximate price per acre: $35

This perennial mixture is well-suited for bottomland sites that are fairly moist most of the time. Weed control will be necessary and the plot should be top-dressed annually.

The Need for an Annual Cool-Season Grain

All of the cool-season mixtures listed above contain an annual component. Annual plantings complete their life cycle in one growing season and, depending on the plant, variety and management strategy, may or may not re-seed themselves. Biennials normally require two growing seasons to complete their life cycle. Perennials continue living after flowering and bearing seed and, depending upon management, may be present for many years. Because clovers, alfalfa and birdsfoot trefoil are relatively slow to get established, it is important to include a

cool-season grain (oats, rye or wheat) in the mixture. [Note: barley is not included because white-tailed deer did not eat barley when other forages were available.] Cool-season grains germinate and establish quickly, providing forage soon after planting. In addition, because establishment is relatively fast, cool-season grains help prevent soil erosion. Another reason to include these annual grasses in a cool-season forage mixture is because they serve as a "nurse crop" for perennial legumes through the first winter after planting and die the following spring/summer. This allows perennial legumes to establish a good stand before summer.

This series of pictures illustrates the typical progression of an annual (e.g., oats) planted in a perennial clover mix. This plot was sown in September 1999. Soon after planting, the oats germinated and became established, providing forage for deer quickly. By May, the oats had matured and produced seedheads and the clover had become well established. While growing, the oats served as a "nurse crop" for the ladino white clover. By July, the oats had died and started to fall over. By September, the dead oats had "melted" into the clover (the plot was not bushhogged), leaving a pure clover stand that can be maintained for several years with the appropriate management techniques (see *Plot maintenance - Perennial cool-season forage plots* on page 26).

Ruffed grouse don't prefer perennial grasses either!

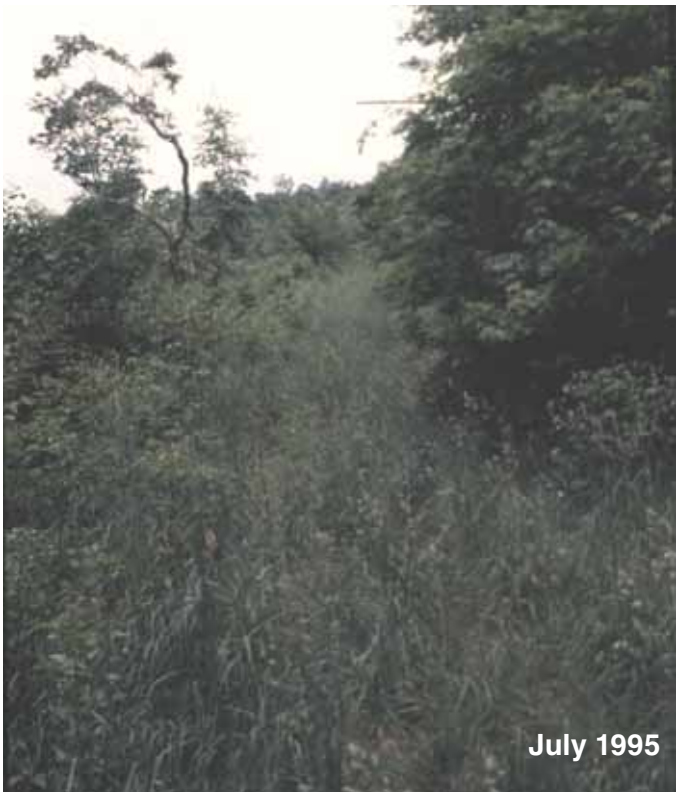
From 2000–2002, 53 ruffed grouse were collected during March in western North Carolina to determine their physiological condition and to see what grouse were eating during this time of year. The effort was part of a regional project – the Appalachian Cooperative Grouse Research Project – that studied the ecology and management of ruffed grouse in the central and southern Appalachians. Crop contents from all birds killed were identified, weighed and preserved. All of the grouse were killed from gated roads that were initially planted in an orchardgrass/white-dutch clover mixture. Leaves and flowers of herbaceous plants were found in 92 percent of the 53 crops examined and comprised 40 percent of the material in the crops over the three-year period. Other foods included evergreen and deciduous leaves, acorns, ferns, buds and twigs, soft fruits, etc. Of the herbaceous material eaten, cinquefoil and clover represented the vast majority, followed by avens and ragwort. The interesting thing was that orchardgrass, which was the dominant cover on most of the roads, was not present in any of the grouse crops. In fact, the graduate student who sorted through the crops of 326 grouse colected from NC, VA, WV, KY, MD and PA reported, "Grasses were not eaten much at all at any site in any year. I did get a few (very few) grasses in crops, but their quantities were very minimal (usually not measurable) and were classified as 'trace' (<0.1 gram dry mass). Apparently grouse ate grass incidentally while foraging on the forbs."

(Bob Long, M.S. Thesis, West Virginia University)

Don't Plant Perennial Cool-Season Grasses

Do not include tall fescue, orchardgrass, brome-grasses, bluegrass or timothy in any food plot mixture! Perennial grasses rank at the bottom in terms of forage preference by white-tailed deer. In the experimental plots used to determine the above recommendations, there was no measure of deer foraging on tall fescue or orchardgrass at all, in any year or season (see Appendix 2). Noted food habit studies of white-tailed deer across the South over the past 50 years also have noted a lack of perennial grasses in the diet. Not only are they not preferred, perennial grasses are competitive and usually choke out clovers by the second growing season, leaving nothing but a rank field of grass with relatively high lignin content, providing low palatability, low

These 2 photos show plots of oats and orchardgrass in the same field during April. The difference in growth and use by deer is obvious. Oats has consistently been the most preferred cool-season forage by white-tailed deer every year since the demonstration fields were established, while virtually no measure of grazing has ever been recorded in the orchardgrass plots during any season of the year. In addition, crude protein and total digestible nutrients are both considerably higher in oats (until maturity) than orchardgrass (see Appendix 2). Which would you rather have in your forage food plot?



This woods road was limed, fertilized and sown with a mixture of white dutch clover and orchardgrass in the fall of 1993. By July 1995, the clover was out-competed and disappeared from the site, resulting in a road of orchardgrass, which offered poor-quality forage, poor structure for poults and fewer invertebrates. Perennial cool-season grasses should never be included in a planting mixture where wildlife is a consideration.

digestibility and low nutrition. Even if other desired forages were not choked out completely, why would you want a certain percentage of your food plot taken up by non-preferred plants with lower nutritional quality? It doesn't make sense!

Are you interested in wild turkeys, ruffed grouse or bobwhites using your plot(s)? If so, then there are more reasons why you shouldn't plant perennial cool-season grasses. Because of the sod-forming nature of these grasses, a dense mat is created at ground level. This inhibits travel for young turkeys, grouse and quail. Research in the southern Appalachians showed wild turkey and grouse broods used only the periphery of openings dominated by orchardgrass, while openings of naturally occurring weeds arising from the seedbank were used entirely.

Grain Plots

Grain plots are primarily warm-season annual plots; however, they provide important sources of energy during fall and winter, particularly when the hard mast crop is poor. Corn is by far the favorite among white-tailed deer; however, grain sorghum and/or several types of peas can be planted along with corn. Peas climb up the corn and milo stalks in late summer and provide quality warm-season forage until the first frost. Strips of corn 100–150-feet wide adjacent to strips of forage plots (listed previously) make excellent sources of food and cover for deer, rabbits, wild turkeys, bobwhites and doves. When sowing grain plots, keep in mind a lighter seeding rate is better than a heavy seeding rate. Grain plots seeded in excess of the recommended rate generally produce less seed. Also, larger plots (2–3 acres, or more) are usually warranted when growing grain plots. Smaller plots, especially when located near drainages, may be decimated in a night or two by raccoons.

Corn/Milo mixture

8# quality seed corn
3# grain sorghum (milo)
20# iron-clay cowpeas or 10# catjang cowpeas
Approximate cost: $27

Weed control may be necessary and can be difficult when peas are included in the mix. A pre-emergence application of 2 pounds Atrazine® per acre is recommended to control various broadleaf and grass weeds in corn and grain sorghum plantings. However, the addition of peas restricts you from being able to use Atrazine®. When forage legumes are included, 2–3 pints of Prowl® applied pre-emergence is recommended.

Corn plots may be drilled with a corn planter, but this is not necessary. Successful grain plots are possible by simply discing and covering the seed 1–2 inches after sowing. Corn is a heavy nitrogen user. It is very important to amend the soil as recommended by a soil test. Recommended seed corn is open-pollinated (less expensive) or hybrid field corn (more expensive) commonly grown for feed. Seed corn prices are variable and fluctuate year to year. Both seed corn and grain sorghum are often available free through local chapters of Quail Unlimited. A 50-pound bag of seed corn will plant four acres of corn alone and even more if other seeds are included in a mixture. Seed variety of grain sorghum is very important. Preference should be given to tall varieties and bird-resistant varieties. Tall varieties compete with weeds (and corn) better and bird-resistant varieties help prevent seed crop depredation through the summer by house sparrows, grackles and starlings. KS 989 is a good tall, bird-resistant variety of grain sorghum.

