COMMON GROUND

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Sowing seeds for future systems

White lupin, tropical corn and hybrid pearl millet are being tested for compatibility with some traditional crops to develop alternative systems for the humid South. Wayne Reeves of the USDA-ARS lab at Auburn is directing the work in Alabama, Georgia and the Florida Panhandle

In the trials, lupin shows promise as an alternative to wheat when doublecropped with soybeans. The tropical corn and hybrid pearl millet are being evaluated as an alternative to soybeans when doublecropped with wheat or lupin.

Although the project coordinators still have two more years to fine tune the systems, they have already produced information useful to producers seeking more options in cropping systems.

A new look at lupin

Lupin was a favorite winter cover and green manure for cotton during the 1940s. A succession of back-to-back freezes, plant diseases, cheap fertilizers and other factors diminished lupin seed production so that by the 1960s, the graceful spires of this useful plant had all but disappeared from southern fields.

Then in the early '80s USDA-ARS researchers in Tifton, Georgia, developed a winter-hardy variety called Tifwhite-78 and ushered in a new era for white lupin. This is the variety upon which Reeves has built his research.

The winter hardiness allows the lupin to withstand late-spring freezes. This means a farmer could doublecrop the lupin with heavy nitrogen users such as corn and cotton.

Lupin is such an efficient nitrogen producer, according to Reeves, that it could reduce annual application of nitrogen fertilizer in the South by 64,000 tons or $33 million, if it were planted in place of just 25 percent of the winter wheat crop. Since the high rainfall and warm temperatures of a southern winter contributes to high nitrogen losses to the environment through leaching and denitrification, planting a winter legume such as white lupine instead of wheat has the potential to reduce those losses.

While there is still room for breeding improvements, Reeves also is enthusiastic about the legume's potential as a forage crop. Lupin in Reeves trials averages 30 bu/acre, but has produced grain yields of up to 70 bu/acre during a cool, sunny spring with abundant rainfall. Another plus, the high protein (32%-38%) grain doesn't contain trypsin inhibitors or other components that require heat processing like soybeans so it can be added directly to rations for cattle, sheep, poultry or swine.

Research in other states has shown lupin to be a rediscovered food for human consumption. Once popular with ancient Egyptians, Greeks and Romans, lupin is showing up in health food stores as a low-calorie, high-protein pasta. Its usefulness in the human diet is making lupin a hot research topic right now, a trend that lupin pioneers like Reeves are happy to see.

Tropical corn

While about 200,000 acres of cropland in the Southeast are suitable for growing tropical corn, it's being raised on only about 40,000 acres, says David Wright of the University of Florida Research and Education Center, a co-project leader with Reeves. Their research has shown that tropical corn can economically provide silage and grain for livestock

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Wayne Reeves and research technician Rachel Kingery inspect lupin plots.

Scientists from as far away as Poland have visited the SARE plots at the USDA-ARS labs at Auburn.

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Mail letters and comments to
Gwen Roland, editor
SARE/ACE
Georgia Experiment Station
Griffin, GA 30223-1797
Fax: (770) 412-4789
Phone: (770) 412-4786

You asked for it

Perhaps it due to the loquacious nature of Southerners or to the participatory concept behind *Common Ground.* Or perhaps *Common Ground* readers just have a lot of time on their hands. Whatever the reason, your answers to the annual survey rarely fit in the blanks. I turned your survey forms around to read in the margins, and I followed arrows to the back of the page to read your opinions about white space (you don't value it), cute little graphics (you don't value them either) to story length (you want more) to story number (you want more). In other words most of you said, "Cut the frills, give more information." In response I have reduced the spacing between lines and omitted some illustrations, plus added an extra page to offer the most tightly packed *CG* to date. With an audience this vocal, it's best not to mess around.

The majority of you were content with the reading level and amount of technical information. As one reader put it, "I like it because I can read it all in my lunch hour." You were evenly divided among those who would read an electronic version and those who would not. However, of the ones who would like the electronic version, only a handful opted to be removed from the mailing list. So for now we will continue *Common Ground* in the printed version but add an electronic transmission in the near future.

