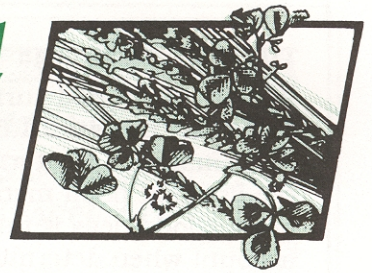


SUSTAINABLE FARMING

Quarterly



Vol. 3 No. 2 August 1991

Soil conservation takes root in reduced-till options

The author, Jerry Harper, is district manager of the Palouse Conservation District, Pullman, Wash.

The Palouse Conservation District is conducting a two-year demonstration of conservation seeding equipment for small grains, which allows producers to compare and evaluate the latest reduced-tillage and no-till equipment in actual side-by-side field-scale comparisons.

It also gives agency field technicians and researchers an opportunity to familiarize themselves with some of the conservation equipment being used on farms today.

The district has focused its efforts on seeding wheat after

peas or lentils, because this is the point in the crop rotation where most erosion occurs in our area. Seeding winter wheat after these low-residue crops is where producers can make the most progress in controlling erosion with the least amount of effort.

The current demonstration was seeded to wheat during September of 1990 using 12 equipment systems in two categories: **reduced tillage equipment**, often referred to as deep shank applicators, which places fertilizer in bands below the soil surface without prior tillage, ordinarily followed by a conventional drill, and **no-till equipment**, in which both fertilizer and seed are placed in a single operation without any prior

tillage. The site near Pullman is in rotation of winter wheat-spring barley-spring peas, with silt loam soils and slopes ranging from 8 to 14 percent.

Surface residue and surface clods measured

We compared the surface residue left after the seeding for each machine using the line and point method, a simple and effective way to measure the percent of surface cover. Six measurements were taken on each plot, and then averaged. The amount of surface residue left over winter is one of the key considerations in every producer's conservation farming plan. Many factors were taken into account when evaluating conservation plans, but surface residue remains one of the more verifiable components.

More TILLAGE, page 2

Innovative computer system takes mystery out of weed identification

The following is an edited version of an article that appeared in the July issue of Growers Guide.—ed

University of Idaho weed scientist Richard Old has developed a unique weed identification system that might be the most useful technological advance in the field since the dichotomous key.

"We're getting the information out of the ivory tower," remarked Robert Callihan, Old's major professor and another UI weed scientist. Development of the system was the basis of Old's doctoral dissertation, while the computer programming was done by Robert Dobbins of UI agricultural computing.

More WEEDS, page 5

Inside the SFQ

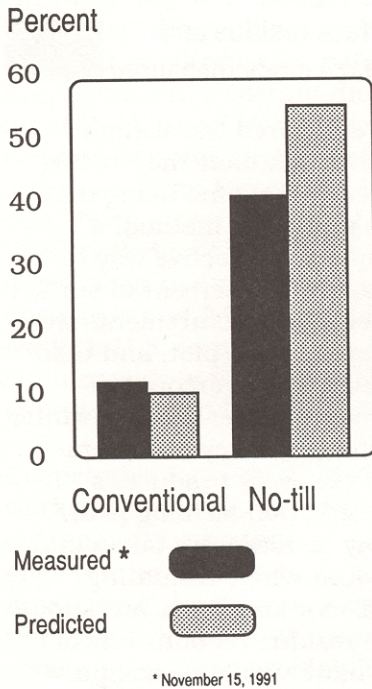
- Reduced tillage comes out ahead in cost comparisons. Page 2.
- Legumes prove their value in Montana field testing. Page 3.
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TILLAGE, from page 1 —

We also compared surface clods that measure 1.5 inches in diameter or greater. Again, the line and point method was used. Cloddiness is taken into account when determining a cropping factor for a particular farm.