WILD TURKEYS

All the cool-season forage plots listed for white-tailed deer will attract wild turkeys as well. Expect heavy use in late winter/early spring after the acorn crop disappears and turkeys begin searching for green patches. In addition, wild turkeys will use both warm-season forage plots and perennial cool-season plots as "bugging grounds." These plots usually harbor an abundance of insects and other invertebrates that are critical components in the diet of wild turkey poults during early- to mid-summer.

Wheat is also a valuable food source for many species of wildlife. Turkeys, deer, rabbits, groundhogs, quail, doves and many species of songbirds eat the forage and/or seed produced. Whenever turkeys and quail are a primary consideration, wheat should be considered over oats in forage plot mixtures listed for deer. If the soil is amended properly, green wheat forage can be quite nutritious (test plots contained 24.9 percent crude protein with 69.6 percent total digestible nutrients – 23 March 2003). If the plots are not overgrazed and allowed

Corn is a great source of carbohydrates and energy for wildlife during the fall and winter. During years with a large acorn crop, corn plots may not be used much. When this occurs, leave the corn standing. Excellent brood cover for wild turkeys and bobwhites is created the following spring and summer by forbs germinating from the seedbank, while the corn is preserved by the shucks. Later, during the second fall after planting, the plot can be bushhogged a few strips at a time to make the remaining corn more available.

to mature and produce seed, a quality food source is available for birds the summer after planting. If allowed to set fallow, these fields (as well as corn/milo fields) can provide excellent brood habitat for wild turkeys and bobwhites the following summer (second summer after planting) as a variety of forbs become established from the seedbank.

Wild turkeys readily feed upon available grain during fall and winter. The grain plots listed for deer and doves are also excellent choices for wild turkeys. Chufa (a variety of yellow nutsedge) is another popular planting for wild turkeys. Turkeys feed upon the nut-like tubers produced among the roots of chufa. Be aware, however, that chufa grows best in sandy soils and turkeys cannot feed upon the tubers unless they can scratch down into the soil far enough to turn up the roots. This is not possible in heavy clays unless the soil is disced after the chufa has matured. For these reasons, chufa plots are most successful in sandy or sandy-loam soils.

MOURNING DOVES

Doves are attracted to many different seeds and grains, including corn, milo, millets, sunflowers and buckwheat. Larger food plots (5–20 acres) are recommended to attract large numbers of doves. Freshly cut grain fields are preferred feeding spots for doves. Doves do not scratch and are "weak-beaked;" therefore, they prefer feeding upon loose grain (rather than corn still attached to the cob) or other seed in relatively open sites with some bare ground available. Bushhogging and strip discing can make seeds more available and feeding sites more attractive. Do not bushhog an entire field at once, but mow and/or disc sections or strips to provide seed throughout the fall and winter. Doves also prefer fields with structure (e.g., trees or powerlines) nearby that allow them to perch and loaf near the field. In addition to perching sites, a source of water and grit will make the area more attractive for doves.

Weed control can be a problem in dove fields, but be aware that several naturally occurring weeds (e.g., ragweed, barnyardgrass, tropic croton, red-

Photos by Marion Barnes

Grain fields are most attractive to doves when seed is scattered by bushhogging or silage chopping. Either way, don't clear an entire field, but cut strips, leaving food available for later in the season.

root amaranth, pokeberry, Carolina geranium, foxtail grasses, fall panicum) produce seed favored by doves and actually can make a food plot more attractive to these birds. Where certain broadleaf weeds (e.g., cocklebur, sicklepod) are problematic, grasses (e.g., milo and millets) should be substituted for forbs (e.g. sunflowers) because 2,4-D then can be used for weed control. Where grasses (especially crabgrass and johnsongrass) are problematic, a pure stand of sunflowers or buckwheat allows the use of grass-selective herbicides (e.g., 8-10 ounces of Select® per acre) to control grass weeds.

Mixed plot for doves

10# white proso millet
10# dove proso millet
10# browntop millet
5# peredovic sunflowers or 3# grain sorghum

Approximate cost: $25

Research has shown white proso millet is the preferred seed for mourning doves, followed closely by dove proso millet and browntop millet. Regardless of type, if a good crop of millet (including foxtail and pearl) is established, doves will come. The propensity for doves to feed on sunflowers is no secret; however, where deer are abundant, sunflower heads may be consumed before maturing.

Corn/milo plot for doves

10# quality seed corn
3# grain sorghum (milo)

Approximate cost: $17

Pure stands of corn or milo may be planted according to the rates given in Appendix 1. These grains also can be mixed, if desired, and planted at the rate shown above. A pre-emergence application of 2 pounds of Atrazine® per acre is recommended to control various broadleaf and grass weeds.

Sunflower plot

25# peredovic sunflowers (black-oil type)

Approximate cost: $13

Sunflower fields are normally managed by bushhogging sections or strips before and during the dove season. Fields of sunflowers also can be burned after the plants mature and turn brown to attract birds. Burning releases the seed and creates an open structure at ground level that doves prefer. For weed control, 3 pints per acre of Prowl® should be applied pre-emergence, then disced to approximately 1 inch deep before planting. Treflan® (1.5–2.0 pints per acre) may be tank mixed with Prowl® for additional weed control. Select® (10 ounces per acre) or Poast Plus® (2.5 pints per acre) may be used for post-emergence grass control.

Managing Wheat Fields for Dove Hunting

Hunting over baited fields is always a concern for dove hunters (at least most of them!). Because mourning doves are migratory, the US Fish and Wildlife Service regulates the restrictions placed on dove hunting. The US Fish and Wildlife Service allows dove hunting over mowed or cut grain fields as well as fields grown specifically for doves and other wildlife. In addition, “Lands planted by means of top-sowing or aerial seeding can be hunted [for doves] where seeds are present solely as the result of a normal agricultural planting or normal soil stabilization practice. Normal agricultural planting, harvesting or post-harvest manipulation means a planting or harvesting undertaken for the purpose of producing and gathering a crop, or manipulation after such harvest and removal of grain, that is conducted in accordance with official recommendations of state Extension specialists of the Cooperative State Research, Education

and Extension Service of the US Department of Agriculture." (Note: By policy, the Service does not make a distinction between agricultural fields planted with the intent to harvest and those planted without such intent as long as the planting is in accordance with Cooperative Extension Service recommendations.) (Excerpts from Title 50, Code of Federal Regulations, Parts 20.11 and 20.21i)

This means dove hunting over harvested and non-harvested agricultural fields is legal. Further, it is legal to hunt doves on, over or from fields of top-sown or drilled winter wheat as long as the seeding rate does not exceed that recommended by the state Extension Service. Nonetheless, you should always check current and local laws before manipulating and hunting fields for doves.

Winter wheat is one of the most popular plantings for wildlife food plots. And for good reason – both the forage and seed are nutritious and fed upon by a myriad of wildlife species, both game and non-game. A planting of wheat has other benefits as well. If allowed to set fallow for a year after maturity, excellent brood habitat is created for wild turkeys and bobwhites by forbs germinating from the seedbank during the second summer after a fall planting.

Recommended rates (UT Extension) for top-sowing winter wheat on a prepared seedbed.

Use	Seeding rate*	Seeding dates
Winter cover	1–1.5 bushels per acre	Sept 15 – Oct 20
Fall grazing	2–3 bushels per acre	Sept 1 – Oct 1
Cover, wildlife enhancement or fall grazing	1.5–3 bushels per acre	Aug 15 – Oct 15

**Seeding rate may be increased 50 percent if using combine-run seed.*

The following summer, after the wheat has produced seed and died, the field can be burned to attract doves again. When the dead foliage is consumed by fire, the seeds are released and made readily available to ground-feeding birds (if not already consumed by wild turkeys, songbirds, small mammals and/or deer).

BOBWHITE QUAIL

Bobwhites use a variety of grain plots, annual lespedezas and weedy fields for seed. In addition to the mixtures listed for doves, quail benefit from mixtures that include cowpeas and soybeans when the deer density is low enough to allow these plants to produce seed. Food plots for quail should not be nearly as large as those for doves. Quail require all of their habitat needs in close proximity. As a result, they are often associated with habitat edges. Food plots for quail should be long and narrow, ideally along a field border situated close to blocks of natural cover (e.g., oldfields, thickets and woodlots) or brushy fencerows or hedgerows. A prime location would be adjacent to the corner where a fallow field and a rowcrop field (separated by a brushy hedgerow) meet a cutover area or some other type of thicket.

Quail broods frequent forage plots and weedy fields as they search for insects and other invertebrates. Optimally, fields intended for use by quail should be relatively open at ground level with a canopy of forbs (weeds) overhead. This type of

environment enables quail chicks in search of invertebrates to move about easily while protected by the "umbrella cover."