As for topics, there were almost as many different answers as there were respondents. Fortunately SARE/ACE projects address every topic you requested. Multiple land-use options and livestock waste management received the most requests, followed by cover crop systems. Stories on all these topics appear in this issue, but there isn't room to mention every SARE/ACE project that touches those three topics. If you want more, just request a copy of our 170-page Annual Report which contains summaries of all the active projects, written in everyday language. If after reading a summary, you still want more information on a particular project, let me know and I will send you the complete, more technical report written by the project director.

Many people requested more farmer success stories. *Common Ground's* winter edition will be devoted to the producers who participated in the Southern Region's first round of Producer Grants. An innovative, pioneering lot, they proved their flexibility when project plans had to be altered due to stray bears in the corn or a stray crop duster over the beans. Look for stories about them in the next issue.

Now the moment we have all been awaiting, the drawing for the handsome, heavy duty, 100 percent cotton SARE/ACE t-shirts. The winners are: **Leola Moore** of the Jefferson County Cooperative Extension Office in Florida; **Vernon Heath**, an Extension Agent in Virginia; **Tulon McKee, Jr.** of McKee Dairy Farm in Mississippi; **Larry Chapin** of Baswell, Oklahoma; and **Carl Hutcherson** of USEPA Region 6 in Texas.

Thanks to all of you who responded. Often readers take time to write only when they have something negative to say about a publication. I appreciate that so many *CG* readers take the time to write such positive feedback. In return, every comment will be considered as we plan next year's issues.

Wishing you a bountiful harvest season,

Gwen Roland
Editor

	Lupin	Tropical Corn	Hybrid Pearl Millet
Suggested systems	Lupin can be harvested for silage in mid May and for seed in mid June. Late-planted crops with high nitrogen requirements, like tropical corn, grain sorghum or hybrid pearl millet fit best in double cropping systems with lupin.	The late-planting window of tropical corn enables it to do well when grown in reseeding systems of legume cover crops like hairy vetch and crimson clover. It also fits well into doublecropping systems with winter crops like wheat, canola and lupin.	The late planting window of hybrid pearl millet fits well into doublecropping systems with winter crops like wheat, canola and lupin.
Seed availability	While researchers are working toward commercial sources of winter-hardy white lupin seed, Tifblue-78, a less cold-hardy variety can be located through Georgia Foundation Seed at (706) 542-5640.	Growers should ask their county agent for sources of tropical corn seed. Major seed producing companies like Pioneer Hi-bred and Dekalb offer tropical corn varieties.	Growers can obtain seed of HGM-100 hybrid pearl millet from Agra Tech Seeds, Inc. 244 Perimeter Center Parkway, NE, Atlanta, GA 30346. Ph: (800) 841-8600.
Geographic adaptability	Well-drained soils in the Southeastern Coastal Plain in Alabama, Georgia, South Carolina, Florida, Mississippi and Louisiana.	Throughout the Southeast.	Throughout the Southeast
Planting schedule	Early fall. Trials found that in northern Alabama, the ideal planting time was in late September; in central Alabama, mid October; and in southern Alabama, late October.	Tropical corn hybrids are usually planted after May 1. They can be planted as late as July 1 in the lower South, however, earlier plantings yield better with less insect pressure.	Hybrid pearl millet can be planted as late as July, but plantings before June 15 are recommended to help reduce the incidence of rust disease.
Planting rates	In 30-inch rows, plant about 75lb seed/acre. For drilled rows, plant about 120lb seed/acre. Final stands should be about 3 to 5 plants per foot of row.	Planting rates, row widths, etc., are similar to temperate hybrids. Growers should use recommended seeding rates for cultural conditions in their areas.	Use a precision planter and plant from 2½ to 3lb seed/acre from ½ to ¾ inches deep in 36-inch or narrower rows. Narrower rows reduce weed competition. Avoid fields less than 10 acres to reduce potential bird damage.