In general, the machines that

Figure 1. Predicted and measured surface residue levels



left the most surface residue produced the fewest surface clods. Four drills primarily utilizing a rolling opener and/or disc-shoe combination produced the fewest clods while leaving the most residue. They are the Cross Slot, the John Deere, the Yelder, and the Palouse Zero-Till drills.

Three machines that utilize a chisel shank, which produces the most clods and the least residue, are the Chisel-Chopper and Till-All applicators, and the Chisel Plus drill. The five other machines utilize a coultter, knife or boot, and/or rolling opener combination that produces relatively few clods while doing well on residue too. They are the Wilbur-Ellis and Puregro applicators, the McGregor drill, and the two Palouse MV Series drills.

Tillage comparison

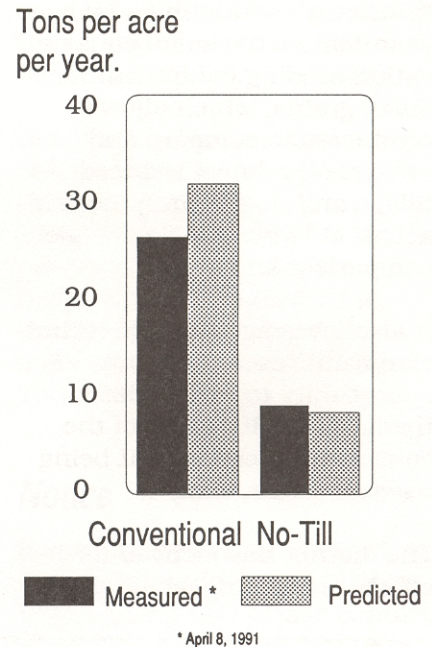
In addition to demonstrating the 12 planting systems, we compared conventional tillage and no-till, hoping to show that excessive tillage is often unnecessary and more costly, both in soil loss and out-of-pocket expenses. Side-by-side plots 100 feet by 160 feet were seeded on a uniform south slope of 24 percent. The plots were treated exactly the same except for the offset discing on the conventional plots in mid-August. Both plots were seeded with the Palouse Zero-Till drill on Oct. 13, and a good rain fell the next day.

Surface residue

As shown in Figure 1, the conventional plot had very little surface residue remaining, compared to the no-till. The measured amount was compared to the residue level predicted by the SCS cropping factor program using the actual operation dates.

Another important difference was the near total disturbance of the top five inches of soil on the conventionally tilled plot, while the no-tilled plot had much of the soil structure intact. The detached layer of soil seems to set the potential for severe soil erosion because it readily flows when saturated.

Figure 2. Predicted and measured annual soil erosion.



Soil erosion

As anticipated, the conventional plot suffered from severe soil erosion — 27 tons per acre, nearly three times that of the no-till. Predicted annual erosion rates using the cropping factor program and other factors determined from actual site conditions were close to the measured rates. Both measured and predicted rates are shown in Figure 2. Since the goal for most conservation plans in our area is to reduce erosion to five tons per acre

More TILLAGE, page 5

The Sustainable Farming Quarterly is a publication of the Dryland Cereal/Legume Project, a LISA project based at Washington State University, Pullman. The publisher is the Alternative Energy Resources Organization, 44 N. Last Chance Gulch, Helena MT. (406) 443-7272.

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A "bumper crop" of legume options takes root in Montana

The author, David Granatstein, is coordinator of the six-state Dryland Cereal/Legume Project.

Montana State University researchers are screening a large number of legume species under diverse irrigated and dryland growing conditions, and have found some with excellent potential for summer fallow replacement, green manure, and/or multi-purpose forage use.

The Statewide Legume Adaptation Trials (SLAT) were started in 1988 and are in their fourth year at at least eight Montana locations. Results from the first two years were reported in the Winter/Spring 1991 issue of *Montana AgResearch*. Dr. Jim Sims, one of the project leaders, is optimistic that farmers will have a good choice of legumes to use for any purpose.

