



Triple cropping can be a valuable waste management tool for dairies

by Ladi Asgill, Kristen Hughes, and Jeff Mitchell

THE CHALLENGES currently facing the dairy industry in California and throughout the West are unprecedented.

Increasing air and water regulations and diesel fuel costs nearing \$3 a gallon last summer were bad enough. In December, the Associated Press reported that natural gas prices were at an all time high, largely due to gulf hurricanes this past summer.

Because natural gas accounts for up to 90 percent of the cost of nitrogen fertilizers, farmers can expect to pay even more for nitrogen fertilizer in 2006. On top of all this, we have continuing labor shortages with no end in sight.

That said, necessity is the mother of invention, and dairy producers throughout California's San Joaquin Valley have been evaluating a technique that is potentially an ideal solution to these problems: triple cropping and conservation tillage. So far the results are promising.

From a nutrient management perspective the benefits of triple cropping are obvious: If you increase crop yields you can legally and safely apply more manure nutrients to the farmland at the same time you reduce costs associated with buying off-farm feed.

Examples of common triple cropping rotations include corn-corn-winter forage, or corn-sorghum/sudan-winter forage. In some cases, multiple cuts from the sorghum/sudan can increase total harvested tonnage even further.

Conservation tillage saves time . . .

Conservation tillage (CT), a term that includes a range of reduced tillage techniques, can help growers reliably achieve these yield goals by eliminating two to four weeks of cultivation during the growing season.

According to Larry Beckstead of Western Farm Service in Merced in California, "Even though we had a rainy spring in 2005, we planted corn at four dairies in the Hilmar and Turlock areas by the first week of April, compared to the first week of May for the standard tillage fields. The savings in time we saw was in the range of three to four weeks."

Asgill and Hughes are Project Managers with Sustainable Conservation in San Francisco, Calif. Mitchell is a Vegetable Crops Specialist at the University of California, Davis.

The key to making this approach work is advancements made in CT technologies in the past few years. University of California, Davis researchers and the Conservation Tillage Workgroup, a diverse group of over 500 farmers, the Natural Resources Conservation Service, the private sector, and other public agency members, have been evaluating CT for corn and forage production since 1999. Private companies like Western Farm Services have been using CT equipment to grow corn for their clients for the last six or seven years.

In addition to the savings in production costs associated with reducing tillage, CT can also help with air permitting compliance. The number of California dairy producers trying CT has been steadily growing over the past few years.

Case studies:

#1: Oat and double corn rotation.

Andy Zylstra of Zylstra Dairy in Turlock, Calif., (milking 500 Holsteins) tried CT on eight acres in 2004. He saw no effect on yields with reduced tillage, so in 2005 he planted 76 acres using a CT triple cropping system with an oat and double corn rotation. Last March, oats were harvested early to accommodate the time needed for two corn crops, yielding six tons per acre.

After the oats were cut, Zylstra pre-irrigated the stubble and planted a 110-day Roundup-ready corn variety directly into it, which yielded 29 tons per acre at 70 percent moisture when it was chopped in July. He then immediately drilled a second corn planting into the corn stubble. His strategy was to gain the higher feed value from double cropping corn instead of going for a second crop of sudan grass or alfalfa.

As expected, the second crop had a longer maturity period due to declining heat units in the fall. Yield from the second corn crop was 15 tons per acre, which meant a total corn harvest of 44 tons and a grand total for the year of 50 tons per acre of all crops.

The increase in harvested tonnage has a significant impact on nitrogen uptake. According to the *Western Fertilizer Handbook*, about 8.3 pounds of nitrogen are removed in every ton of silage corn (at 70 percent moisture). Harvest removal by sudan grass is similar. U.C. researchers have found that depending on the stage of harvest, winter forages (oats, wheat, triticale, etc.)

can remove 10 to 14 pounds of nitrogen per harvested ton (also at 70 percent moisture), with the lower number typical for harvest at the "milk stage" of grain development.

Using this estimate at Zylstra Dairy, the second corn crop increased nitrogen uptake by 125 pounds per acre. As far as Zylstra is concerned, triple cropping in conjunction with CT has the potential to be a win-win situation for the California dairy industry.

"The more feed you get off, whether it be from corn, oats or sorghum-sudan, the more nitrogen you can take up and the more feed you have for your cows," he says.

#2: Wheat, corn, sorghum-sudan rotation.

Tom Barcellos of T-Bar Dairy in Tipton, Calif., (milking 750 Holsteins) has been using CT techniques for the past five years. In 2005 he put in a wheat-corn-sorghum/sudan rotation on 40 acres. In the spring of 2005 he chopped 15 tons of wheat at the boot stage and 31 tons of corn. He double chopped sorghum-sudan which yielded 11 tons per acre the first chop and seven tons the second cut. All crops were harvested close to 68 to 70 percent moisture. Total harvests in 2005 were 64 tons per acre.