"Weeds" that should be encouraged for bobwhites include ragweed, partridge pea, beggar's-lice, Carolina geranium, milk pea, butterfly pea, smartweeds, blackberry, pokeberry, native lespedezas, morninglories, annual panicgrasses and foxtail grasses. These plants are important for bobwhites, for both food and cover. To stimulate these plants, disc blocks and/or strips adjacent to field borders in late winter. This disturbs the soil and encourages seed in the seedbank to germinate. The plant composition created by discing not only provides a food source, but also serves as cover for quail, rabbits and many other small animals. Discing around fields serves as a firebreak as well. Burning oldfields every two or three years is by far the best way to maintain early successional habitat favored by many wildlife species, including bobwhites, wild turkeys, rabbits and deer.

Burning is by far the best way to manage fields for wildlife. Burning consumes the litter layer, allowing small wildlife to travel through the field easily. Burning also stimulates plant growth and allows the seedbank to germinate, creating a "natural food plot" for many wildlife species. The bottom picture was taken in July after the field was burned in March. Conditions for brooding quail and turkeys were optimum, browsing by deer was obvious and rabbits were seen throughout the field when the picture was taken.

Do not plant tall fescue, orchardgrass, bromegrasses, bluegrass or timothy! They can be detrimental to bobwhites and other wildlife species for several reasons. Perennial cool-season grasses displace good nesting and brood-rearing habitat (such as native warm-season grasses and the associated "weeds" described above). The dense structure of perennial cool-season grasses at ground level precludes the mobility of quail chicks and other small wildlife species (see ***Don't Plant Perennial Cool-Season Grasses*** on page 12). Also, fields dominated by these grasses typically do not harbor as many invertebrates as fields predominately comprised of forbs (broad-leaved herbaceous plants), providing less food for young quail, wild turkeys and ruffed grouse. When invertebrates are less abundant, broods have to spend more time searching for food, which leads to increased energy expended and increased exposure. Later in life, when seeds become more important in the diet, the thatch produced by perennial cool-season grasses limits seed availability (if any is present). Further, consumption of tall fescue seed by bobwhites leads to weight loss, cloacal swelling and, ultimately, increased mortality. For these reasons, it is obvious that cool-season perennial grasses displace quality habitat for bobwhites and, over time, can lead to increased mortality and reduced recruitment into the fall population.

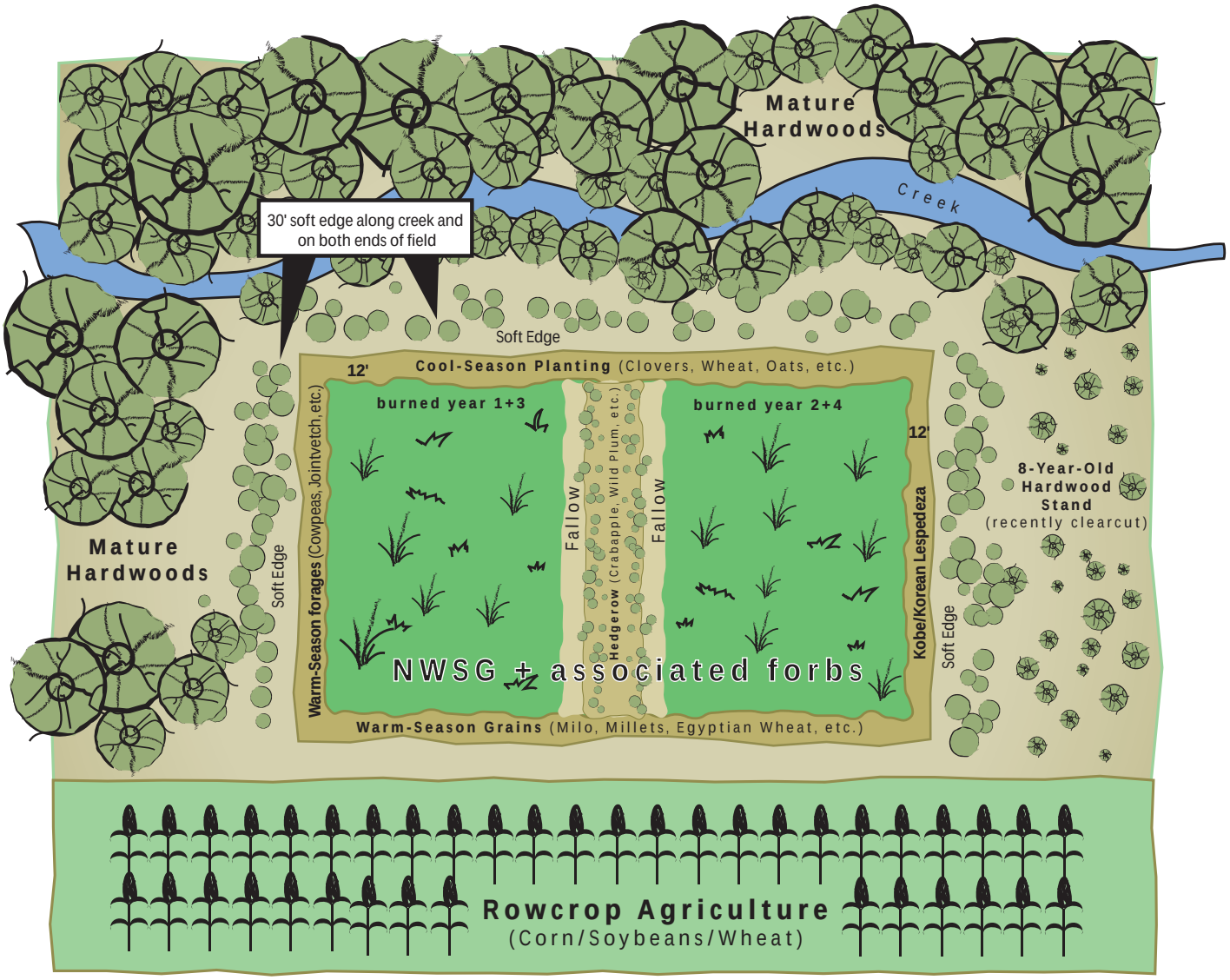
Fields can be made more attractive to feeding, brooding and nesting bobwhites by killing perennial cool-season grasses and allowing the various forbs listed above to establish. Perennial cool-season grasses are killed most effectively by spraying while they are actively growing. Burndown herbicides (e.g., glyphosate) are recommended when the field is dominated by these grasses. Grass-selective herbicides (e.g., Select®) may be used when desirable grasses (e.g., native warm-season grasses) are not in abundance across the field. Other selective herbicides (e.g., Plateau®) can be used to kill tall fescue when desirable forbs and grasses are present. Refer to labels for rates and application recommendations. Also, see ***Plot Preparation — Getting Rid of Perennial Grasses*** on page 23 for additional information on controlling perennial cool-season grasses.

Firebreak Management

Prescribed fire is the most effective and efficient management technique used to enhance and maintain quality early successional habitat. Prescribed fire is also highly recommended to improve habitat conditions for many wildlife species in forest stands, including pine stands and hardwood stands. Whenever controlled burning is conducted, it is very important to establish a firebreak around the area before burning to help keep fire from spreading into areas where burning is not intended. Most firebreaks around fields are created with a tractor and a disc; bulldozers may be used to establish firebreaks within forest stands (some of which may be used as woods roads).

Photo by Mike Hansbrough

Planting firebreaks is an excellent way to provide a quality food source adjacent to cover. This firebreak has been planted to clovers and is used to contain fire when burning the native warm-season grasses between the firebreak and the road, which is on the left side of the photo.



This illustration shows the proper arrangement, juxtaposition and management for bobwhites and other wildlife species. A 4-acre field of native warm-season grasses has been established and is being managed with prescribed fire. A hedgerow of soft mast-bearing shrubs and trees was created to break the field into two sections. Firebreaks are planted to various mixtures, providing a supplemental food source.

Firebreaks should be established well ahead of the projected burning date. If you plan to burn in late winter/early spring, it is a good idea to establish your firebreak the previous fall. This allows the firebreak to be planted to a cool-season food plot, if desired. If the firebreak is located adjacent to woods, it may be necessary to disc after the leaves fall or re-discing may be necessary, as fire can move across a firebreak filled with leaves and/or pine needles.

When managing for quail, blocks of cover (fields) should be created with strips of food (planted firebreaks), as opposed to blocks of food and strips of cover. This is because cover is almost always the limiting factor for bobwhites. This technique provides good juxtaposition of food and cover.

Firebreaks can be managed in several different ways. They can be planted to cool-season forage plots, warm-season forage plots, grain plots or left fallow to stimulate the seedbank and establish naturally occurring legumes and other forbs. Managing firebreaks for year-round food resources is recommended. This can be done by planting different sections (depending on your objectives) of your firebreak in different types of food plots. Several different seed mixtures are possible to provide quality food strips for quail. An example is given in the figure on page 18.

One long side of the firebreak was planted to a cool-season forage strip. This section will provide green forage during winter and spring and invertebrates during the brood-rearing season. The other long side was planted in a warm-season mixture to provide supplemental seed in late summer through fall and winter. One short side was planted in warm-season legumes for seed production, brood habitat and forage for deer, rabbits and groundhogs during summer. One short side was planted in lespedeza to provide seed for bobwhites during winter. Firebreaks adjacent to the central hedgerow were left fallow to stimulate desirable weed growth, which will provide seed, invertebrates and sites for dusting. All of these food sources are in close proximity to quality nesting, brood-rearing and escape cover. This juxtaposition helps decrease the required travel and exposure of a given pair, brood or covey.

