PFI 1999 On-Farm Research Results

The last year of the millennium is behind us, and how was it out on the land? Good for ducks, bad for bucks. You've heard it before, and we won't dwell on it here. In the face of it all, PFI cooperators hosted a record 33 field days and carried out research on an ever-widening range of questions. Two swine field days took place without the pigs, which had gone to town in response to continuing low hog prices. Yet in true Practical Farmers of Iowa style, cooperators shared their "learning experience" with others who might benefit from the lessons.

Ever creative, PFI cooperators continue to explore new markets, technologies and systems, and they're re-exploring some that have been around for a while. From sweet corn to swine, tillage to tofu, PFI members are exploring ways to save and to earn a little money – all while nurturing this rich resource that we call home. And as you the members take responsibility for your future, your organization will be there to help you make your way forward.

This year's on-farm research results include some old stand-bys like nitrogen rates and some new topics like parasite management and flame cultivation. Check *Reading Numbers* on the next page for tips on interpreting these results. Here is your opportunity to follow up on the work you saw at a field day or heard about from a neighbor. *This is "show time!"* The facts and figures are in this document, and the rest of the story is in the heads of the cooperators. Be sure to visit with them during the poster session.

Mulch Ado about Onions (and Potatoes)

It always pays to repeat the trial! In 1998 it looked so clear. **Angela and John Tedesco**, Johnston, looked at the effect of mulching the onions that go to feed members of Angela's Turtle Farm CSA. The experiment also examined the value of planting single onions or multiples in cell-packs of four at a time. In 1998 both mulching and multiple planting were winners – but that was then.

(Onions, continued on page 23.)

On-Farm Research Table of Contents

This on-farm research and demonstration program has been supported, in part, by Iowa State University Extension, the Leopold Center for Sustainable Agriculture, the Sustainable Agriculture Research and Education (SARE) program of the United States Department of Agriculture, and the Iowa Farm Bureau Federation.

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Reading Numbers, Knowing Terms

Valid and reliable farmer-generated information is a cornerstone of Practical Farmers of Iowa. Consequently, PFI has worked to develop practical methods that safeguard the accuracy and credibility of that information. PFI cooperators use methods that allow statistical analysis of their on-farm trials. Chief among these methods are: 1) "replication," and 2) "randomization." (See Figure 1., a typical PFI trial.) The farming practices compared in a trial are repeated, or "replicated," at least six times across the field. Thus trial results do not depend on a single comparison only, but on six or more. The order of the practices, or "treatments," in each pair is chosen with a flip of the coin. This "randomization" helps to avoid unintentional bias.

PFI on-farm trials have been recognized for their statistical reliability. So, while PFI cooperators don't have all the answers, they do have a *tool* for working toward those answers.

When you see the outcome of a PFI trial, you also see a statistical indication of the strength of the difference observed. The following information should help you to understand the reports of the trials contained in this report. The symbol "*" shows that there was a "statistically significant" difference between treatments; that is, one that likely did not occur just by chance. We require ourselves to be 95% sure before we declare a significant difference. If, instead of a "*," there is a "N.S.," you know the difference was "not significant" at the 95 percent confidence level.

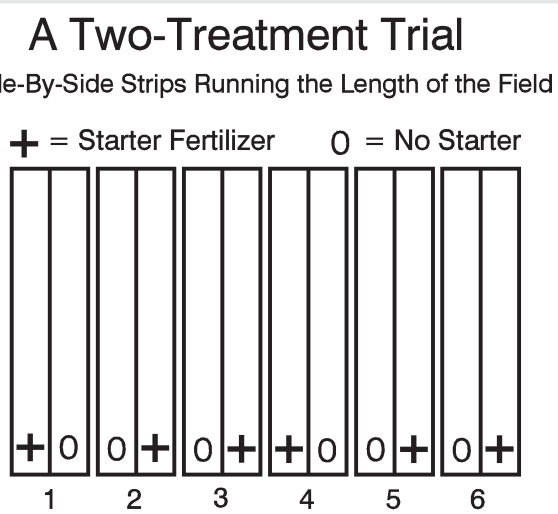

Figure 1. A typical two-treatment PFI trial with six replications.

"A/B" Comparisons Many on-farm trials are of a straightforward "A versus B" type. These trials, which are easy to design and analyze, correspond to the typical experimental question "Is alternative 'B' better than, worse than, or the same as my customary practice 'A'?" This approach can be used to evaluate individual practices or whole systems of practices.

There is a handy "yardstick" called the "LSD," or "least significant difference," that can be used in a trial with only two practices or treatments. If the difference between the two treatments is greater than the LSD, then the difference is significant. You will see in the tables that when the difference between two practices is, for example, 5 bushels (or minus 5 bushels, depending on the arithmetic), and the LSD is only, say, 3 bushels, then there is a "*" indicating a significant difference.

Multiple Treatment Trials The LSD doesn't work well in trials with more than two treatments. In those cases, letters are added to show whether treatments are statistically different from each other. (We use a statistical test called a multiple range grouping.) The highest yield or weed count in a trial will have a letter "*a*" beside it. A number with a "*b*" next to it is significantly different from one with an "*a*," but neither is statistically different from a result bearing an "*ab*." A third treatment might produce a number with a "*c*" (or it might not), and so on.

Economics Average 1999 statewide prices for inputs were assumed in calculating the economics of these trials. Average fixed and variable costs and time requirements were also used. These can vary greatly from farm to farm, of course. The calculations use 1999 prices of $1.65 per bushel for corn, $4.55 for soybeans, and $55 per ton for grass-clover hay in large bales. Labor was charged at $9.00 per hour.