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or grain as a cash crop. This under-used crop exhibits several advantages over temperate hybrids. For example, it is more drought tolerant and has a lower nitrogen requirement. Also the late planting date allows it to be double-cropped with winter grains including lupin without sacrificing summer crop yields.

Under favorable conditions, tropical corn can produce up to 21 tons of silage per acre or 100 bushels of grain per acre. New varieties have even higher grain yield potential. Currently there are not many varieties of tropical corn hybrids available, but the number increases as research proves the crop's potential.

Hybrid Pearl Millet

Hybrid pearl millet is drought-tolerant with a low nitrogen requirement when compared to other grains. It is also tolerant of acidic and infertile soils. A late crop that can be sown May through July, it should fit into a double-cropping system with wheat or white lupin. In fact, due to its short season, Reeves expects that it will probably fit better than tropical corn into doublecropping with lupin.

HGM-100, the only commercially available pearl millet grain hybrid, was developed by Wayne Hanna, a researcher with ARS in Tifton. Its high-quality grain is being used as a protein source in poultry, swine, cattle and catfish rations. Several large dairies have reported better results with grain millet silage than when cows were fed corn.

For more information request annual report LS93-53.

Constructed wetlands: Taking manure to the cleaners

Lagoon failures in two states made headlines this summer when thousands of gallons of waste water from hog operations burst through embankments. Those disasters might stimulate new interest in alternatives to lagoons for livestock wastewater management, but farsighted researchers have already been working toward such solutions. A SARE project funded in 1994 is evaluating constructed wetlands as a secondary treatment system for removal of nutrients from lagoon wastewater.

Earth works

A constructed wetland is a shallow earthen pond planted with emergent aquatic plants, such as cattails and bulrushes, which act as filters and attachment sites for microorganisms. Livestock wastewater from a primary treatment system, such as a two-stage lagoon, is gravity fed into the wetland and flows continuously down a gradual slope of less than one percent. The wastewater remains in the wetland for about nine days, and during this time contaminants are removed by microbial conversion, chemical processes and sedimentation. Treated wastewater exiting the wetland can then be recycled back into the system or be irrigated to cropland or pasture.

Project Investigator Tom McCaskey of Auburn and a research team from Alabama and Georgia aim to find out whether constructed wetlands are practical for livestock operations. They are addressing design, construction and operation; wastewater loading rates; the useful life of the treatment system and the long-term impact of the constructed wetlands on the surrounding environment.

"They operate best in hot weather when there is little rain and the plants are fully mature, doing their job."

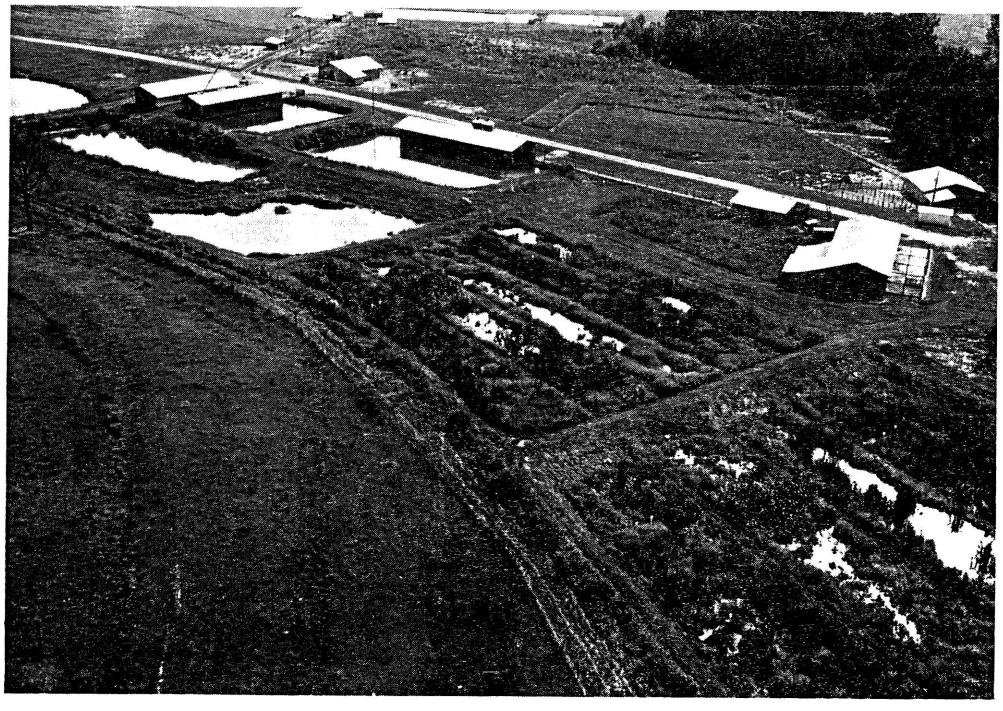
"Based on this work I hope to propose design and operation criteria, which can be recommended to livestock producers who want to use the wetland treatment system," says McCaskey. "I hope we can demonstrate what size and loading rates will effectively treat animal wastewater in a manner that is environmentally sound and economically feasible.

