

by Dr. John R. Anderson, Jr. and Gabriele Onorato

Systems Agriculture At Open Grounds Farm

Precision fluid fertilizer and pesticide management protect ecosystem at 44,000-acre site in North Carolina.

Summary: Open Grounds Farm is located on the coast of North Carolina in one of the nation's most environmentally sensitive estuarine regions. In 1993, the 44,187-acre farm produced almost three percent of the North Carolina corn crop. Open Grounds Farm has prospered because it successfully integrates Best Management Practices (BMPs) and latest technologies into productive cropping systems. Starter fertilizers and fluid suspensions play an important role at Open Grounds, where fertility programs are designed to complement specific weed and insect management plans.

Open Grounds Farm, Inc. (checkered region pictured in satellite photo below) is located 10 miles north of historic Beaufort, North Carolina. The 44,187-acre site was purchased in 1974 by Gruppo Ferruzzi, a large Italian agro-industrial firm that also operates farms in Argentina, England, Italy, and Paraguay. Open Grounds lies in the Albermarle-Pamlico estuarine system, third largest in North America.

Marsches adjoining the farm at the headwaters of the South River host a food chain that supports both finfish and shellfish. Estuarine creeks on Open Grounds function as nurseries for such commercially important species as juvenile summer flounder, menhaden, mullet, brown shrimp, and blue crabs. The marshes and fields of Open Grounds serve as breeding and feeding sites for songbirds and game birds, as well as numerous species of ducks, rails, snipe, and other waterfowl. River otters, raccoons, beavers, black bear, and deer also live in the marshes.

To preserve the biological integrity of the surrounding ecosystem, Open

Grounds has sought to incorporate environmentally friendly cultural practices into its farming enterprises. Almost 20 years of experience and experimentation have enabled Open Grounds Farm to develop and implement profitable cropping systems with minimal environmental impact.

Land use

The typical field at Open Grounds is 330 feet wide by a mile long. Soils typically contain greater than 10 percent organic matter.

Out of the total acreage available at Open Grounds Farm in 1993, 35,683 acres were devoted to growing crops or managing pasture (Table 1). The balance of the acreage was parceled among forest land, building sites, roads, canals, etc. Soybeans were double-cropped, following 4,000 acres of winter wheat.

Over the years, corn yields have ranged from 108 to 138 bu/A. In 1993, corn yields averaged 137 bu/A.

Soybean yields have fluctuated from 35 to 45 bu/A. Wheat has averaged about 60 bu/A.

Open Grounds also manages a 3,500-head cow/calf operation. Breeds include Black Angus, Santa Gertrudis and Hereford.

BMPs

Integrated into every operation at Open Grounds are Best Management Practices (BMPs). Fields are separated by "V" ditches that drain into headland canals. Ditches and canal banks are grassed to control sedimentation and runoff. Field borders are left atop ditches and buffer zones lie between crop fields and marshes.

Recently, water control structures were strategically placed in canals and ditches. The flashboard risers slow water movement into marshes and creeks during periods of heavy rain. Slower water movement in ditches and canals minimizes off-site movement of phosphorus via sediments while



increasing the probability that denitrification in ditches will prevent nitrate movement into surface waters.

Systems approach

Open Grounds approaches fertilization of its corn/winter wheat/double-cropped soybean rotation in a systematic fashion.

Soil testing. Fertilizer management begins with soil testing in the fall. Each 40-acre "cut" is divided into three 110-foot by one mile sections that are sampled annually. Soil sample data are then computerized and recommendations generated for spring fertilizer applications.

Prescription blending. Open Grounds manages its own suspension plant where numerous fertilizer ratios are precisely formulated to satisfy field requirements.

Mapping. Following formulation, applicators are given field maps that ensure prescription NPK blends are precisely applied in 13.33-acre blocks across all crop acres.

"Systems" thinking is extended to all farm management activities at Open Grounds.

Table 1. Land use at Open Grounds Farm, 1993.

	Acres
Corn	11,762
Soybeans*	14,119
Converting to crop	300
ASCS deducts	775
Pasture**	<u>8,727</u>
Total cropland	35,683
Forest	4,730
Building sites	74
Roads	921
Canals	588
Field ditches	1,220
March, etc.	<u>971</u>
Total-all land	44,187

* Soybeans are often double-cropped following winter wheat.

** Farm manages 3,500-head cow/calf operation.

For example, preplant N for wheat is applied at three rates within each field. Applications can vary from 40 lbs/A of N at the edges of a field to 20 lbs/A of N at its center.

Soybeans are fertilized with P and K prior to fall wheat planting so that both crops may benefit from nutrient applications.