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Some tables show both a "treatment cost" (which includes relevant costs, but not the total cost of production) and "treatment benefit." The treatment benefit is the relative advantage of a practice compared to a "check" or "control" treatment or customary practice, which is often assigned a treatment benefit of $0.

If there are no significant yield differences, treatment benefit is calculated solely from input costs. If the yield of a practice is significantly different from that of the control treatment, then that difference in bushels is also taken into account to calculate treatment benefit for the more profitable practice.

A treatment "benefit" that is a negative number indicates a relative loss. The highest-yielding practice doesn't always have the greatest treatment benefit. You will see that sometimes the additional input costs of a practice outweighs its greater gross return.

Here is one more thing to be aware of. Fertilizer shown with dashes between the numbers (18–46–0) means *percent* by weight of nitrogen, phosphate, and potash in the product. Fertilizer shown with plus signs (18+46+0) indicates *pounds per acre, per ton, or per 1,000 gallons* of those nutrients in an application.

The results that appear here imply neither endorsement nor condemnation of any particular product or practice. Producers are encouraged to carry out their own trials to find what works in their operations. In reports of trials that involve proprietary products, brand names are included for the purpose of information. ❦

(Onions, continued from page 21.)

This was a new year and also a new site. Angela is buying some gently sloping land on Highway 17 at Granger. She also got her onions off to a better start before planting them out in 1999. And then there was the spring and early summer weather, which you couldn't exactly call dry. So how about mulch in 1999? As Table 1 shows, the top yield of onions came from the *un*mulched plots where *single* onions had been planted! Overall, single-vs.-multiple planting was not a statistically significant

Table 1. Tedesco Onion Trial – Mulch and Planting Pattern 1999

FACTOR	LBS/ 100' BED	LBS/ ONION	% SURVIVAL	HRS LABOR/100'
MULTIPLE /MULCH	292.2 ab	0.25 a	96.1% a	3.29 c
MULTIPLE NO MULCH	322.4 ab	0.27 a	98.6% a	2.45 d
SINGLE/ MULCH	271.0 b	0.25 a	91.4% b	5.74 a
SINGLE/ NO MULCH	350.7 a	0.30 a	97.2% a	4.55 b

Table 2. Two Years of Tedesco Onion Trials – Multiple-Seedling Planting & Mulch

	LBS/100' BED		LBS/ONION		SURVIVAL %		HRS/100' BED	
	MULTIPLE	MULCH	MULTIPLE	MULCH	MULTIPLE	MULCH	MULTIPLE	MULCH
1998	+ **	+ **	+ **	+ **	+ **	NS	– **	NS
1999	NS	– *	NS	NS	+ *	– **	– **	+ **

* effect significant at 95% confidence level. ** effect significant at 99% confidence level.

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Table 3. Two-Treatment Nitrogen Rate Trials in Corn

	LOW RATE TRT			HIGH RATE TRT				
COOPERATOR	YIELD (bu)	N RATE (lbs N)	STALK NO_3-N	YIELD (bu)	N RATE (lbs)	STALK NO_3-N	RATE DIFF.	LSNT (ppm)
(AFTER SOYBEAN)								
HARVEY	171.4	120	2,820	170.3	200	4,775	80	—
LUBKE	153.8	38	53	160.1	70	58	32	15
SIEVERS	194.9	154	2,737	197.4	204	2,670	50	42

Anglea led an onion tour at the July field day.

factor in yields, but mulching definitely was (Table 2).

Mulching also had a negative effect on transplant survival, and it significantly increased the total labor in 1999. In 1998 the weeds were bad enough that mulching saved as much weeding time as it took to distribute the mulch. In 1999, the stronger transplants competed better with the weeds – and maybe there are fewer weeds at the new site. Mulching saved precious moisture in 1998, but there was plenty of moisture during most of 1999. So the word on mulching may be: know when to use it. On the other hand, planting multiple onions instead of singles did reduce the total labor hours in both years. And in the more stressful conditions of 1998, multiple planting also benefitted yields.

So the word on mulching may be: know when to use it.

Some on-farm research just doesn't work out, and that was never clearer than in the mulching experiment attempted by **Virginia and Marion Moser**, Garrison. Virginia tried mulching potatoes with coffee bean hulls, a local resource she can get from Frontier Herbs. Here is a portion of her report.

June 5th – Applied mulch. It blew away in the night.

June 6th – Tried application again and it was too windy.

June 19th – I applied it again and it blew away. At this point we were soon going to be digging the first potatoes to sell, so I didn't try it again. I learned that the coffee bean hulls can't be used for mulch. They are like working with chicken feathers... I'm not going to give up on the coffee bean hulls, partly because they are free, but mostly because of the 2% nitrogen. I would like to use them in compost.

Nitrogen

The PFI on-farm research program has seen a resurgence of nitrogen trials with the addition of cooperators associated with the Iowa Farm Bureau. Not that we got nitrogen all figured out with the first 70 replicated trials! Yes, the late spring soil nitrate test saved people over $6 per acre, and the fall stalk test now provides a good end-of-season snapshot of nitrogen status. But what do you do in a year like

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Two-Treatment Nitrogen Rate Trials in Corn

STALK N SIG.	YIELD DIFF.	YLD SIG.	YLD LSD	LOW RATE $ BENEFIT	GAL. DIESEL EQUIV.	COMMENT
*	1.1	NS	—	$15.94	19.1	SIDEDRESSING MAY HAVE CUT STAND, BUT NOT SIGNIFICANTLY
NS	–6.4	*	3.4	–$5.51	7.7	RECEIVED 9.8" RAIN IN JULY
NS	-2.5	NS	4.1	$14.27	11.9	ONLY THREE REPS OF STALK AND SOIL NITRATE

1999, where for most producers (stop gloating, northwest Iowa) it stopped raining just long enough to get the corn planted?