"One aspect of our work is to determine how long wetlands operate efficiently. Some wetland studies have been conducted for 12 months or less, but livestock producers need to know before they invest in the wetland system how long it will serve their needs."

A seasonal solution

He points out that constructed wetlands are only one component in a sustainable waste management system—a seasonal component in a system that produces waste year round.

"They operate best in hot weather when there is little rain and the plants are fully mature, doing their job," he says. "Winter is a different story when there is no evaporation



Mimicking nature's own filtering system, constructed wetlands have proved they can efficiently handle municipal wastewater management.

Can they handle the heavy duty cleaning required for livestock wastewater? A SARE project directed by Tom McCaskey of Auburn aims to find out.

and plants are not growing, but the waste continues to be deposited. This critical time needs more study."

With two more years to go, the project's preliminary results indicate that constructed wetlands do have a future in livestock operations.

More than hogwash

A surface flow wetland was constructed at the Sand Mountain Agricultural Substation in Crossville, Alabama, to evaluate how efficiently it could treat the waste of a 500 pig/year (farrow to finish) operation. A two-stage anaerobic lagoon system serves as a temporary wastewater storage structure. The effluent from the lagoon system is combined with pond water (70% lagoon wastewater and 30% pond water) in a holding pond to reduce the waste load, particularly the ammonia content of the lagoon effluent. Effluent from the holding pond is discharged continually into a two-tier constructed wetland consisting of five upper cells and five lower cells, with each cell measuring 0.1 acre.

Data collected for 34 months indicate that wetlands are highly efficient for treatment of swine lagoon effluent. The total nitrogen content of the wetland inflow was reduced from 79 mg/L to 13 mg/L after treatment, an 83% reduction. Ammonia nitrogen represented 76% of the total nitrogen content of the lagoon discharge and was reduced 88% from 61 mg/L to 8 mg/L.

Because the primary treatment occurs in an anaerobic lagoon, exclusion of oxygen necessary for the conversion of ammonia to nitrate resulted in nitrate nitrogen levels of less than 1 mg/L.

Total phosphorus was reduced from 32 mg/L to 9 mg/L. Biological oxygen demand (BOD) was reduced from 71 mg/L to 9 mg/L. Total suspended solids (TSS) was reduced from 136 mg/L to 22 mg/L. Outflow from the wetlands meets preliminary guidelines suggested by the Natural Resource Conservation Service for maximum concentrations of BOD (30 mg/L), TSS(30 mg/L) and ammonia nitrogen (10 mg/L).

For more information request the report on LS94-16.

Before you hire that backhoe

Tom McCaskey offers these questions for producers to ponder before jumping feet first into wetlands construction:

What's the real scoop on their track record?

Constructed wetlands have been used for more than 10 years for treatment of wastewater from small communities. Wastewater from livestock operations, usually from one- and two-stage lagoons has higher nutrient loads and is more difficult to treat than municipal wastewater. Although the short term treatment efficiency of wetlands is quite good, the long term efficiency is still under study.

What benefits do constructed wetlands offer?