The 25 legumes used in the trials are listed in the table at right and new entries are added as they are identified. The trials have been run at most of the MSU research centers including Conrad, Huntley, Bozeman, Moccasin, Havre, Sidney and Corvallis (all non-irrigated) and Kalispell (irrigated). They represent a great range of rainfall, temperature and soil conditions. A similar set of legumes has been used in screening tests in southeastern Wyoming, and a set of seed recently was sent to a researcher in central Oregon.

The legumes were all seeded in the spring, generally in early May. Most species were only harvested once during the season, at the mid- to late-bloom stage, but those that did regrow were harvested again. All results are reported on a dry matter (DM) basis. A laboratory test of bloat hazard was run on the forage samples to give an indication of the grazing potential for the various species.

Green manure potential

One purpose of the study is to identify legumes that could be used in place of summer fallow in dryland cereal cropping. These species need to use minimal water, compete with weeds, fix nitrogen, and produce enough growth for a reasonable green manure. Maximum growth may not be an important criteria, since a large green manure crop can return far more nitrogen to the soil than the next grain crop can use.

Based on other studies, Sims proposes a threshold level of 900 pounds per acre dry matter production for poten-

tial green manures for meeting the nitrogen needs of the next crop in the drier, lower-yielding areas. Of the 25

Legumes tested in the Montana SLAT project, 1988-89. (Varieties)

Small-seeded -----

Berseem clover (Bigbee, Multicut)
Yellow sweetclover
Subterranean clover (Mt. Barker)
Maral Shaftal clover
Arrowroot clover (Youchi)
Black medic (George)
Barrel medic (Harbinger)
Disc medic (Tornafield)
Alfalfa (Nitro)

Medium-seeded -----

Lentil (Indianhead)
Snail medic (Robinson)
Gamma medic (Paraponto, Sapo)

Large-seeded -----

Austrian winter pea (Melrose)
Chickling vetch
Tangier flat pea (Tinga)
Feed pea (Sirius)
Lentil (Red Chief)
Pinto bean (UI 114)
Red kidney bean (Sacramento)
Soybean (Maple Amber)
Lupine (Ultra, Primorski)

legumes tested, 23 met this criteria at least one year at those locations where there were two years of data.

Dry matter yields ranged from a low of 168 pounds per acre (arrowleaf clover at Huntley in 1989) to a high of 14,200 pounds

per acre (subterranean clover at Bozeman in 1989), with large variations among locations and years.

More LEGUMES, page 4

"You don't know that something won't grow here until you try it."

----- **Researcher Jim Sims**

LEGUMES, from page 3 —

Sims has a number of other studies under way to help fine tune the green manure/fallow replacement strategy. He is testing a self-seeding medic system (based on Australian experience), researching the water-use efficiency of several species, and studying the idea of green manure incorporation based on consumptive water use.

Preliminary data indicate that Austrian winter peas produce the most plant growth per unit of water used. They have performed well at all locations and appear to compete well with weeds, compared to the small-seeded legumes. Seed costs could be reduced by selecting for small seed size, as has been successfully done by Saskatchewan researchers with Indianhead lentils.

Forage potential

In the wetter environments, small-seeded legumes often yielded more than 8,000 pounds per dry matter acre, and typically outyielded the large-seeded legumes. At the drier locations, the small-seeded legumes averaged 1,700 pounds per dry matter acre, and seldom exceeded 2,000 pounds per dry matter acre. Here the large-seeded entries often produced over 2000 pounds per dry matter acre. This difference in performance is most likely due to seed size. Compared to small-seeded species, the large-seeded species can be planted deeper, which increases their chance of successful germination in drier environments. Thus, their stands and subsequent yields are better.