In 1999, **John and Joan Lubke**, of Ridgeway, worked with IFB rep Ron Fairchild to compare nitrogen rates for corn following soybeans. The late spring soil nitrate test was 15 ppm. The critical level of 25 ppm left John 10 ppm, or about 80 lbs fertilizer N short. He compared late-June sidedressings of 32 and 64 lbs of N as 28% UAN, so both rates fell short of what the late spring soil test suggested. As it turned out, 1999 was not the year to underestimate corn N requirements, at least not in northeast Iowa. In July Lubke recorded 9.8 inches of rain, and it is likely that additional nitrogen was leached out of the root zone. Even though yields were respectable, at the end of the growing season, stalk nitrate-N levels in both treatments were far below the 700-2,000 ppm optimum range (Table 3). John now wishes he had tried a higher nitrogen rate, and he hopes to do so in 2000.

At the other end of the sufficiency spectrum, **Brad and Chris Harvey**, Akron, fall-applied what he calculates as 120 lbs N in 5,000 gallons of liquid manure in the fall of 1998, then came back in 1999 and sidedressed an additional 80 lbs of N as 28% UAN in strips (Table 3). The fall stalk test showed both the low and high rate treatments to be well over the target range of 700-2,000 parts-per-million (ppm) nitrate-N. In fact the high N treatment measured nearly 4,800 ppm. This was a demonstration of "what not to do," and Brad hopes that his northwest Iowa neighbors will get the point and use their manure to best advantage.

Bryan and Lisa Sievers, New Liberty, sidedressed an additional 50 lbs of N as anhydrous ammonia on top of 154 lbs N from preplant and planting operations (Table 3). This was another demo of what not to do when your late spring soil nitrate test says 42 ppm (25 ppm is sufficient). The two-and-a-half bushel yield difference wasn't close to being statistically significant, but even if it were real, it wouldn't pay for the fertilizer and application.

Dave and Becky Struthers, Collins, bit the bullet and included a zero-N treatment in their 1999 nitrogen rate trial. Table 7 shows that there was no yield difference between 100 and 140 lbs N, which isn't surprising given the late-spring soil nitrate test of 27 ppm. The zero-N rate did average significantly

Dave Struthers compared two nitrogen rates in 1998, three in 1999.

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lower than the 100-lb and the 140-lb rates. But consider these yields from replications of the zero-N treatment: 80.0, 130.4, 147.4, 144.9, 108.5, 65.9. As you can see, the zero-N treatment did fine in the middle of the field. This is not revealed in the overall averages. Is this an argument for precision agriculture? Is there a more location-specific way to take the late spring soil nitrate test? Would it be economical? The truth is out there.

The zero-N treatment did fine in the middle of the field. This is not revealed in the overall averages.

Dennis Abbas describes his research at the August field day.

Other Fertility Research

Dennis and Eve Abbas, Hampton, carried out a trial that may not look like a fertility experiment. They compared two planting populations of corn, looking for effects on nitrogen sufficiency. This was the second year of the trial. Dennis figures that in

Table 4. Other Fertility Trials

COOPERATOR	CROP	TREATMENT "A"			TREATMENT "B"
		DESCRIPTION	YIELD (bu.)	TREATMENT COST	DESCRIPTION
ABBAS	CORN	25,000 FINAL POP	102.7	$16.80	20,000 FINAL POP
SELLERS	HAY	LYSINE BY-PRODUCT TO HAY FIELD	3.2 T	$73.02	NO FERTILIZATION
VALVICK	SOYBEAN	N & S SIDEDRESS SOYBEAN, VAR 272	32.1	$16.35	NO SIDEDRESSING
VALVICK	SOYBEAN	N & S SIDEDRESS SOYBEAN, VAR 210N	40.7	$16.35	NO SIDEDRESSING
WEIS	CORN	FALL DEEP 0+2+48	195.6	$37.45	NO FALL FERTILIZER
WILSON	CORN	COMPOST	175.8	$5.61	NO COMPOST

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their organic cropping system, nitrogen can be a limiting factor for corn. So he wonders if reducing the number of plants competing for that nitrogen might actually have the effect of improving each plant's N status – and therefore overall yields.

As Table 4 indicates, it didn't seem to work that way in 1999. Whereas in 1998 they at least saw higher leaf N at the low population, this year there was no difference in leaf nutrients. Stalk nitrate-N was close to zero for both population treatments, which wasn't an unusual result in PFI 1999 trials. The higher population actually would yield significantly better if rep 1 were eliminated from the analysis. As it is, the yield difference is nonsignificant, and the extra seed cost is the only economic difference. It may be that any nitrogen benefit from reduced population is offset by the greater number of ears at higher populations. But Dennis would like to see some more data before he draws final conclusions from this experiment.

Backed by switchgrass, John Sellers showed a watering system near to the fertility experiment.