A major benefit is odor control. Efficiently operated wetlands have little or no odor, which is important in areas where private dwellings are encroaching on livestock operations. Additionally, the reduction of nutrient loads allows much higher land application rates of the wetland treated wastewater. Other benefits include low mechanization, energy and labor requirements because the system depends on gravity flow. The treated wastewater can also be recycled to conserve water.

Can they replace other livestock wastewater treatments?

No. Wetlands systems can be used only with liquid manure operations which require some removal of the organic load, such as with a two-stage lagoon, prior to discharge to a constructed wetland for secondary treatment of the wastewater. Lagoons should be pumped down in the autumn to make room for winter rains. If sufficient land is not available for application of the lagoon wastewater, or if manure odors during land application are a problem, constructed wetlands can help.

How much land is required?

Based on wastewater loading rates for municipal wastewater, about one acre is required to treat the liquid effluent from a two-stage lagoon designed for a 500 farrow-to-finish swine operation per year. Loading rates for animal wastewater treatment are not well defined, therefore the wetland size described above is a rough approximation. The wetland should be built under the guidance of the Natural Resource Conservation Service on a site that has a gradual slope that will accommodate two or more wetlands in series. Allow for adequate land below the wetland site for construction of additional wetlands or water storage ponds if necessary. Choose a site with heavy soil, which prevents the movement of pollutants into the groundwater below the wetlands.

What happens to water that flows through the wetland?

Properly treated wastewater will resemble the quality of farm pond water. It cannot be discharged to a stream or lake, therefore it must be recycled. It can be applied to land at relatively high rates because most of the nutrients have been removed by the wetlands, or it can be used as flush water for manure removal from livestock facilities. During late summer when rainfall is low and water evaporation is high, there is generally no discharge from the wetlands. During winter, the opposite occurs. This might be viewed as a potential problem, but limiting the flow of wastewater into wetlands during critical periods could solve the problem.

Tracking Nitrogen

What's the best cover crop for nitrogen management? That depends on where you want that nitrogen to come from, according to project LS91-35 coordinated by Michael Wagger of NCSU. Rye, wheat, spring oat and crimson clover were evaluated for their ability to recover soil nitrogen following corn harvest in the Coastal Plain, Piedmont and Mountain regions of the Southeast. For two years, the cover crops were terminated in April/May to make way for no-till corn.

At all three locations rye was rated highest for accumulating nitrogen from the soil and growing the fastest, followed by spring oat and then wheat. All the grasses recovered more soil nitrogen than the crimson clover. However, even though the crimson clover grew slower than the grasses and recovered less nitrogen from the soil, it contributed more total nitrogen to the next crop because of nitrogen fixation from air.

For farmers this means that if your goal is to increase total nitrogen for the next year's crop then winter legumes should be the cover of choice, but if nitrate leaching during non-crop periods is your concern then go with one of the grasses.

Weather matters

Another phase of the project under the direction of Dan McCracken and Miguel Cabrera of UGA worked toward predicting how much nitrogen would be released to plants from the residue of each of the cover crops. Cover crop decomposition was monitored with nylon mesh bags containing cover crop residue placed on the soil surface one week after corn planting. The bags were retrieved periodically throughout the growing season. The dry weight and nitrogen remaining in each bag were used, along with weather data, to develop nitrogen release curves over time for each of the cover crops.

In a cold, dry year nitrogen is released more slowly from decomposing covers crops, reducing the amount of nitrogen that quickly becomes available to the subsequent cash crop, according to McCracken. Conversely, a warm, moist year makes for a quick release, providing enough nitrogen for some crops without applications of fertilizer nitrogen.

Eventually a computer model that uses weather data may be able to predict how much nitrogen will be released from each of the cover crops.

"Knowing how much nitrogen has been released from the cover crop provides a good basis for deciding whether the summer crop needs more nitrogen in the form of fertilizer," says McCracken. "It makes nitrogen management more efficient and maintains water quality."