A word about Native Warm-Season Grasses

Native warm-season grasses (including big bluestem, little bluestem, broomsedge bluestem, indiangrass, switchgrass, sideoats grama and eastern gamagrass) are planted (or stimulated and encouraged by burning and using selective herbicides) to provide cover for wildlife; in particular, nesting and escape cover for quail, rabbits and several species of songbirds. Nwsg grow in bunches and, when sown and managed correctly, contain open ground between bunches. Bobwhites prefer to nest at the base of these bunchgrasses and use the open spaces as “runways” for travel and feeding. White-tailed deer also use fields of nwsg as bedding sites and fawning areas. Nwsg are not, however, planted as food plots for wildlife.

Photo by Mike Hansbrough

Annual cool-season firebreak mixture

5# crimson clover
20# Austrian winter peas
50# wheat
Approximate cost: $23

An annual cool-season mixture is recommended for firebreaks. This facilitates the need to disc every year or two in late summer/early fall. This mixture is adapted from the annual cool-season forage plot recommended for deer, except wheat is included and at a higher rate because seed production is desired. If Austrian winter peas are not included, just increase the percentage of crimson clover (another 5 pounds) as appropriate.

Annual warm-season firebreak mixture (forb and grass)

15# iron-clay cowpeas
20# soybeans
10# buckwheat
5# browntop millet
5# grain sorghum (milo)
Approximate cost: $26

Photo by Jerry Rhinehardt

This is the mixture used for the Tennessee 4-H Food And Cover Establishment (FACE) plots. This mixture produces an abundance of seed for birds; however, seed production from soybeans, cowpeas and buckwheat may be limited in areas with a high deer density. Sunflowers (3 pounds) can be added to this mixture if desired.

Annual warm-season firebreak mixture (grass only)

7# white proso millet
7# browntop millet
5# Egyptian wheat
5# grain sorghum (milo)
Approximate cost: $20

Deer eat very little grass during summer; thus, this mixture does well even where there is a high deer density.

Annual warm-season firebreak mixture (lespedeza)

15# Kobe/Korean lespedeza
2# partridge pea
Approximate cost: $40
Without partridge pea: $16

Kobe and Korean lespedeza produce seed readily fed upon by quail during fall and winter. Using annual lespedezas in a firebreak facilitates discing in late winter, just prior to burning a field in March or April.

Bobwhites relish seed from Kobe/Korean lespedeza, which are available through winter, making areas planted to these lespedezas primary feedings spots from December through February. The best time to plant is late winter (mid-Feb–mid-Mar). Both Kobe and Korean lespedeza are good re-seeders, which allows them to be retained by discing in late winter (many stands will re-seed without discing). If not already present in the seedbank, partridge pea is a good addition to this mixture. Partridge pea seed, however, is expensive (approximately $12 per pound).

WATERFOWL

Food plots in areas that can be flooded 8–12 inches are magnets for ducks. A shallow dike with some type of water-control structure (e.g., flashboard riser) enables the water level to be manipulated over the field. Flooding should be conducted gradually beginning September through November (according to objectives), with full flood occurring by late November. Drawdowns also should be conducted gradually and completed by late February, if another crop is to be grown.

Natural Resources Conservation Service

A water-control structure allows the water level to be manipulated when fields are flooded for waterfowl.

It is important to realize food plots for ducks cannot be manipulated like those for doves. Current federal regulations allow waterfowl hunting over standing crops and harvested crops (flooded or not). Crops, however, cannot be manipulated except by standard agricultural practices used to establish, manage and harvest the crop. Grain inadvertently scattered through harvest operations, entering or exiting the field, placing decoys or retrieving birds is not considered bait. Nonetheless, you should always check the current US Fish and Wildlife Service and state hunting regulations before hunting.

The main consideration when establishing a food source for waterfowl is deterioration of seed after inundation (flooding). Naturally occurring moist-soil plants typically persist longer than agricultural crops. For example, many moist-soil plants (e.g., smartweeds, sedges, panicgrasses) experience only 20–25 percent deterioration after flooding for 90 days. In addition, most agricultural crops do not contain enough protein to provide a complete diet for waterfowl. It is for these reasons that naturally occurring moist-soil plants should be encouraged either in the same flooded unit or in an adjacent flooded unit to provide optimum feeding conditions for waterfowl.

Millet mixture

15# browntop millet
15# white proso millet
Approximate cost: $21

Browntop and white proso millet are highly sought after by several duck species. Browntop millet has a maturation date of only 60 days (white proso, 70 days) and a deterioration rate of only 25 percent after 90 days of inundation, making this mixture most worthy of consideration.

Natural Resources Conservation Service

Managing naturally occurring moist-soil vegetation will attract lots of ducks, such as these mallards. The U.S. Fish and Wildlife Service allows vegetation within moist-soil areas to be manipulated (e.g., bushhogging and burning) for duck hunting; however, crops (e.g., planted millets, corn, chufa), whether grown for ducks or agriculture, cannot.

Japanese millet

25# Japanese millet
Approximate cost: $18

Japanese millet can be flooded shallowly, but not inundated, soon after establishment. This supports wetland habitat into the growing season and helps provide weed control. Japanese millet has a maturation date of 90 days after germination and a deterioration rate of 57 percent after 90 days of inundation. Often, Japanese millet re-establishes in an area where previously grown if it is allowed to mature and produce seed. "Naturalized" Japanese millet (that coming up naturally at least one growing season after it was planted) can be manipulated legally, as can other naturally occurring moist-soil plants.

Grain mixture

7# quality seed corn
5# grain sorghum (milo)
Approximate cost: $17

Corn and milo have deterioration rates of 50 and 42 percent, respectively, after 90 days. Soybeans should not be flooded for ducks because they decompose rapidly (86 percent over 90 days) and may cause food impaction within duck crops (throat), which can be fatal.

Chufa

40# chufa
Approximate cost: $132

Chufa can be planted for ducks, just as for wild turkeys. Ducks relish the tubers, much as turkeys do. Chufa grows best in well-drained sandy loams, but can be grown in predominantly clay soils as well. This is not a problem when planted for ducks (as it is for turkeys) because the area is later flooded, which makes the soil relatively soft, enabling ducks to get to the tubers. Chufa does best in high-fertility soils; therefore, P and K levels may be raised to high levels (31–120 and 161–320 pounds available per acre, respectively). After the chufa has grown to 6–12 inches in height, top dress with ammonium nitrate (100–200 pounds per acre). Chufa matures approximately 100 days after germination. Broadleaf weeds can be controlled with 2,4-D and problem grasses can be controlled with Select®. "Clean" chufa plots typically produce greater yields than weedy plots. Chufa plantings can be expensive (approximately $3.50 per pound).

Winter wheat

100# wheat (1½–2 bushels)
Approximate cost: $25

Wheat sown in the fall can be flooded after it reaches about 6 inches in height. This produces an excellent food source for Canada geese and American wigeon.

MANAGING FORAGE PLOTS

To establish and maintain quality food plots for wildlife, management is necessary. This is especially true for perennial plots. Food plot management involves liming, fertilizing, herbicide and insecticide applications, mowing, discing and rotational planting.

Maintaining soil pH at the appropriate level is critical. Soil pH can limit plant growth by restricting nutrient availability to plants. In acid soils, nutrients may be bound to soil particles; thus, only a limited amount of any fertilizer applied is actually available to the plant. This condition is corrected by liming. Liming corrects soil acidity, improves

Site and nutrient availability are major considerations when planting food plots. Liming is absolutely critical to increase soil pH, improve availability of nutrients, improve nitrogen fixation among legumes and increase herbicide effectiveness. Hiring a lime truck from the local fertilizer supplier is much more efficient and economical than buying and applying bagged lime.

nutrient availability, supplies calcium and magnesium, improves nitrogen fixation in legumes, reduces nutrient leaching and improves the efficacy of herbicides. On acid soils (pH < 5.8), liming is the most important step in establishing and managing successful food plots. After the pH has been corrected, annual top-dressing with the appropriate fertilizers will boost available nutrition and growth. Consider liming fields by contracting a lime truck (ag lime) from a local farm supply store – it is much more cost effective. Lime trucks typically have a six-ton minimum order. At $16 per ton (price is higher in some areas, lower in others), the order will cost about $100 for six tons of lime. Compared to bagged lime, this may be the biggest bargain of all time. A 50-pound bag of pulverized dolomitic lime costs approximately $1.89 per bag – $75 per ton. A 40-pound bag of pelletized lime costs approximately $2.89 per bag – $145 per ton. Plus, you have to handle and spread bagged lime yourself! Be aware that **ag lime, pulverized lime and pelletized lime have the same neutralizing properties**. The notion that less pelletized lime is needed is wrong. Pelletized lime is largely a waste of money unless you are applying it on very small acreage.