Lime rates are chosen with the idea that no-till corn will follow wheat and double-cropped soybeans.

Starters

At corn planting time, starter fertilizers are applied from 12-row planters via knives that deliver 10 gal/A of a 1:1 mixture of 11-37-0 and 30 percent UAN, approximately one inch from the seed.

Mixed with the starter is one qt/A of fertilizer grade *Furadan 4F*. This application of liquid Furadan from a closed system is less hazardous to equipment operators and wildlife than granular soil insecticides used in past years. Moreover, the liquid insecticide, in tandem with the starter, provides effective control of wire-worms and Southern corn billbug, the area's most serious insect pest.

Total N applied to corn at Open Grounds has ranged from 190 to 230 lbs/A. No-till corn and soils with lower organic matter receive the highest rates. N in the suspension plus the starter (20 lbs/A) ranges from 90 to 110 lbs/A. The remaining 120 lbs/A of N is sidedressed as UAN approximately six weeks after planting.

Open Grounds has worked for a number of years to ensure that N application rates are optimal. Denitrification rate studies are under way on the farm. Other studies are examining the feasibility of using nitrate electrodes or chlorophyll meters to predict N sidedressing and top-dressing rates for corn and wheat, respectively. Plant tissue testing is also extensively used, particularly for wheat.

IPM

Open Grounds Farm operates a sophisticated pest management program whose activities are coordinated by the farm's crop manager, Sam Brake, Jr.

The Integrated Pest Management

(IPM) department fields two crews that focus upon pest management. Its product and scouting supervisors report to Gabriele Onorato, the farm's pest management coordinator.

Product supervision. Crew I is responsible for the mixing of pesticides and other chemicals, supervision of ground and aerial application, control of pesticide inventories, and maintenance of spray records that includes documentation of the storage and disposal of rinsate water. Pesticide mixing for ground and aerial applications is accomplished on a completely enclosed concrete pad equipped with a spill collection system. The mixing area is 200 feet from the water source. These precautions are accompanied by annual pesticide safety training for each crew member. Special efforts are taken to assure all pesticide and fertilizer equipment operators are aware of the importance and sensitivity of the environment surrounding the farm.

Scouting. Crew II is responsible for monitoring crop weeds, insects, diseases, and weather conditions. Weeds are normally scouted at least twice per season. For example, first scouting for weeds in winter wheat occurs in January, prior to the crop's first nitrogen application. The second scouting occurs ten days after final nitrogen application on wheat. Later trips assess wheat insect and disease pressures.

Scouting has become the cornerstone of Open Grounds' efforts to farm profitably in one of the nation's most environmentally sensitive areas. Scouting facilitates early detection of nutritional and insect problems. It denotes type, size, density, and location of infestations. Rigorous scouting, combined with economic thresholds (predicted by herbicide decision model developed by North Carolina State University), enabled Open Grounds to reduce its pesticide expenditures by more than \$120,000 in 1993. For example, the traditional gallon per acre of pre-emergence *Lasso* for corn and soybeans on organic soils has been replaced by applying postemergence products only when economic thresholds justify their use. Figure 1 shows how the farm's remedial