John and Jean Sellers, Corydon, graze beef cows and sell hay. John is also active in the effort to make switchgrass a biofuel for southern Iowa. Sellers wants to make the best use of local resources,

Other Fertility Trials

TRT "B"		DIFFERENCE				COMMENT
YIELD (bu.)	TREAT-MENT COST	YIELD DIFF.	YLD LSD (bu.)	YLD SIG.	$ BENEFIT OF TRT "A"	
99.9	$13.20	2.9	5.6	NS	–$3.60	NO DIFFERENCE IN LEAF OR STALK N STATUS BETWEEN POPULATIONS. LOW STALK N
1.7	$5.29	1.5	1.6	NS	–$67.73	IF YIELD DIFFERENCE IS "REAL," YIELD BENEFIT EXCEEDS COST
31.5	$0.00	0.6	1.7	NS	–$16.35	FOLLOWING SOYBEANS. NO SIGNIFICANT DIFFERENCE IN LEAF N OR S
39.6	$0.00	1.1	7.1	NS	–$16.35	FOLLOWING CORN, SECOND VARIETY. ONLY 3 REPS. COMBINED TRIALS NOT SIGNIFICANT EITHER
189.3	$0.00	6.3	10.7	NS	–$37.45	FERTILIZER TRT HAD HIGHER LEAF K, LOWER LEAF Ca & Mg
171.9	$0.00	3.9	11.5	NS	–$5.61	NONSIGNIF. REDUCTIONS IN LEAF N, S, P, K WITH COMPOST. STALK NITRATE NONDETECTABLE IN BOTH TRTS

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Table 5. "A/B" Tillage Trials

COOPERATOR	CROP	TREATMENT "A"			TREATMENT "B"
		DESCRIPTION	YIELD (bu.)	TREATMENT COST	DESCRIPTION
LUBBEN	CORN	DEEP-RIPPED 3" CORN IN ALTERNATE ROWS	172.3	$4.14	CONTROL
WEIS	CORN	FALL PARAPLOW	175.6	$18.39	CONTROL

including a by-product of lysine production. This by-product is 107+7+7+7S per ton. John spiked it to 145+45+45+7S and applied it at the 1-ton rate in strips to a mixed grass-clover hay field (Table 4). The fertilized strips yielded nearly 90 percent more than the check treatment, although with only three replications in the experiment, it wasn't a difference that was statistically significant. As such, the input costs were pretty staggering. If you assume that the yield difference observed was in fact because of the application, then the yield benefit marginally outweighs cost by $10-$15. The test is encouraging. But to convince other producers to use this material, we may need to see how it works without the additional fertilizers that doubled the treatment cost in this trial.

Sellers wants to make the best use of local resources, including a by-product of lysine production.

Another alternative fertilizer use trial was carried out by **Arlyn and Annette Valvick**, of Swea City, but instead of putting an alternative fertilizer on a standard crop, they applied a standard fertilizer – nitrogen – to a crop that usually doesn't receive it – soybeans. Soybeans have a symbiotic relationship with *Rhizobium* bacteria that make atmospheric nitrogen available to the plant "in return for" sugars. However, Arlyn had read in the April, 1996 issue of *Soybean Digest* how some southern farmers were applying nitrogen and sulfur to soybeans in mid-season for a yield increase. On August 1, Arlyn soil-applied a mix of UAN and ammonium thiosulfate to two different soybean varieties, one following corn and the other following soybeans (Table 4). He saw no yield benefit at all in these two trials. With leaf tissue samples from only two replications, it is not possible to tell whether additional nitrogen and sulfur were getting into the plants. The developing soybean crop probably used the additional nutrients, but the fertilizer didn't increase the total amount of nutrients converted to grain.

Expect to see more trials with manure and compost in the year 2000, because several ISU scientists have a project that involves PFI. For 1999 we have just one trial to show you. **Colin and Carla Wilson** and **Dan and Lorna Wilson**, Paullina, repeated a trial with the composted bedding/manure from their swine facility. As in 1998, there

Arlyn Valvick showed the soybean fertility plots at the late August field day.

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"A/B" Tillage Trials

TRT "B"		DIFFERENCE				COMMENT
YIELD (bu.)	TREAT-MENT COST	YIELD DIFF.	YLD LSD (bu.)	YLD SIG.	$ BENEFIT OF TRT "A"	
170.9	$0.00	1.5	6.6	NS	($4.14)	RIPPED 10" DEEP
183.4	$6.51	-7.8	9.8	NS	($11.88)	NO LEAF NUTRIENT DIFFERENCES, BUT PARAPLOW TRT .5% MOISTER

Ag engineer Tom Richard probes a PFI compost pile. Tom will be probing more piles in a Leopold-funded project.

was no yield difference between the corn that received compost (nearly 7 tons) and the corn that did not (Table 4). (Both treatments received 40 lbs of nitrogen before planting.) As in 1998, stalk tests at the end of the season suggested the crop ran out of nitrogen in both treatments. In 1999 mid-season leaf samples suggested that tissue levels of N, P, K, and S might actually be lower in compost-treated corn. So how composted *was* this material? It had not been turned, and basically just sat in a windrow for a year. Did it pull nutrients "out" of the soil to complete its breakdown after application? PFI trials in 2000 will help shed light on these questions.

Steve and June Weis, Osage, had potassium on their minds in 1999, and they approached the topic with two kinds of trials. Steve tried a fall deep-band application of 0+2+48 before corn (Table 4). The application did result in significantly more potassium in the mid-season leaf samples, although K levels in both treatments would be considered adequate. Given the fairly large LSD of this trial, the 6.3-bushel yield difference between treatments isn't close to being statistically significant. If it were, it still wouldn't have paid for the fertilizer and application.

Steve and June also tried to get at nutrient sufficiency in an indirect fashion by examining the effect of tillage on potassium uptake. See below for those trial results.