Overall, the annual clovers tended to yield better than the

annual medics. But the data suggest that the annual clovers are better adapted to the wetter, cooler environments, while the annual medics are superior under drought conditions. NC3-chickling vetch generally produced well in both wet and dry conditions, perhaps due to its grass-like leaf shape, which may give it extra drought tolerance. The legumes varied in growth habit, with some being upright and others prostrate. The upright habit is an important characteristic for a legume used in hay production.

From the Nile to the Yellowstone

Studies such as those of the SLAT project can lead to real payoffs for farmers. As Sims notes: "You don't know that something won't grow here until you try it." One good example is berseem clover (*Trifolium alexandrinum*), a legume native to Egypt and the Mediterranean. It is managed as a winter annual most everywhere it is grown. But not in Montana. This species was studied as a potential summer annual forage, and has the attractive feature of being non-bloating when grazed by livestock. It has good seedling vigor, rapid growth and regrowth, good forage quality, and high nitrogen fixation potential. Berseem clover is similar in drought tolerance to alfalfa and can stand moderate periods of waterlogging, and is more salt-tolerant than most alfalfa or red clover.

Two varieties currently being used in Montana are Multicut from California and Bigbee from Mississippi.

An estimated 5,000 or more acres of berseem clover are currently being grown in

Montana, about half on irrigated land and half on dry land. Its versatility in terms of end use and environmental adaptation make it attractive.

Dry matter yields from the SLAT plots ranged from a low of 800 pounds per acre to a high of 8,700 pounds per acre among the seven non-irrigated locations (average 2,670 pounds per acre), while the average irrigated yield at Kalispell was 7,400 pounds per acre.

A 1988 study at several locations found that a seeding rate of about eight pounds per acre is best, with row spacings of 12 inches or less for maximum forage yields.

In a study of planting dates, yields were highest when berseem clover was planted by mid-May, with substantial decreases for June plantings. First harvest was generally 60 to 70 days after planting.

Legumes have not been widely used by dryland farmers in recent decades, but their role as important soil-building crops is being exploited by farmers in more humid regions.

The extensive and innovative work under way in Montana will likely help dryland farmers in the Northwest find ways to put legumes to work on their farms as well. □

Mailing notice

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TILLAGE, from page 2

per year or less (commonly referred to as meeting "T"), it appears that both tillage methods still fall short. But the predicted erosion for the entire three-year rotation cycle (without divided

would reduce these erosion estimates by about a third.

Plant survival

An unexpected result was the good plant survival with no-till compared to the severe winter kill suffered by the wheat on the conventionally tilled plot. Both the conventional and no-till plots started out last fall with about 18 plants per square foot. Seed depth also was fairly uniform, about 2 1/2 inches deep for the conventional and 2 1/4 inches deep for the no-till. But when the plots were checked in April, only three plants per square foot remained on the conventional plot, while the no-till plot still had 12 plants per square foot. A recent Washington Association of Wheat Growers newsletter states: "As a general rule, you want five or more live, vigorous plants per square foot." The conventional plot clearly didn't make it.

and were not included. The cost of herbicides was included. Today's high fuel prices favor the systems with the least number of operations.

These demonstrations play a valuable role in helping growers and ag service personnel to evaluate the constant influx of new equipment choices. While sound statistical comparisons may be hard to make, some differences in performance will literally be easy to see. The equipment is being tested under realistic farm conditions, an important point for growers.

And learning from the unexpected, such as the difference in winter survival, may make the difference between failure and success. □

COMPARISON OF WINTER WHEAT TILLAGE SYSTEM COSTS *

Conventional-tillage

Heavy offset disk	\$10.73 per acre
Shank fertilize	7.53
Rodweed	5.24
Conventional drill	<u>7.08</u>
	\$30.58 total

Reduced-tillage

Deep shank fertilize	\$10.26 per acre
Rodweed	5.24
Conventional drill	<u>7.08</u>

\$22.58 total

No-till

Herbicide application	\$6.55 per acre
No-till drill	<u>19.92</u>
	26.47 total

* Calculated using the Washington State University Cooperative Extension Cost List (September 1989).

slopes) on this field would average 12 tons per acre per year for the conventional and five tons per acre per year for the no-till. In this case, the system using no-till would meet the conservation planning goal without divides.