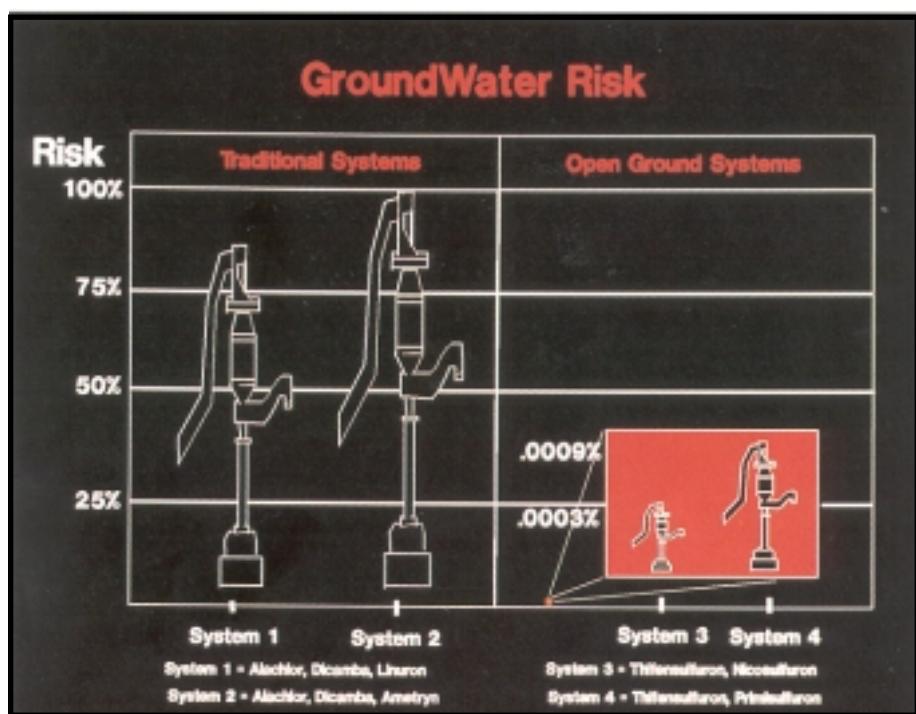
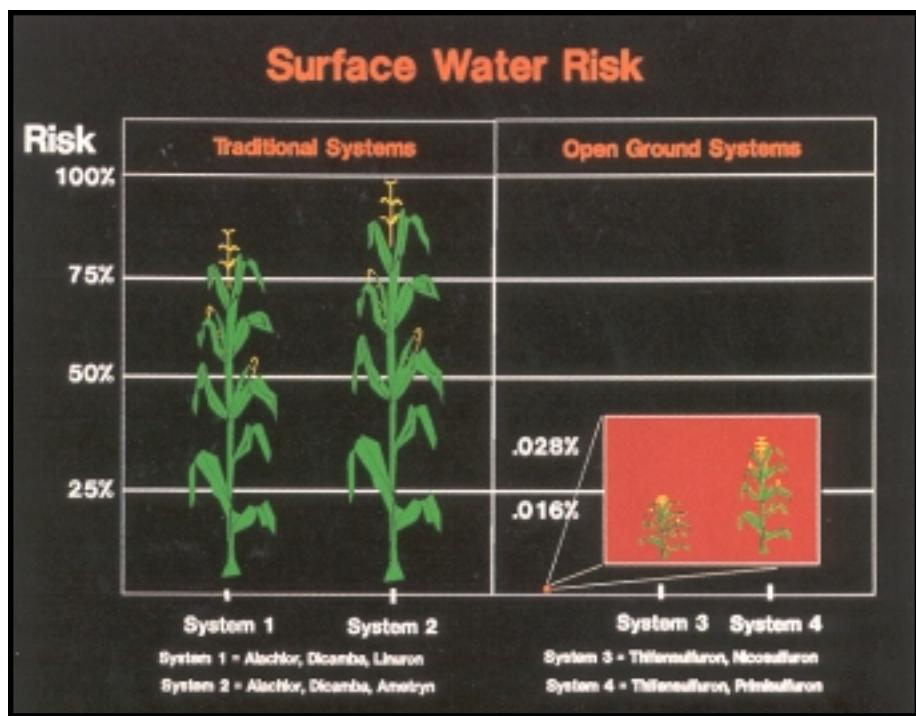


Figure 1. Reduced risk of pesticide movement, Dana Hoag, Colorado State University.

approach to pesticide usage has reduced the risk of pesticide movement from its acreage to surface and ground water.

Battling weed resistance

The use of sulfonylurea herbicides at Open Grounds (*Classic* and *Pinnacle* in soybeans, *Harmony Extra* in winter wheat, and *Accent* in corn) has raised

concern about targeted weeds developing resistance to these herbicides. One preventative measure used by Open Grounds is to rotate crops annually. Another uses sulfonylurea herbicides only in tank mixes or in sequence with other herbicides possessing a different mode of action. The farm's mid-February use of sub-lethal, preplant *Roundup* rates to

control winter vegetation has expedited implementation of a herbicide rotation strategy while reducing herbicide and tillage costs. Efforts to prevent the rise of herbicide-resistant weeds have been further assisted by the short half-life of sulfonylurea herbicides in acid soils (typically pH 5.0), as well as the farm's use of economic thresholds that encourage a favorable ratio of susceptible to potentially resistant weeds.

Opportunity

The search continues for new technologies, environmental improvements, cost cutting, and improved profits.

Contrary to conventional wisdom, Open Grounds successfully no-tills approximately half its corn acreage, even into soils classified as poorly drained.

Improved N and P placement has contributed significantly to the farm's emergence as a regional leader in conservation tillage.

Cotton was recently evaluated in a 500-acre experiment. It was dropped because weeds could not be managed economically on organic soils.

Being considered are new ditch bank management techniques that reduce mowing costs and enhance wildlife populations.

Ongoing are efforts to find ways of slowing fresh water movement from farmlands to estuaries following spring rains.

Open Grounds cooperates with North Carolina State University, Duke University, the University of Minnesota, the University of North Carolina and the Environmental Protection Agency.

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