Tillage

Steve and June Weis' interest in potassium was described above. In addition to trying deep-banded K, Steve looked for a tillage effect on potassium absorption. Richard Thompson, Boone, believes that moldboard plowing once in his five-year rotation helps yields by allowing plants to take up potassium better. The tillage that Steve exam-

(Fertility trials, continued on page 32.)

The tillage that Steve examined was the paraplow, a horizontal blade that he pulled through the soil at a depth of 20 inches be-

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CSA Farm Economic Analysis

Farm: One Step at a Time Gardens, 1465 120th St., Kanawha, IA 50447

Farmers: Jan Libbey & Tim, Andrew, and Jessica Landgraf, One Step at a Time Gardens

Year: 1999

Tool: Standardized Analysis of Farming Economic Benefits †

developed by David Washburn of Red Cardinal Farm, Stillwater, MN

Washburns' tool involves using eight "economic facts" to generate 11 "economic ratios". A selection of these figures is provided along with what we think they mean

Goal of economic analysis project: evaluate the economic condition of our direct marketing operation.

In this **first season,** we

· established a record-keeping format that is fairly easy to use, covers appropriate categories and is transferable to other farms

· used a series of economic ratios developed by David Washburn of Red Cardinal Farm in Stillwater, MN

· will follow the number analysis with subjective evaluation of the results and identify specific changes to implement in the next season.

Labor records (hours/task):

· Daily work log for field records

· Permanent logs - field records transferred daily, maintained in central notebook

  · general categories

  · crop specific categories

· Hired help maintains daily records in separate notebook

(Field records are transferred to a basic spreadsheet for calculations and analysis.)

Financial records:

· A basic spreadsheet form to keep track of income and expenses

In a **subsequent season**, we would like to

· repeat the data collection

· compare results between several farms

Jan Libbey discussed cropping analysis as part of the last PFI field day of the season.

1999 Findings:

We have compared data from, our farm, One Step at a Time Gardens (OSTG), with the same from Spring Hill Farm (SHF) and Common Harvest (CH). The data for the SHF and CH was provided at a workshop

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† David has developed this tool so farms have a standardized measure of their financial health. He has copyrighted this tool and requests that copyright be honored. If you are interested in running your farm numbers through this tool, he would like you to consider sharing your data with him to be used as part of an expanded study he is doing with the Minnesota Department of Agriculture.

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session in February where we were first introduced to Washburn's analysis tool. Do note the following:

CSA share scale differs - As of 1997, SHF - 85 shares and CH - 171 CSA shares.
In 1999, OSTG - 21 shares.
Experience differs - SHF and CH have been in operation for between 7 and 10 years.
1999 was OSTG's 4th CSA season.

Initial observations

The use of the ratios allows common ground for comparing the different farming operations.

The labor being used at One Step at a Time Garden, the total dollar income off the operation, and the payroll expense to gross farm income is consistent with data for SHF and CH.

Ratios	OSTG	SHF	CH
Gross Income to # Acres Farmed	$10,808	$13,714	$10,429
Total Person-Days to # of Acres Farmed	99.8	114.3	82.6
Payroll Expense to Gross Farm Income	13.5%	14.0%	12.5%

We have observed that there are greater efficiencies to be gained through increase in scale and maturity. Comparison between the three farms on farmer income/# acres farmed, net farm income to gross income, and farmer income to length of farm season indicate striking differences between the farms. Our past four years of farm records indicates that as size increases, the cost per share decreases. Comparison with SHF and CH, both larger and more mature, may support this observation.

Ratios	OSTG	SHF	CH
Farmer income to # acres farmed	$2,145	$7,429	$5,286
Net farm income to gross farm income	36%	68%	68%
Farmer income to length of farm season	$4,853	$32,190	$45,810

Washburn compares Payroll Expense + Farmer Income to Gross Farm Income (GFI) as one measure of sustainability. The comparison between the three farms indicates that we have a lot of room for improvement. Increased sustainability is one of the goals of our operation. The records we've kept will be used to target improvements for the 2000 season.

Ratio	OSTG	SHF	CH
Payroll expense + farmer income to GFI	33.5%	68.1%	63.2%

So what?

This is still a relatively new tool that's been used on approximately 5 farms. As such, there is little in the way of benchmarks at this point. The presentation of information from the two larger, more experienced farms and OSTG offers some insight. However, this information may prove even more helpful as successive seasons of records allow us to develop our own benchmarks and track the impact of decisions we make. It is also a tool for farm-to-farm support and problem solving.

One final comment

The process of record keeping involved with this analysis serves as a powerful awareness tool for reviewing the operation's efficiencies and profitability and we recommend it to others farms. ❦

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(Fertility trials, continued from page 29.)

ined was the paraplow, a horizontal blade that he pulled through the soil at a depth of 20 inches beneath the ridges in the fall of 1998. Maybe 1999 wasn't the year for the paraplow. Steve feels the plowed plots didn't take in precipitation well, leading to problems when the weather turned dry in late summer. For whatever reason, paraplowed yields trended lower, although the difference was not statistically significant (Table 5). As for the potassium hypothesis, leaf tissue showed no differences in nutrient concentrations.

David and Lisa Lubben, Monticello, also examined deep tillage. Dave pulled a shank ten inches deep through alternating inter-rows when corn was three inches tall (Table 5). There was no statistically significant difference in crop yields due to the spring ripping.

Fertility Paradigms

Readers of the PFI newsletter may remember that in 1998 the organization received a grant from the USDA SARE program to evaluate "fertility paradigms." Paradigms are ways of looking at the world, constructions that we put on reality to make sense of it. There are two important ways of looking at soil fertility, which can be characterized as the "sufficiency" paradigm and the "ratio" paradigm. The sufficiency perspective looks at a soil sample and asks "is there enough" of available crop nutrients. The ratio approach looks at the cation (positively charged) nutrients attracted to the (negatively

Paradigms are ways of looking at the world, constructions that we put on reality to make sense of it.