How would reduced tillage compare? Predictions for machines utilizing a chisel-type shank followed by a conventional drill are 16 tons per acre annually and seven tons per acre per year over a three-year average. Machines utilizing a coulter knife would fall somewhere between the chisel type shank and the no-till. Divided slope farming

Cost estimates

General cost estimates for using conventional tillage, reduced tillage, and no-till when seeding winter wheat on pea or lentil ground are presented above. These were calculated using the WSU Cooperative Extension Cost List (September 1989). The estimates take into account equipment costs, including repairs and depreciation, 1989 fuel costs, and labor costs. No-till drill costs vary considerably. The figure shown is about mid-range. Fertilizer and seed costs are assumed to be nearly the same for any of the options,

WEEDS, from page 1

The Western Expert Educational Diagnostic System (WEEDS) is a computer program containing 170,000 pieces of data, accompanied by a manual and a book entitled *Weeds of the West*. WEEDS truly is an expert system, Old says — and that means the user doesn't have to be.

In many cases a plant can be identified with as little information as the color of its flowers, its approximate height, whether or not it has thorns, and whether its leaves are hairy or smooth. The user simply enters what he or she is sure of, and in a matter of seconds, the possibilities can be reduced from more than 300 to a half dozen.

To order the WEEDS program and user's manual, send \$84.99 (includes shipping) to the Weed Diagnostic Lab, Department of Plant, Soil and Entomological Sciences, University of Idaho, Moscow, ID 83843-4196. □

Agriculture, public agree on the importance of clean environment

A majority of farmers in the U.S. are concerned about the environment and want to reduce their use of chemicals, according to several recent polls by the Gallup and Roper organizations and the American Farm Bureau Federation.

The 1990 Gallup poll showed 61 percent of farmers would switch pesticides if they felt a chemical they were using was damaging the environment and they had an alternative, said Ann Sorensen, assistant director of the Natural and Environmental Resource Division of the American Farm Bureau Federation. Forty-seven percent of those polled had already reduced their use of agricultural chemicals and 84 percent of western U.S. farmers were familiar with biological control of pests, she said.

Cooperative Extension Service workers rated environmental contamination as their number one concern, according to the American Farm Bureau Federation poll. Prior to 1988, the top concern was farm profitability. Synthetic pesticides were of utmost concern from 1970 to

1988, but now that priority has been replaced by integrated pest management.

Ninety-three percent of the consumers polled by Gallup said they trust farmers to bring them safe food, according to Sorensen. That's a higher trust level than federal agencies, environmental groups, or farm organizations enjoy.

But Sorensen also noted that a Roper poll showed that 15 to 20 percent of the public wants to abolish use of agrichemicals, and another 66 percent said farmers need to limit their use of those chemicals. □

SFQ tightens its belt

This issue of the SFQ is smaller than in the past. Our publication budget cannot keep up with the increasing amount of outstanding and practical sustainable farming information available. We regret that we cannot provide more pages. SFQ is funded by a grant from the federal Low Input Sustainable Agriculture (LISA) project. □

CALENDAR

August 18-21: Second Annual Conference on Agroforestry in North America, Springfield, Mo. Participants will exchange ideas on agroforestry's potential to reduce soil erosion, improve wildlife habitat and water quality, help build a resource base for value-added businesses, and provide an above-average rate of return for landowners who practice it. Contact University Extension Conference Office, 344 Hearnes center, University of Missouri, Columbia, MO 65211.

Oct. 11-12: "Sustainable Agriculture in a Changing World," University of Utah, Logan. This conference features a wide variety of topics and state and nationally-known leaders in sustainable agriculture. For more information, call (801) 750-2206. □

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