Weed control is another problem and is absolutely necessary for many types of food plots, especially forage plots. The seedbank in your soil is full of weed seeds. Ever since Eve ate the fruit, we have had a problem with weeds (Genesis 3:17-18) and it is doubtful the situation will improve much in the near future! There are many herbicides available for a myriad of applications. Appendix 4 lists several commonly used herbicides for managing wildlife food plots. The applications listed do not represent the only possibilities, but have been used with success for the stated objectives. Before using any herbicide, be sure to read the label and follow directions.

Plot Preparation — Getting Rid of Perennial Grasses

Preparing the site before planting is extremely important, especially if perennial grasses are present and/or if you are planting a perennial food plot. If perennial grasses are not controlled (especially tall fescue, bermudagrass and johnsongrass), they will present major competition problems later. The most widely used multi-purpose herbicide is glyphosate. It is available under several trade names with various formulations. The most familiar trade name is Roundup®. Roundup UltraMax®

Grasses should not be included in warm-season forage plots for deer. Not only do deer seldom eat grasses in the summer, but the worst weed problems are grasses. In this photo, johnsongrass has completely overtaken a field of cowpeas (evident in the exclusion cage). Several herbicides are available to prevent this problem.

offers a higher concentration of glyphosate (50.2 percent) and has surfactant included in the product. Other brands offer reduced concentrations of glyphosate and may or may not include surfactant; however, the price is usually considerably lower.

The use of surfactants is critical for success of post-emergence herbicide applications. Surfactants are water- or oil-soluble substances added to herbicides to modify or enhance the effectiveness of the active ingredient. Surfactants are surface-active agents that produce physical changes at the interface of the liquid herbicide mixture and the surface of the plant. Surfactants help herbicides stick, spread, wet, penetrate and disperse on the surface of plants. Hence, surfactants are not added to pre-emergence applications, unless no-till drilling seed and weeds are already present. In short, surfactants make many herbicides more effective by aiding the herbicide to penetrate the plant.

If tall fescue or orchardgrass is present where you intend to plant, spray 1.5–2.0 quarts of a glyphosate herbicide per acre in the fall before a spring planting or 2 quarts per acre in the spring before a fall planting. It is critical that the grass be burned, hayed, grazed or mowed before spraying. Burning, grazing or haying is best. This provides a "clean" field for spraying, free of thatch and dead material that will block much of the herbicide from contacting the growing grass. The grass should be growing vigorously and 6–10 inches in height when sprayed for best results.

If bermudagrass is the dominant field cover, the field should be burned in late winter. Bermudagrass should be sprayed the following summer with imazapyr (48 ounces of Chopper® or 24 ounces of Arsenal® AC per acre with surfactant). An application of a glyphosate herbicide at 2 quarts per acre mixed with 12 ounces of Select® per acre is another option. It is not advisable to plant a perennial plot in the fall after spraying bermudagrass. Instead, plant an annual plot and wait to see if the bermudagrass returns the following summer. If it does, growth should be fairly sparse, but don't let that fool you! It will spread across the field in a couple of growing seasons if not sprayed again. Because bermudagrass does best in full sunlight, a warm-season annual (e.g., iron-clay cowpeas and lablab) can be planted at this time to help "smother" residual bermudagrass by shading. Once you have control of the bermudagrass, then plant a perennial cool-season forage if desired.

If johnsongrass is a problem, wait until it reaches 18–24 inches in height at the whorl and spray with 2 quarts of a glyphosate herbicide or 8 ounces of Select® per acre with surfactant added. Another way to control johnsongrass is with a pre-emergence herbicide application (spraying immediately after planting). Control of residual sprouts is then much easier (with a grass-selective herbicide) if a broadleaf plot (e.g., cowpeas and/or lablab) is established. A pre-emergence application of Pursuit® DG (2 ounces per acre) when planting legumes (e.g., clovers, alfalfa, cowpeas, lablab) provides excellent control. Efficacy of pre-emergence herbicide applications is increased when applied within a day or two of a rain event. Precipitation is necessary to carry the herbicide down into the top couple inches of soil where the weed seed will be germinating. Johnsongrass also can be controlled with a rope wick applicator and a 50:50 solution of glyphosate and water. The solution is "wiped" on the taller johnsongrass stems and leaves and does not kill clovers, cowpeas or other plants underneath.

Plot Maintenance

Warm-season forage plots

Weed control in warm-season forage plots is relatively easy. To begin, only forbs should be planted in warm-season forage plots — no grasses. This is because deer eat very little grass during summer and the worst warm-season weeds are grasses — crabgrass, johnsongrass and bermudagrass.

This series of photos shows the importance of weed control in forage plots. The picture at the top shows a plot of iron-clay cowpeas that was not sprayed. The middle photo is from a plot of iron-clay cowpeas (grown adjacent to the plot in the top photo) that was sprayed pre-emergence with 2 ounces of Pursuit® DG per acre. The bottom photo shows the two plots side by side a few

Grass-selective herbicides, such as Select® or Poast Plus®, can be applied post-emergence over any of these forages to help control grass weeds (remember to add surfactant). Pursuit® can be used to control non-leguminous warm-season broadleaf weeds, such as cocklebur, groundcherry/nightshade, jimsonweed, morninglories, pigweeds, prickly sida, ragweed, lambsquarters, spurges and others. If applied post-emergence, all of these weeds should be sprayed before they flower. Best results with Pursuit® are usually realized when plots are sprayed pre-emergence. Treflan® and Prowl® are

pre-emergence/pre-plant incorporated herbicides that can be used with most warm-season food plot plantings. All of these herbicides, however, do not control all weeds equally. Refer to labels for species controlled by each. When planting mixtures of legumes and sunflowers (such as the mixture listed on page 6), Treflan® or Prowl® is recommended because Pursuit® will kill sunflowers.

Bushhogging is another practice used to reduce weed competition, especially when hard-to-control weeds (e.g., horseweed) are present or when other annual weeds are present late in the growing season (September/August). Plots should be mowed before weeds flower and produce seed. If weeds get too tall for optimum spraying efficacy (see herbicide labels for optimum heights to control different weeds with various herbicides), mow as appropriate, then spray as weeds begin to grow afterwards. If annual warm-season weeds are present in late summer, just mow as needed to keep them from flowering – spraying at this time is generally a waste of money.

Annual cool-season forage plots

Cool-season legumes can be sprayed pre-or post-emergence with Pursuit® just like warm-season legumes. Treflan® (1.5 pints per acre) or Prowl® (2 - 3 pints per acre) can be sprayed pre-emergence/pre-plant before establishing cool-season plots. The appropriate herbicide depends on what is being planted (refer to herbicide labels) and the problem weed.

Annual cool-season forage plots don't have to be! Good re-seeding annual clovers, such as crimson and arrowleaf, can be managed year after year without re-planting. After the annual clovers and cool-season grains (oats, rye or wheat) have died and gone to seed in June or July, bushhog the plot. Weeds will begin to germinate from the seedbank and grow. Before the weeds flower, spray the entire plot with a glyphosate herbicide (plus surfactant) at 2 quarts per acre. It is important to spray before the weeds flower. Not only is a better kill realized, it also helps reduce the seedbank. Bushhog the plot again after the weeds die. If additional weeds appear before Labor Day, spray again at the same rate. In late August/early September, top-dress with the appropriate amount of lime and fertilizer and disc the plot. You have effectively re-sown your annual plot without planting! If Brassicas (e.g., dwarf essex rape) and/or additional cool-season grains are desired, they can be top-sown before (oats) or after (rape) discing.

Annual clovers can be managed so that re-seeding is not necessary.

Photo at upper left shows how a stand of crimson and arrowleaf clover, planted in the fall, should look in April — lush and green.

Photo at left shows how a stand of crimson clover and oats should look in June — brown and dead with a few weeds starting to come in. Through the summer, the plot should be sprayed with a glyphosate herbicide (such as Roundup®) to kill all incoming weeds before they flower. Around Labor Day, the plot should be top-dressed as necessary with lime and fertilizer and disced to effectively re-seed the plot.

Photo above shows a 2-year-old plot of arrowleaf clover in March. The right side was disced the previous September, while the left side was not. The difference is dramatic.

If cool-season grains (e.g., oats or wheat) are planted alone, broadleaf weeds, such as henbit, deadnettle and chickweed, can be controlled with Overdrive® (4 - 8 ounces per acre with surfactant added). This is a forb-selective herbicide that will not kill grasses and may be more effective than 2,4-D. Spray cool-season broadleaf weeds before they reach 4 inches in height for best results.

Perennial cool-season forage plots

Perennial cool-season forages are vulnerable to a host of weeds. The biggest threats during fall and winter are the cool-season broadleaf weeds, especially henbit, purple deadnettle and common chickweed.

These weeds can be especially problematic in the year of establishment because perennial forages are relatively slow to get started. This makes pre-emergence/pre-plant herbicides (e.g. Treflan® and Prowl®) particularly important. Treflan® (1.5 pints per acre) can be used with perennial legumes and other forb plantings, such as rape and chicory. Pursuit® does an excellent job at reducing problem weeds when applied pre-emergence, however, it should not be used when planting non-legumes, such as rape and chicory. The addition of a cool-season annual grain also helps with initial weed problems because these grasses (e.g., oats and wheat) germinate quickly.