Table 6. Fertility Paradigm Trials

COOPERATOR	CROP	TREATMENT "A"			TREATMENT "B"
		DESCRIPTION	YIELD (bu.)	TREATMENT COST	DESCRIPTION
ALERT	SOYBEANS	18-46-0, GYPSUM, ZINC	—	$32.60	18-46-0
ARMSTRONG	CORN	18-46-0, GYPSUM, ZINC	121.2	$48.66	18-46-0
BRUNER	CORN	18-46-0, 0-0-60, ZINC	152.4	$35.80	18-46-0
DORSHEIMER	CORN	GYPSUM, ZINC	133.6	$24.66	NOTHING
HENNINGS	OATS	ROCK PHOSPHATE, CALCITIC LIME, ZINC	—	$102.58	ROCK PHOSPHATE, DOLOMITIC LIME
LUBBEN	SOYBEANS	0-0-60, CALCITIC LIME	63.0	$88.54	0-0-60, DOLOMITIC LIME
MUGGE	CORN	CALCITIC LIME	172.0	$48.07	NOTHING
NEW MELLERAY	CORN	ROCK PHOSPHATE, ZINC	168.9	$25.60	ROCK PHOSPHATE
AVERAGE				$50.81	

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charged) soil cation exchange (clay minerals and organic matter) and asks "are they in the appropriate proportions" for optimum crop growth. There has not been much communication between the two schools of thought, with universities taking the sufficiency approach and some crop consultants and testing laboratories espousing the ratio approach. Farmers are left to make their own decisions when it comes to soil amendments, and the related expenditures can be great.

Farmers are left to make their own decisions when it comes to soil amendments, and the related expenditures can be great.

This project compares the ratio and sufficiency approach in side-by-side strips on six farms and two ISU experiment farms. Several producers from the Organic Crop Improvement Association (OCIA) are also cooperating in the study, as are ISU organic specialist Kathleen Delate and National Soil Tilth Lab scientist Doug Karlen. Crop consultant Keith Cuvelier is also a partner in the project, providing ratio-based recommendations.

In the first year of the effort, no significant differences appeared in crop yields (Table 6). Input costs are shown in the table, but neither yields nor costs should be taken too seriously after one year. Soil fertility is not necessarily a "one shot deal"; it will take several growing seasons for any long term effects to become evident and for input costs to be amortized. Thanks in part to the Tilth Lab, quite a number of soil and crop quality components are being examined. These also may take some years to develop patterns. Expect to see more of these trials in 2000.

Fertility Paradigm Trials

TRT "B"		DIFFERENCE				
YIELD (bu.)	TREAT-MENT COST	YIELD DIFF.	YLD LSD (bu.)	YLD SIG.	$ BENEFIT OF TRT "A"	COMMENT
—	$12.57	—	—	—		BROADLEAF WEED BIOMASS LESS IN RATIO TRT
119.6	$10.12	1.6	13.3	NS		HIGHER GRAIN CRUDE PROTEIN IN RATIO TRT
152.0	$25.13	0.4	20.3	NS		
133.4	$0.00	0.2	5.8	NS		
—	$96.19	—	—	—		
62.0	$38.92	1.0	1.3	NS		
171.3	$0.00	0.7	4.0	NS		
165.3	$22.15	3.6	12.4	NS		
	$25.64					

(Trials continued on page 38.)

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Alternative Parasite Control in Dairy Goats, An On-going Study

Frances Zacharakis-Jutz, Blazing Stars 4-H Club, Solon IA

(Editors' note: These reports from Frances Zacharakis-Jutz and her mother, PFI board member Susan, are reproduced here at some length. That's because this on-farm research is the first of many PFI trials with alternative worming practices, and we want members to have some idea what the issues are and how this research can work.)

Introduction

When I was five years old we got our first dairy goat. As soon as I was old enough, I started showing goats in 4-H shows. Three years ago we started a goat dairy. Now we have 47 milking does and 35 kids. We also have 50 ewes, 75 lambs and 30 pigs, all of which we are trying to raise organically. Because, at this time, organic standards do not allow the use of chemical wormers, we are always looking for alternative ways to deal with parasites.

At the beginning of this year my mom and I decided to do a research study on alternative wormers with Practical Farmers of Iowa (PFI). Our plan is to make this an on-going research project until we have found an herbal wormer that works and is reasonably easy to give to the animals.

Parasite Cycle

It is normal in nature to find internal parasites in animals and humans. However, internal parasites (worms) can be very destructive, especially in young animals. Worms can affect growth, development and performance. Worms can also cause tremendous economic loss, poor health, discomfort, and sometimes death.

Under most conditions it is impossible to have a worm-free herd, so it is important to have a program that reduces worms to a safe level in your animals. A healthy diet, a clean environment, an understanding of the parasite cycle, and the monitoring of internal parasites through regular fecal sampling are important factors in developing a good internal parasite management program.

There are several different kinds of internal parasites in ruminants. Nematodes and Cestodes are two of the major internal parasite classes. A third is the Flukes, which can cause serious damage. However, they are more commonly seen in areas with high snail population levels. The most common kind of parasite egg we found in our study was that of the Haemonchus Nematodes (roundworms).