Time it right

For precise nitrogen management, you also need to know how quickly a cover releases its quantity of N. According to an earlier SARE project (LS88-7) directed by Bill Hargrove, also of UGA, both crimson clover and hairy vetch experienced the majority of their nitrogen losses within the first 14 days. This rapid release means farmers can synchronize their system so that the period of greatest nitrogen release corresponds to the period of greatest nitrogen uptake of the next crop.

New directions

After wrapping up the SARE project, coincidentally, both Wagger and McCracken have taken the research farther in similar directions. Working independently of each other, they are now evaluating what happens when winter grasses and legumes are grown as cover crops in mixtures. It may prove to be the most efficient way to recover residual nitrogen from the soil and at the same time fix the most nitrogen for next year's crop.

Wagger's findings indicate that hairy vetch or Austrian winter pea in combination with rye may fit the niche in North Carolina. McCracken reports that while Austrian winter pea performs poorly in Georgia's climate, the crimson clover and hairy vetch show promise for that region when combined with the small grains.

For details request the final report on LS91-35 or LS88-7).

Dan McCracken collects a mesh bag containing plant residue which will be analyzed for nitrogen release during decomposition.

Farmers may soon be able to predict how much and how quickly a particular cover crop will release nitrogen for use by the successive crop.

Photo by Gwen Roland

Bobwhite quail: *running for cover*

Heard any good quail recipes lately? John Anderson and Pete Bromley of North Carolina State University have one. Not for cooking, though. It's a recipe for attracting bobwhite quail back to the farm.

With an ACE grant (AS92-5), Anderson, Bromley and a host of cooperators that included 17 farmers, Quail Unlimited, the North Carolina Soybean Growers, the North Carolina Wildlife Resource Commission and university researchers in several disciplines examined why quail numbers have been declining on Southern farms. The project's objective was to determine what farmers can do to rejuvenate populations of this small bird that symbolizes quality living in the rural South. For three years research was conducted on two farms and quail activity was surveyed on 15 other farms. Some of the project's results were anticipated—others were surprising.

Bobwhite quail have declined two percent per year for about 20 years, according to wildlife biologist Bill Palmer, who, along with Marc Puckett, conducted the field work on the farms. They investigated three variables in a quail's life: habitat, food supply and pesticide applications. Wild quail wearing miniature radios generated data that allowed Puckett and Palmer to assess habitat needs on farms. Feeding rate trials with human imprinted quail provided additional information on the quality of agricultural areas as brood habitat for quail chicks.

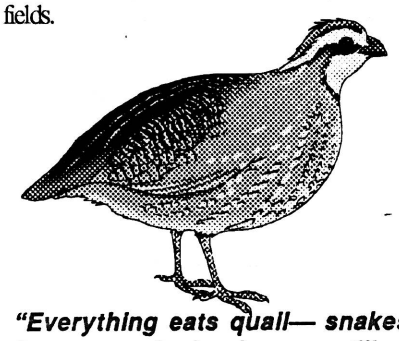
In worst-case scenario trials, the researchers monitored quail broods exposed to insecticides in cotton, peanut and soybean fields. They found that most insecticides commonly used in North Carolina posed little direct threat to quail chick survival and health. Surprising was the fact that chicks fed heavily upon dead insects in insecticide treated fields, yet, they suffered no apparent ill effects.

Feathered feedback

Collectively, the North Carolina research has shown that habitat loss is the principal reason for declining quail populations.

"Good quail habitat is lacking on most modern farms," says Palmer. "During the growing season fields are too clean to provide nesting areas for adult birds and feeding areas for chicks. The good news is that no-till soybean and other no-till crops comprise good quality nesting and chick-rearing habitat."

For example, using human imprinted quail chicks, the researchers observed that young quail exhibited much higher insect feeding rates in no-till versus conventionally-tilled fields.



"Everything eats quail— snakes, foxes, people, hawks, even tillage equipment."

In no-till soybeans, chicks consumed insects at rates comparable to those measured along fence rows and fallow fields. Thus, Anderson and Bromley feel that a combination of filter strips, field borders and no-till production systems can greatly increase quail numbers. Their ideas are supported by research results showing that farms with filter strip areas produced 179 chicks while farms without filter strip areas produced only 37. Flush counts, call counts and radio telemetry measurements confirmed that filter strips were especially important in the late-spring when quail nests contain the greatest number of eggs.