In established perennial legume plots (e.g., ladino white clover, alfalfa, birdsfoot trefoil), an application of Pursuit® DG (2 ounces per acre with surfactant added) or Butyrac® 200 (1 - 3 quarts per acre with surfactant added) is effective in controlling many cool-season and warm-season weeds. Do not spray seedling legumes until at least three fully expanded trifoliate leaves have appeared and do not spray Pursuit® DG over cool-season grain seedlings if you want to retain them. In general, weeds are most susceptible before they reach 4 inches in height.

For control of grasses, especially crabgrass, rhizome johnsongrass, residual tall fescue and bermudagrass, an application of Select® (8 ounces per acre) or Poast Plus® (2 pints per acre) with a non-ionic surfactant added is recommended when grasses are actively growing. Following an herbicide application during spring or summer, top-dressing in September with the appropriate amount of lime and fertilizer will have your perennial forage plots looking good. Treatment for white grubs (Japanese beetles and June bugs) may be necessary in the third or fourth year after establishment.

Purple deadnettle (left) and henbit (right) are common cool-season weeds that can become a real problem if not controlled.

MANAGING OLD LOGGING ROADS FOR WILDLIFE

Planting and maintaining old logging roads (a.k.a. “woods roads”) in quality forages can do more than reduce erosion, it also can improve habitat for a variety of wildlife species by creating linear wildlife openings.

Linear openings can be particularly important to wildlife in areas that are vastly forested where there is relatively little early successional growth. Where white-tailed deer is the focal species and it is desired to establish 2–5 percent of the area in food plots, planting woods roads is often a good way to get the needed acreage planted without having to clear additional forest land, which can be quite expensive. Planting woods roads can impact more animals per acre of ground planted than food plots when the road traverses and winds through an area, encompassing the home range of more animals.

It is important to realize all of the planting procedures outlined under ***Initial Considerations*** also apply when planting woods roads. The foremost consideration is the amount of light reaching the road, which is the biggest limitation when maintaining forages in wooded areas. Unless the adjacent stand has been thinned or regenerated recently, the road will need “daylighting” – that is, trees will need to be removed along at least one side

If a woods road gets a lot of traffic, it is not sensible to plant the road itself. Instead the sides of the road should be "daylighted" and planted, such as this road where crimson clover has been planted along the sides.

When woods roads do not receive much traffic, the road itself can be planted. This road was initially planted to ladino white clover and oats. After three years, a solid stand of clover remains. Encroaching japangrass has been sprayed along the sides. Can't you just see a deer feeding or a gobbler strutting his stuff along this road?!?

of the road to allow sufficient sunlight to reach the road for the forages to grow.

Roads can be managed for wildlife in a variety of ways if the road is gated to public traffic. If the road is gated to public traffic, yet still gets a considerable amount of traffic from land managers, it probably should be graveled. These roads still can be managed for wildlife by clearing and planting the sides of the roads.

Roadsides also can be left fallow. Woody growth can be suppressed by spraying a woody-selective herbicide (e.g., Arsenal® AC and/or Garlon®). Mowing every other year will stimulate and encourage additional herbaceous growth from the seedbank. If the road is gated and does not get much traffic, the road itself can be planted.

Many of the same forages used in food plots can be planted on woods roads; however, some are better suited than others. For example, crimson clover, subterranean clover and white clovers are all relatively shade tolerant. Ladino white clover persists well on roads traversing through bottomlands and on hillsides with an eastern or northern exposure. Ladino white clover does not, however, do well on southern or western exposures. Red clover and alfalfa do not respond to traffic as well as the white clovers. Taller forages, such as sweetclover and arrowleaf clover, are not usually desirable on roads and do not stand up to traffic well.

Soil erosion is often associated with woods roads and logging decks after logging. In fact, research from the Coweeta Hydrologic Lab near Franklin, North Carolina has shown more than 95 percent of the erosion and siltation into creeks following logging opperations comes from improperly constructed roads, not the logging itself. Because erosion is such an important factor, many land managers have been led to the false assumption that it is necessary to include tall fescue or orchardgrass in a mixture sown on woods roads. **This is not true and certainly counterproductive for wildlife**!

Germination and growth of annual cool-season grasses (e.g., oats, wheat, annual ryegrass) are considerably faster than perennial cool-season grasses, which is important for reducing run-off from winter rains. The preference for oats and wheat as forage over tall fescue and orchardgrass was discussed under ***Cool-Season Forage Plots*** for white-tailed deer and the value of wheat seed and resulting brood habitat for wild turkeys and bobwhite quail was mentioned under ***Wild Turkeys***. This practice also benefits ruffed grouse in the same manner when implemented on woods roads where grouse occur (see sidebar on page 11).

It should be noted also that, for a number of reasons, native warm-season grasses are not suited for planting woods roads either. Nwsg are established for wildlife to provide cover, not forage (see sidebar on page 19). Deer, rabbits, groundhogs and other species rarely eat nwsg. In fact, all perennial grasses (whether native or not) are simply not preferred over forbs. Cover along old logging roads is not a limiting factor, as slash, blackberries and other weedy growth is in abundance all along these roadsides. The primary limitation for wildlife in vastly forested tracts is forage, particularly during the fall and winter months. That is why roads are planted to

cool-season forages instead of warm-season forages. In addition, establishment of nwsg is relatively slow, which is not desirable on sites that need cover established quickly to protect against erosion.

Perennial woods road mixture

4# ladino white clover
2# white-dutch clover
2# birdsfoot trefoil
50# oats or wheat
Approximate cost: $38

Oats and wheat germinate and grow relatively quickly, helping to prevent soil erosion while providing quality forage for wildlife. The rate of a cool-season grain should be doubled over that for a food plot because erosion is such a consideration. This mixture will do best in bottomland areas and on slopes facing east and north where there is more moisture.

In vastly forested areas, woods roads can receive a lot of use when planted to desirable species. This clover road in the mountains of NC has seen much use by deer, wild turkeys, black bears and ruffed grouse.

Annual woods road mixture

15# crimson clover
50# oats or wheat
Approximate cost: $25

This annual mixture can be managed as in a food plot (to retain the crimson clover) or it could be left fallow to encourage naturally occurring forbs and grasses.

Annual woods road planting

120# wheat (2 bushels)
Approximate cost: $25

Sowing a road to wheat protects it from erosion. In addition, forage and seed for wildlife is produced. During the summer following establishment (after the wheat has gone to seed and died), naturally occurring grasses and forbs in the seedbank will germinate and create excellent wildlife habitat for future years and protect against erosion. Wild strawberry, low panicgrasses, beggar's-lice, cinquefoil, asters and blackberry provide forage and seed for deer, turkeys, grouse and songbirds, while the perfect structure for brood habitat is created. Roads managed as such should be mowed every other year in the winter and sprayed with a woody-selective herbicide as necessary to kill encroaching woody species.

CONCLUSIONS

Planting and managing food plots can be very rewarding. To work with the land and watch wildlife respond to and benefit from your efforts can be intoxicating. Planting and maintaining quality food plots, however, requires planning, dedication and can be fairly expensive. It requires year-round effort, especially if you hope to actually increase the carrying capacity of your property.

Perhaps the most important thing to realize is there is no "magic bean." There is no single planting that provides a high-quality year-round food source for wildlife. Multiple plantings in the appropriate sites are absolutely necessary to make a real difference in terms of available nutrients and energy for wildlife. Pay no attention to all the ads and gimmicks. There are no worthy short cuts to quality food plots and there is no "trophy in the bag." Establishing quality food plots requires knowledge of farming practices. Managing food plots is simply farming for wildlife!

Finally, the savvy manager realizes **habitat management is the most fundamental component in managing wildlife populations and that food plots are secondary to sound timber management, oldfield management and the judicious use of prescribed fire and herbicides where appropriate**. That being said, let there be no doubt that incorporating quality food plots into a sound habitat management program will enable wildlife populations to respond in ways they were previously unable.

Working with the land and seeing wildlife respond to your efforts is very rewarding. Growing and maintaining quality food plots is an excellent way to make wildlife more visible while providing increased nutrition needed throughout the year.

Appendix 1. Planting guide for wildlife food plots.