Treatments

Most wormers are designed to decrease the amount of eggs in the animal by killing the adult worm and/or killing the eggs. Reducing the level of eggs will reduce the level of re-infection and therefore reduce the worm level in your animal. Before the use of synthetic wormers became a common practice, many types of plants were used. Some of those most frequently mentioned in books on herbs are garlic, wormwood, tansy and tobacco. These have been used individually and in herbal mixtures. There are also homeopathic preparations available, which are made from plants as well.

A healthy diet, a clean environment, an understanding of the parasite cycle, and the monitoring of internal parasites through regular fecal sampling are important.

When we began to look for alternative wormers, we found that there are several commercial, "natural" wormers for goats and sheep available through various catalogs and web sites. However, we found that many of these herbal mixtures have not been tested in a reliable way. The companies could tell us about people with small numbers of animals who reported that a certain brand of "natural" wormer had worked for them, but we were unable to locate any comparison studies done with commercial dairy goat herds or flocks of sheep over 50 ewes.

We decided to use a liquid herbal mixture of black walnut, cloves, Echinacea, hyssop, and wormwood along with a vitamin and mineral extract

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Frances Zacharakis-Jutz prepares a fecal sample for egg examination while her mother Susan chats at the field day.

developed by Groff Brothers Farm, in Pennsylvania. Although they had not researched the use of the herbal wormer on goats, they had a study in progress using it with horses, and some neighboring farmers were reportedly using it successfully with their dairy herds.

For the chemical wormer we needed something that is approved for use in dairy animals. There are only two – Panacur and Ivomec Pour-On (Eprinex). We decided to use Panacur, since we had used it successfully in the past.

I decided that I would collect the fecal samples, and Dr. Allan Beyer, at the West Branch Animal Clinic, agreed to read the samples for us. In each case, the individual fecal sample was collected fresh from the goat, sealed in a plastic Ziplock snack bag, and refrigerated until delivery to the vet the next morning.

On April 22, we took composite fecals on each group of milking does and on the penned group of sheep. The milking does in the big barn were positive for roundworms, so we decided to do the study with the older does in our big barn rather than the younger does, which continued to sample negative for worm eggs. Originally when we designed our study we had planned to use a control group (no wormer), but once we saw the level of eggs present in some of our does we decided we could not take the risk of compromising their health. The composite fecal on the ewes showed a high positive for worms, and we decided to withdraw them from the study because we were not confident we could monitor their health as closely as we could that of the does.

From the does in the big barn we randomly selected 12 individuals and took a fecal from each on April 29. We split this group of does in half and treated one group of six with the herbal wormer from Groff Brothers Farm and the other group of six with Panacur. The does were weighed individually and treated according to the following recommended dosage level:

Herbal wormer – 30cc for a 175# doe once daily for 10 days

Chemical wormer – 7cc for a 175# doe one time (1cc/25#)

All the does were given the prescribed dose of wormer on the morning of April 30th. The does in the herbal wormer group continued to receive their appropriate daily dose each morning for ten consecutive days. All the does in this study lived in the same pen and received the same feed and hay ration. They were milked twice daily.

Results

On May 20, fecal samples were collected from each of the 12 does. Much to everyone's surprise, ours and our vet's, all 12 does had a significant number of worm eggs present in their feces. Overall, the herbal does showed slightly fewer worm eggs than the chemical does (a nonsignificant difference, Figure 2).

Because we were concerned about the health of these does, we decided to do another herbal-vs.-chemical comparison, but this time we would use Ivomec Pour-on as our chemical wormer. We did not take additional pre-test fecals before this second trial. Instead we used the post-test fecals taken May 20. The does were weighed on the morning of May 27 and dosed according to the following recommended dosage level.

Herbal wormer – 30cc for a 175# doe once daily for 10 days

Chemical wormer – 8cc for a 175# doe once (1cc/22#)

(Parasites, continued on next page.)

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(Parasites, continued from previous page.)

The does in the herbal wormer group continued to receive their appropriate daily dose each morning for ten consecutive days.

A post-test fecal sample was taken on June 17. This time there was a significant difference between the number of eggs found in the herbal group and in the chemical group (Figure 2). Five of the six does in the chemical group showed a reduction in eggs, while four of the six does in the herbal group had an increase in the number of eggs found. One of the does in the chemical group that showed a 4+ on the post-test following the Panacur chemical wormer trial was treated with Ivomec but died soon after that, probably due to worms.

Conclusion, First Trial

In the first comparison using Groff Brothers herbal wormer and Panacur as the chemical wormer, the herbal wormer group showed a slightly lower number of eggs than the chemical wormer group. However, neither was effective in reducing the parasite egg load to a level that we considered acceptable.

In the second comparison using the Groff Brothers herbal wormer and Ivomec, the chemical wormer group showed a significant reduction in the number of eggs while the herbal group remained the same or in some cases got worse.

From this study we have concluded that the Groff Brothers wormer was not effective in reducing the parasite egg load in our milking does to an acceptable level. We will continue to try other herbal wormers as well as looking at other alternative parasite control methods.

Second Wormer Trial

Susan Zacharakis-Jutz, Solon

After reviewing the results the results of the fecals from Study # 1, we decided to try another herbal worming product, which the seller said was designed specifically for goats and sheep. The name of the product is Restore and Sustain, produced by Farmstead Health Supply, P.O. Box 985, Hillboro, N.C. 27278. Product ingredients are as follows.

Restore: Wormwood, garlic, gentian, fennel, psyllium, centaury. "…a pure, botanical anthelmintic compound…"

Sustain: Coltsfoot, coriander seed, fennel seed, Irish moss, juniper berry, yarrow herb, rosehips, rhubarb root, sea kelp. "…a rich botanical supplement for livestock that is used along with Restore to build resistance to parasites and promote enhanced overall health."