"The most crucial time for quail habitat is from May to August when hens are nesting, says Palmer. "Hens can produce several nests per season. However, quail must have the proper habitat throughout the crop year if they are to benefit from their huge reproductive potential."

A quail's life is tenuous; mortality rates range from 80-95% annually. That means of every 100 quails alive on this June 1, only 5 to 20 of them will still be strutting next June.

"Everything eats quail," says Palmer. "Snakes, foxes, people, hawks, even tillage equipment. Accordingly, quail have developed huge reproductive capabilities that can be expressed only if they have adequate nesting habitat."

Build a field and they will come

So what is the recipe for more quail? Anderson and Bromley recommend two departures from current farming methods. First they advocate a change to no-till farming techniques, and, second, they recommend the development of field borders inside and adjacent to croplands. Even though field *border* is a term used to describe fallow areas on the outer edges of cropped areas, the researchers believe that increased intermingling of fallow areas with crops fields is fundamental to the resurgence of quail. Accordingly their research has focused upon the management of vegetation along ditch banks, headlands and road edges.

Anderson and Bromley suggest here's no need to invest in special plants for the field borders. They believe most native plants can develop 18- to 24-inch tall canopy that protects quail chicks foraging on the open ground underneath. Native herbaceous annuals are preferable to thick mats of low-growing, non-native plants like fescue.

Hatching bigger plans

To test their quail recipe the researchers have embarked upon a new, larger research project (AS95-18). With much of the original research team intact and Bill Palmer serving as project manager, Anderson and Bromley are striving to implement the practices identified in the original study.

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Quail

When the call went out that the team was looking for farmers who would volunteer up to 500 tillable acres for the study, they were swamped the first day with more farms than they could use. Why were so many growers eager to participate? Simple, they want more quail, according to Bill Palmer.

"While there is the possibility of supplemental income from leasing the hunting rights for quail, most farmers are motivated by the aesthetics and nostalgia of having quail on their property," he says. "Every grower we've talked to remembers quail with pleasure. They talk of hunting with grandpa and having company from town come out to hunt for a weekend. In their minds, quail definitely add to the quality of rural life."

One component of the new study will be to determine the success of the recipe on different types of farms. The 24 farms in the new study feature diverse enterprises such as peanuts, poultry, tobacco, swine and soybeans on variable landscapes.

For more information request reports on AS92-5 and AS95-18.

Covers that come back

The expense of reseeding cover crops annually has limited their usefulness to some farmers. Seth Dabney is addressing that problem as just one part of a project titled *Cover Crop Integration into Conservaton Production Systems.* He has identified two promising cover crops with excellent reseeding capabilities.

Southern spotted bur clover *(Medicago arabica)* appears well suited to the upland soils in zones 7B and warmer, while Paradana balansa *(Trifolium balansae)* has shown promise on wet delta soils as far north as Zone 7A. When compared to control plots of the widely planted Tibee crimson clover, both matured seed earlier than Tibbee. Also both volunteered back for two years after the seed crop was planted in 1993.

Want to try an acre or so of Paradana balansa this year? Dabney has a small surplus of the seed that he is willing to share with *CG* readers just to see how it performs in more locations. If it's not too late for clover in your area, call Dabney at (601) 232-2976. He will send 5-10 pounds per request at no charge until he runs out of seed.

Dabney directs the project from the USDA-ARS National Sedimentation Lab in Oxford, Mississippi, but cooperating farmers and researchers report from 10 locations in Tennessee, Arkansas, Alabama, Georgia and Mississippi. Germplasm research is only one part of the project that also examines practical systems to reduce the need for herbicides in reduced tillage crop production. *For more information request the annual report for LS93-55.*

Southern Region SARE/ACE
1109 Experiment Street
Room 203, Stuckey Building
Georgia Station
Griffin, GA 30223-1797

Special issue:
Readers respond

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