Crop Species[1]	Seeding Rate (lbs/ac)[2]		Planting Date
Cool-Season Legumes[3]			
Alsike clover (perennial)	10		Sept 1 – Oct 1
Arrowleaf clover (annual)	10		Aug 15 – Oct 1
Ball clover (annual)	5		Aug 15 – Oct 1
Berseem clover (annual)	20		Aug 15 – Oct 1
Crimson clover (annual)	25		Aug 15 – Oct 1
Ladino white clover (perennial)	8		Sept 1 – Oct 1; Feb 15 – Apr 1
Red clover (biennial)	15		Sept 1 – Oct 1; Feb 15 – Apr 1
Rose clover (annual)	20		Aug 15 – Oct 1
Subterranean clover (annual)	15		Aug 15 – Oct 1
White-dutch clover (perennial)	6		Sept 1 – Oct 1; Feb 15 – Apr 1
Sweetclover, yellow or white (biennial)	20		Sept 1 – Oct 1; Feb 20 – Apr 1
Alfalfa (perennial)	20		Aug 15 – Sept 15; Mar 1 – May 1
Austrian winter peas (annual)	50		Aug 15 – Oct 1
Birdsfoot trefoil (perennial)	10		Aug 15 – Oct 1; Feb 20 – Apr 1
Cool-Season Grasses			
		lbs/bushel	
Oats (annual)	100	32	Sept 1 – Oct 15; Feb 15 – Mar 15
Rye (annual)	100	56	Sept 1 – Oct 15
Triticale (annual)	100	48	Sept 1 – Oct 15
Wheat (annual)	100	60	Aug 15 – Oct 15
Ryegrass (annual or perennial)	30		Aug 15 – Oct 15; Feb 15 – Apr 1
Warm-Season Legumes[3]			
Alyceclover (annual)	20		Apr 1 – June 1
American jointvetch (annual)	15		Apr 1 – June 1
Catjang cowpeas (annual)	30		Apr 1 – June 15
Iron-clay cowpeas (annual)	75		May 1 – June 15
Lablab (annual)	20		May 1 – June 15
Soybeans (annual)	85	60	May 1 – June 15
Re-seeding soybeans (annual)	40		May 1 – June 15
Kobe and Korean lespedeza (annual)	30		Feb 15 – Mar 15
Partridge pea (annual)	15		Mar 1 – June 1
Warm-Season Grasses			
Corn (annual)	13		Apr 1 – May 15
Grain sorghum (milo) (annual)	10		Apr 15 – June 15
Egyptian wheat (annual)	15		Apr 15 – June 15
Browntop millet (annual)	30		Apr 15 – June 15
German (foxtail) millet (annual)	25		Apr 15 – June 15
Japanese millet (annual)	25		May 1 – Aug 31
Pearl millet (annual)	30		Apr 15 – June 15
Dove proso millet (annual)	35		Apr 15 – June 15
White proso millet (annual)	35		Apr 15 – June 15
Other Plantings			
Buckwheat (annual; warm-season)	40		Apr 15 – June 1
Chicory (perennial; cool-season)	10		Apr 1 – May 15
Chufa (annual; warm-season)	50		Apr 15 – June 15
Rape (annual; cool-season)	8		Mar 1 – May 15; Aug 15 – Oct 1
Sesame (annual; warm-season)	12		Apr 15 – June 1
Sunflower (annual; warm-season)	25		Apr 15 – May 15
Turnips (annual; cool-season)	8		Mar 1 – May 15; Aug 15 – Oct 1

[1]Most commercial mixes are comprised of three or more of the species (or varieties) included in this chart.

[2]All seeding rates are for a single-species planting. When planting mixtures, the seeding rate for each species included should be reduced according to the number of species in the mixture, the composition preferred and the growth form and desired structure of the resulting stand. Seeding rates are given for broadcast plantings. Drilled plantings may require less seed.

[3]All legume seed should be inoculated with species-specific inoculant prior to planting unless the seed was purchased pre-inoculated (see Appendix 4).

Planting Depth	Optimum pH	Preferred Soil Type
¼″	5.8 – 6.5	Adapted to cool climate; moist, bottomland soils
¼″	6.0 – 6.5	Fertile, well-drained sandy loams and light clay
¼″	5.8 – 7.0	Widely adapted; tolerates poor drainage and relatively low fertility
¼″	6.0 – 7.5	Requires highly fertile, moist soils
¼″	5.8 – 7.0	Well-drained sandy loams to heavy clays; moderately shade tolerant
¼″	6.0 – 6.5	Fertile, bottomland, moist - sandy loam to clay; mildly shade tolerant
¼″	6.0 – 7.0	Sandy loamy to clay; tolerates wide range of moisture regimes
¼″	6.0 – 7.0	Sandy loam to clay; tolerant to drought and low soil fertility
¼″	5.8 – 7.0	Well-drained sandy-loam and clay upland sites; mildly shade tolerant
¼″	6.0 – 6.5	Widely adapted - best on fertile, moist bottomland; mildly shade tolerant
¼″	6.5 – 7.0	Well-drained
¼″	6.5 – 7.0	Well-drained loams
1 - 2″	6.0 – 7.0	Heavy clay, moderately fertile
¼″	6.0 – 7.0	Well-drained
1 - 2″	5.8 – 6.5	Well-drained, light-textured
1 - 2″	5.8 – 6.5	Well-drained, light-textured clay or sandy soils; not poorly drained soils
1 - 2″	5.8 – 6.5	Well-drained, light-textured clay or sandy soils; not poorly drained soils
1 - 2″	5.8 – 6.5	Well-drained, light-textured - not poorly drained soils
¼ - ½″	5.8 – 6.5	Well-drained, most textures; tolerates poorly drained soils
¼″	6.5 – 7.0	Moderately- to well-drained soils, including bottomland sites
¼″	5.5 – 6.5	Moist, wet, light-textured loams are best—not droughty soils
½ - 1″	5.5 – 7.5	Widely adapted, well-drained
½ - 1″	5.5 – 7.5	Well-drained soils; drought tolerant; tolerates relatively low fertility
1″	5.5 – 7.5	Well-drained soils; drought tolerant; tolerates relatively low fertility
1 - 2″	5.8 – 6.5	Widely adapted, well-drained soils
½ - 1″	5.8 – 6.5	Well-drained soils
½ - 1″	5.8 – 6.5	Widely adapted
½ - 1″	6.0 – 6.5	Sandy loam to clay
1 - 2″	5.8 – 6.5	Widely adapted, well-drained
1″	5.8 – 6.5	Widely adapted, well-drained
¼ - ½″	5.8 – 6.5	Widely adapted, well-drained
¼ - ½″	5.5 – 6.5	Well-drained
¼ - ½″	5.5 – 6.5	Well-drained
¼ - ½ ″	5.5 – 7.0	Moist soils; tolerates shallow flooding after becoming establishment
¼ - ½ ″	5.5 – 6.5	Well-drained
¼ - ½ ″	5.5 – 6.5	Well-drained
¼ - ½″	6.0 – 6.5	Well-drained; tolerates dry sites
½ - 1″	6.0 – 7.0	Widely adapted; tolerates relatively low fertility
¼″	5.8 – 6.5	Widely adapted; drought tolerant
1 - 2″	5.8 – 6.5	Moderately- to well-drained sandy or loam soils; avoid clay soils
½ - 1″	5.8 – 6.5	Widely adapted
½″	5.8 – 6.5	Well-drained clayey loams
1 - 2″	5.8 – 6.5	Widely adapted, well-drained
¼″	5.8 – 6.5	Widely adapted

Appendix 2.

Growth, deer preference and nutritional information for selected forages in the Mid-South region as determined after 5 years of experimentation using side-by-side comparisons and collecting data (measuring and clipping forage) inside and outside stationary and mobile exclusion cages.

Species	Germination and Initial Growth Rate	Grazing Preference	Resistance to Browsing	Crude Protein (percent)[1]	Total Digestible Nutrients (percent)[1]	Date Forage Collected	Quality Forage Available[2,3]
Cool-season legumes							
Arrowleaf clover	slow	high	excellent	31.0	82.8	23 Apr 03	March – June
Berseem clover	moderate	high	excellent	24.8	80.7	23 Apr 03	October – December; March – May
Crimson clover	moderate	high	excellent	28.4	82.7	23 Apr 03	October – December; March – April
Alsike clover	slow	high	excellent	—	—	—	March – July; October – December
Ladino white clover	slow	high	excellent	31.5	79.7	Apr 02	March – June; October – December
Red clover	slow	high	excellent	23.7	70.1	30 June 03	March – August; October – December
Sweetclover	slow	moderate	good	31.1	79.3	Apr 02	March – early June
White-dutch clover	slow	moderate	excellent	31.3	79.7	Apr 02	March – June; September – December
Alfalfa	slow	moderate	excellent	29.1	77.0	Apr 02	March – early August; September – December
Austrian winter peas	relatively fast	high	fair	28.0	78.4	23 Apr 03	September – April
Birdsfoot trefoil	slow	relatively low	good	28.2	77.4	Apr 02	March – July; September – December
Crown vetch	extremely slow	low	good	16.9	56.2	July 04	September – August (after establishment)
Hairy vetch	moderate	low	good	—	—	—	September – April
Cool-season grasses							
Barley	fast	very low	excellent	23.9	68.9	22 Mar 03	September – mid April
Oats	fast	high	excellent	26.5	70.5	22 Mar 03	September – mid April
Wheat	fast	high	excellent	24.9	69.6	22 Mar 03	September – mid April
Rye	fast	high	excellent	23.6	69.0	22 Mar 03	September – mid April
Ryegrass	fast	low	excellent	—	—	—	September – mid April

Appendix 2. (cont.)

