U. of Del. compares costs of tillage

NEWARK, Del. — Today's grain producers have many tillage alternatives. Choosing the best system to maximize profits while minimizing erosion isn't always easy.

The moldboard plow is still the best tool for covering sod or trash while pulverizing the topsoil, says University of Delaware extension agricultural engineer Tom Williams. It buries many potential weed, insect, and disease problems but leaves the land exposed to erosion.

The chisel plow stirs and pulverizes the topsoil while leaving ridges and furrows and some surface residue to reduce erosion. It's cheaper to operate than the moldboard plow, provided secondary tillage isn't increased to prepare the seedbed, says Williams.

Various disk implements are available for cutting surface residue and shallow tillage, while subsoilers can till up to 2 feet deep where compacted subsoils impede root development.

Then there's no-tillage, which offers growers some attractive alternatives to plowing the soil. It helps conserve soil moisture, reduce soil temperatures and decrease soil erosion by both wind and water. But most attractively, it reduces labor, machinery and fuel requirements, three expensive inputs. This system has allowed farmers to expand their cropped acreage without having to increase their machinery investment substantially, the specialist says.

The University of Delaware Cooperative Extension Service and Agricultural Experiment Station began field studies in 1973 to compare the differences in machine energy requirements for various tillage systems to grow corn on Coastal Plain soils. Williams presented a summary of this research at the annual Mid-Atlantic No-Till Conference in Timonium, Md., last December.

"We started with two International Harvester 656 gas tractors with a vacuum gauge on the intake manifolds calibrated against a PTO dynamometer and fuel meter," Williams said. "This gave us engine horsepower and fuel use in the field." A drawbar dynamometer provided implement draft requirements.

"That first year we found that 60 horsepower-hours per acre were required for moldboard plowing, one disking, one springtoothing and planting on a loamy sand soil," he said. Substituting a chisel plow for the moldboard plow lowered the requirements to 46 horsepower-hours per acre, whereas no-till corn planting required only 8.6 — one-seventh of the moldboard plow system.

No-till also took only about a sixth of the fuel and a third of the labor of the moldboard plow system. Chisel plowing saved 1.1 gallons of fuel per acre and 0.21 hours an acre over moldboard plowing. These figures don't include spraying.

"By 1974 we were able to obtain a 97 PTO HP Minneapolis Moline G955 diesel tractor with more sophisticated instrumentation for these machine system comparisons," Williams said.

Using this, the relationships between no-till and chisel plow systems were ver similar to those obtained with the gas tractors. Chisel plowing required 40.6 more horsepower-hours per acre, 3.25 more gallons per acre of diesel fuel, and 0.45 more hours of labor than the no-till planter. This comparison also didn't include spraying, which would slightly lower the difference, since no-till generally requires a larger volume of spray material per acre than clean tilled soil.

University of Delaware agricultural engineers have also evaluated the inputs and yields for subsoiling to a depth of 15 inches in the row at planting.

"Draft increased as speed and depth of subsoiling increased, with inclined shanks requiring less draft than parabolic shanks," Williams reported. "Subsoiling could require up to 35 additional tractor PTO horsepower per row or shank. Benefits of in-row subsoiling on Coastal Plain soils have been highly variable in both no-till and clean tilled systems. No-till, however, has averaged about a 7 percent increase in yields over clean tilled systems. Yields are usually increased in dry years because of moisture conservation."

The savings no-till offers in machine energy, fuel and labor can have a number of economic implications in a farming operation.

"Saving over 3 gallons of diesel fuel an acre is perhaps not as critical now as during the energy crisis, but the $1 per gallon saved can help pay for the additional chemicals required," he said.

Saving 0.4 hours of labor per acre can be a cash saving of another $3 per acre at a labor rate of $7.50 an hour. However, he pointed out, this is no saving unless the labor is put to another productive use such as planting more acres.

The biggest savings with no-till come from reduced machinery investment over a period of time. "You have to decide what this can mean to your operation," Williams said. "New tractors currently sell for about $400 per PTO HP. If no-till allows you to eliminate a 100 HP tractor, that's $40,000 less capital investment. With another $10,000 less for tillage implements, your fixed machinery costs may drop $15 to $20 per acre."

From 1980 through 1982, farm machinery depreciation in the U.S. exceeded investment by a total of $11 billion. "Certainly most of this came from delayed purchases because of depressed farm income. However, some must have resulted from increased conservation and no-tillage practices," the specialist said.

"In a comparison of machine systems, no-tillage will win out every time because fewer machines are required," Williams concluded. "Many other factors must be considered as well, when a cropping system is analyzed. But in the final analysis, one thing seems sure, there will be more no-till in '84."