According to Barcellos, "Under ideal situations, this works. But if you have any kind of rotation like alfalfa or oats that you want to grain or bale, the timing can get thrown off."

#3: Multiple harvests from sorghum-sudan with transition into triticale.

John Knutson of J&B Dairy, Modesto, Calif. (milking 650 crossbreeds) experimented in 2005 with multiple harvests from sorghum/sudan planted after harvesting triticale in the spring. The triticale harvest in April yielded 16 tons per acre, and four cuttings of sorghum/sudan planted in early May yielded close to 30 tons per acre.

Triticale was planted with a no-till drill into sorghum/sudan between the third and fourth harvests to try to get in two irrigations before water availability ended for the winter. One problem they did run into was maintaining furrows with multiple harvests.

"We had to do a lot of shovel work before irrigating," explains Knutson. But there was one major advantage – nitrogen removal. "We just took soil tests and I can't believe how much ni-

trogen the sorghum/sudan removed. I'd say that if you have a nitrogen problem, this should take care of it," he adds.

Marsha Campbell Mathews, U.C. Cooperative Extension Farm Advisor, says another option is to plant winter forage early and take a cutting off before the winter rain, although this can be risky if the rain comes early.

She suggests that the safest bet for ensuring adequate heat units for triple cropped rotations is to plant sorghum/sudan after corn, followed by winter forage.

Sudan rules of thumb . . .

However, there is one important rule of thumb, "Don't plant sudan grass after August 30th, and don't plant winter cereals before September 15th," she says. "Definitely do plant sorghum/sudan before August 15th if you can; you don't have enough heat units for sudan grass after August 30th and in most years results will likely be disappointing."

Ladi Asgill, an agricultural economist with Sustainable Conservation has been working with growers using double and triple cropped CT systems to evaluate the economic impacts of the practice. He found that a common characteristic of the more successful dairies trying CT is they had a good understanding of the total break-even tonnage required to cover costs and feed needs. Even though some dairies experienced a 30 percent or higher reduction in yields in the fall harvest, triple cropping often resulted in higher annual net returns.

Start out small . . .

While this year's triple cropping results are promising, both Barcellos and Zylstra caution that growers who are interested in CT should first try out the technique on a small plot.

Zylstra points out that the first eight acres he started with in 2004 hasn't been tilled since fall of 2003. "I haven't seen any problems yet, but if I do see them, they'll show up in the small field first," he explains.

Barcellos also recommends that growers start experimenting with CT on one or two small fields, "Something you have the time to manage, look at, and understand the process," he says. "You want to pay close attention to irrigation timing. If the crops look like they need water, it's already too late."

On one hand, Barcellos has noticed that CT crops take more management than standard tillage systems, but "because we aren't spending so much time on tractors or repairing equipment, our guys have more time to spend managing the crops," he adds. "We have found that with the CT system we are, in general, operating in a more timely fashion."

One question that often comes up for growers considering CT is how to overcome subsurface soil compaction. Dino Giacomazzi of Giacomazzi Dairy in Hanford, Calif.,

(milking 850 Holsteins) notes that reducing the total number of tractor passes also reduces compaction. Last year Giacomazzi used a strip tiller with a 16-inch shank and a sweep on the bottom to triple crop with a wheat-corn-sorghum/sudan rotation.

"With the strip tiller, we are shanking and tilling in one pass, so I don't expect to have any compaction problems," he says. In 2006, Giacomazzi will be working with Jeff Mitchell at U.C. Davis on field trials to evaluate several different types of strip tillage equipment.

Without throwing caution to the

wind, triple cropping with CT might be something for producers to consider – especially if you are worried about meeting new water board manure land application requirements.

According to Kristen Hughes, an agricultural engineer with Sustainable Conservation, "We've been working with researchers and the dairy industry to identify and evaluate manure management techniques that can help dairy producers utilize manure nutrients and comply with regulations cost-effectively. Triple cropping with CT is the one I recommend dairies try

first. Combining triple cropping with CT is the only strategy I know of that can, in theory, address numerous challenges currently faced by the dairy industry and increase profits at the same time."

Anyone who is interested in trying triple cropping and would like more information may contact Sustainable Conservation at 209-576-7729, or Jeff Mitchell at 559-646-6565. It is also worth noting that the Natural Resources Conservation Service can pay up to \$30 per acre for CT production to eligible growers who apply for EQIP cost-share funds. 