Species	Germination and Initial Growth Rate	Grazing Preference	Resistance to Browsing	Crude Protein (percent)[1]	Total Digestible Nutrients (percent)[1]	Date Forage Collected	Quality Forage Available[2,3]
Orchardgrass	slow	no use recorded	n/a	14.6	61.4	Apr 02	n/a
Tall fescue	slow	no use recorded	n/a	16.6	67.3	Apr 02	n/a
Matuagrass	relatively slow	relatively low	excellent	22.0	80.5	22 Mar 03	November – April
Warm-season legumes							
Alyceclover	slow	moderate	good	20.8	64.1	July 04	July – October
American jointvetch	slow	moderate	good	25.3	74.5	July 01	July – October
Iron-clay cowpeas	moderate	relatively high	good	29.7	78.3	July 01	June – October
Lablab	moderate	relatively high	good	25.7	67.2	July 01	June – October
Soybeans	moderate	high	poor	28.6	71.4	July 04	June – October
Quail Haven soybeans	moderate	relatively high	excellent	24.5	—	8 Aug 03	June – October
Other plantings							
Buckwheat	fast	moderate	excellent	—	—	—	May – September
Chicory	moderate	relatively high	good	25.4	74.4	March 04	November– December; March – July; September – December
Rape	moderate	moderate	good	32.9	87.7	July 01	October – early April
Turnips	moderate	relatively low	good	—	—	—	October – early April

[1]Levels of crude protein and total digestible nutrients vary greatly with respect to plant maturity, soil fertility and soil moisture. These figures merely represent what the forages are capable of on certain sites at certain times of the year.
[2]This represents the general time period(s) when forage production is best, starting from the time of planting and going through the following year. Forage availability is naturally dependent upon many factors, such as time of planting, soil conditions, weather and weed control.
[3]Perennial cool-season legumes (as well as chicory) generally do not produce considerable forage during the fall of establishment. Production is best the following spring and early summer, then picks up again the following fall. In addition, clovers and chicory normally "wilt down" in the winter following hard frosts and very cold temperatures. In milder winters, mid-winter production may be significant.

Appendix 3.

Innoculating legume seed for successful wildlife food plots.

Legumes are plants that bear seed in a pod and have a symbiotic relationship with certain species of nitrogen-fixing bacteria (e.g., *Rhizobium* spp., *Bradyrhizobium* spp.). These bacteria attach themselves to the roots of legumes and form nodules. From these nodules, the bacteria extract nitrogen from the air. *Rhizobia* and others obtain energy from the plant, while the plant receives nitrogen produced by the bacteria. Thus, both bacteria and plant benefit from the relationship. This phenomenon is important when planting wildlife food plots for three reasons: 1) minimal nitrogen fertilization is required (thus, you save money), 2) nitrogen is not a limiting factor to properly inoculated plants and 3) weed competition is reduced because little nitrogen fertilizer is applied.

Particular legumes require specific bacteria; no one species of bacteria will inoculate all legumes. Therefore, it is important to use species-specific inoculant for the legume planted. Although bacteria, such as *Rhizobia*, are found naturally in the soil, it is critical to inoculate seed prior to planting to ensure the proper bacteria is in contact with the seed. Seed of many improved varieties of legumes may be pre-inoculated. This means the seed has been inoculated already with the proper bacteria prior to bagging. Pre-inoculated seed is coated to protect the bacteria and usually has an off-white or gray color. Because the bacteria are present under the coating surrounding the seed, pre-inoculated seed do not need to be inoculated if the seed is sown before the expiration date on the seed tag. Check the seed certification tag to determine if the seed has been pre-inoculated, the germination test date and the inoculant expiration date. If the inoculant has expired, additional inoculation may be necessary.

If the seed is not pre-inoculated, the following procedure will ensure proper inoculation.

1. Buy inoculant suited specifically for each legume planted. Inoculant has a limited life span (it is a bag of live bacteria), so it is important to check the expiration date.
2. Never expose the package of inoculant to heat or direct sunlight (especially the dashboard of a truck), as this will kill the bacteria. To ensure viability, inoculant should be refrigerated.
3. Most inoculants come packaged in a medium of peat, which is black. This material must be mixed with just enough water to form a "slurry."
4. It is critical that the inoculant adheres to the seed. If not, the entire process may be useless. A commercial "sticker" should be used to stick the inoculant to the seed. Some stickers contain gum arabic, which is recommended for its ability to sustain high numbers of bacteria on the seed. If a commercial sticker is not available, a solution of 4 parts water to 1 part sugar can be used as a substitute. Do not use cola as a sticker because the pH of most soft drinks is very low and the acid solution may kill the bacteria.
5. Mix the sticker with the inoculant as directed on the package to form a slurry. Add slurry to seed and mix well, making sure all seeds are coated with inoculant. The coated seed should be allowed to sit in the shade and dry. Do not place in the sun to dry. The seed should be dry enough to sow in about an hour. Do not mix inoculated seed with fertilizers, because the salts in fertilizer can kill the bacteria in the inoculant.

Properly inoculated seed may later produce up to 200 pounds of nitrogen per acre, depending on species of legume planted. This is very beneficial in reducing fertilization costs, especially when following a legume crop with a grass, such as corn, grain sorghum, wheat or oats.

Legumes commonly grown for wildlife and their associated inoculant groups[1].		
Legume group	**Inoculant code**	**Bacterium**
Alfalfa Sweetclover	A	*Sinorhizobium meliloti*
Alsike clover Ball clover Ladino white clover Red clover White-dutch clover	B	*Rhizobium leguminosarum* biovar *trifolii*
Austrian winter peas Field peas Flat peas Hairy vetch Sweet peas	C	*Rhizobium leguminosarum* biovar *viceae*
Alyceclover American jointvetch Cowpeas Lablab Lespedezas Partridge pea Velvet bean	EL	*Bradyrhizobium* spp.
Prairieclover Sainfoin	F	*Rhizobium* spp. (*Petalostemum*) *Rhizobium* spp. (*Onobrychis*)
Birdsfoot trefoil	K	*Mesorhizobium loti*
Crownvetch	M	*Rhizobium* spp. (*Coronilla*)
Arrowleaf clover	O	*Rhizobium leguminosarum* biovar *trifolii*
Berseem clover Crimson clover	R	*Rhizobium leguminosarum* biovar *trifolii*
Soybeans	S	*Bradyrhizobium japonicum*
Rose clover Subterranean clover	WR	*Rhizobium leguminosarum* biovar *trifolii*
[1]For additional information regarding LiphaTech Nitragin® Brand inoculants and Nitra-Coat® sticking agent, call 1-800-558-		

Inoculated seed should be allowed to dry in the shade. The seed should be ready to plant in an hour or so. If allowed to dry in direct sunlight, the bacteria may be killed.

Properly inoculated seed is obvious. You can see the black peat from the inoculation mixture stuck all over these peas.

Appendix 4.

Various herbicides[1] and possible applications for establishing and managing wildlife food plots.

Trade Name	Common Name	Suggested Rate per Acre	Application	Crop	Manufacturer	Approximate Cost	Purpose for Spraying
Roundup	glyphosate	1 – 5 quarts	post-emergence	—	several	varies	Spraying existing vegetation for new plots
Pursuit DG	imazethapyr	2 ounces	pre- or post-emergence	legumes	BASF	$155 per 14.4 ounces	Controlling forb and grass weeds in legume plots
Prowl 3.3 EC	pendimethalin	2 – 3 pints	pre- or post-emergence	several	BASF	$55 per 2.5 gallons	Controlling forb and grass weeds in legume plots and sunflower plots
Select 2EC	clethodim	8 – 10 ounces	post-emergence	forbs	Valent	$175 per gallon	Controlling grass weeds
Poast Plus	sethoxydim	2 – 3 pints	post-emergence	forbs	BASF	$125 per 2.5 gallons	Controlling grass weeds
Arsenal AC	imazapyr	6 – 24 ounces	post-emergence	—	BASF	$480 per gallon	Controlling woody succession
Garlon 3-A	triclopyr	2 pints – 2 gallons	post-emergence	—	Dow AgroSciences	$73 per gallon	Controlling woody succession
2,4-D Amine	2,4-D	1 – 2 pints	post-emergence	grasses	several	$7 per quart	Controlling forb weeds
Butyrac 200	2,4-DB	1 – 4 pints	post-emergence	legumes	several	$30 per gallon	Controlling non-leguminous forb weeds
Treflan HFP	trifluralin	1 – 2 pints	pre- or post-emergence	several	Dow AgroSciences	$83 per 2.5 gallons	Controlling forb and grass weeds
Atrazine 4L	atrazine	2 pints	pre- or post-emergence	corn, grain sorghum	several	$25 per 2.5 gallons	Controlling forb and grass weeds
Overdrive	dicamba and diflufenzopyr	4 – 8 ounces	pre- or post-emergence	grasses	BASF	$36 per pound	Controlling forb weeds

[1]Use of brand, trade or company names in this publication is for clarity and information; it does not imply approval of the product or company to the exclusion of others, which may be of similar composition or equal value. Always be sure to read, understand and follow directions and precautions on herbicide labels before use. As herbicides, herbicide labels and their availability and recommendations may change, it is best to consult your local Extension agent, state wildlife agency or farm supply distributor for the latest recommendations on herbicide use.

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