We used a procedure similar to the one used in Study # 1. We were able to use the same six does for the herbal alternative but had to substitute 2 does in the chemical group because two of the does we had used previously had been sold. For this study we decided that Frances would read the samples at home and randomly select several samples to take to Dr. Beyer to cross check for accuracy.

Pre-test samples were collected and read on the twelve does on September 7, 1999. The six does in the chemical group were treated with Ivomec Pour-on for the chemical wormer and the six does in the

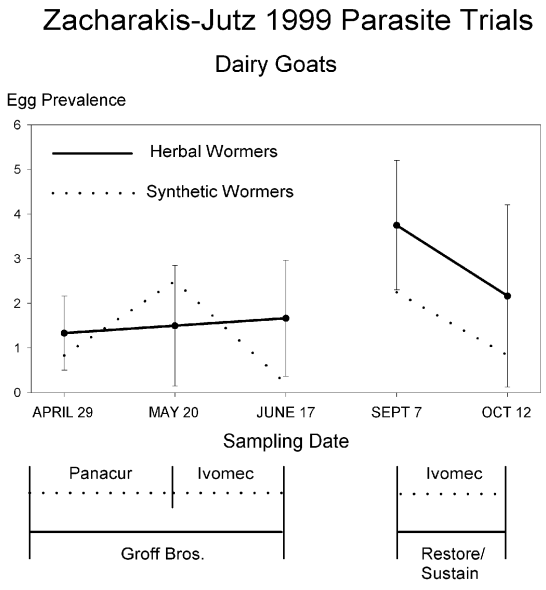

Figure 2. Infestation levels and treatments over the course of the experiments. Vertical bars show LSDs at each date.

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herbal group were treated with Restore and Sustain from Farmstead Health Supply. They were dosed according to the following recommended dosage level.

Chemical wormer – 8cc for a 175# doe once (1cc/ 22#)

Herbal wormer – 1 T. of Restore and 1 T. of Sustain for each worming. To be fed AM and PM for 10 days and then weekly throughout the year.

All the does were given the prescribed dose of wormer on September 9. The does in the herbal group continued to receive their appropriate daily dose AM and PM for ten consecutive days and then weekly beginning September 26. We initially tried feeding the powdered wormer to them in their feed, but when they refused to eat their feed we began mixing it with water and administered the wormer as a drench for the 20 recommended doses. As indicated, these does all live in the same pen, receive the same feed and hay ration, and are milked twice daily.

Results – Study # 2

On October 12, fecal samples were collected and read from each of the twelve does. Four of the six does in the herbal group showed a reduction in the number of eggs in their fecals, with two of them showing a marked reduction in egg count. The other two showed no change in the number of eggs in their fecals. Five of the six does in the chemical group showed a reduction in egg count, with four of them showing a significant decrease. One doe's fecal egg count went from a moderate to a high level in this group.

Conclusion – Study # 2

In this comparison using Farmstead Health Supply's Restore and Sustain as the herbal wormer and Ivomec pour-on as the chemical wormer, the chemical wormer showed a marked reduction in fecal egg count in four of the six does, while the herbal wormer showed a marked reduction in egg count in two of the six does and a slight reduction in egg count in one doe, although the chemical and natural groups were starting from different infection levels. From this study we have concluded that this herbal wormer may have potential, and we intend to use it in another trial, probably augmented with another herbal product from the same company. ❦

Frances and Reuben Zacharakis-Jutz at milking time.

A Vet Responds

ISU veterinary parasitologist Julie Jarvinen is a resource in PFI's parasite research. Julie was very impressed with the goat trials but had these comments for improving future trials:

1) There were no untreated control groups to monitor natural changes in parasite populations unrelated to the treatments, and having them might not be as dangerous as you'd think (see #4).

2) There needed to be a sample at 7-10 days (possibly 14 days) post-treatment because the life cycle of the parasites can be completed within 21 days. Because the samples were obtained from 21 to 33 days after treatment, even though treatment might have been effective, you would be unable to tell because the goats could have acquired new infections by eating larval stages in the environment, and these larvae would have matured to egg-laying adults before post-treatment samples were taken.

3) Reinfection might have been harder on the Panacur-treated group than the herbal group if the latter animals never lost resistance to the parasites. (This resistance is called premunition.)

4) Sampling a control group at 7-10 days, you could find out if parasites were getting out of hand and treat if necessary.

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Table 7. Multiple-Treatment Variety and Planting Trials

				TREATMENT "A"				
COOPERATOR	CROP	PREVIOUS CROP	YIELD SIGNIFI-CANCE	DESCRIPTION	YIELD (bu. or T)	STAT.	TRT COSTS	$ BENEFIT
DORDT COLLEGE	CORN	SOYBEANS	*	NK 44640	168.5	b	$44.09	$0.00
DORDT COLLEGE	SOY-BEANS	CORN	*	ASGROW 2247	56.8	a	—	
				IA1009	56.1	ab	~$18.70	
STRUTHERS	CORN	CORN	*	0 NITROGEN	112.9	b	$0.00	
WILCOX	CORN	SOYBEANS	NS	GARST 8600IT	190.7	a	$29.39	$0.00

(Trials, continued from page 33.)

Variety and Planting Trials

The **Dordt College Agricultural Stewardship Center** continued in 1999 its comparison of three kinds of corn hybrid: a well-known commercial hybrid, its Bt-gene cousin, and an inexpensive hybrid from a local seed company (Table 7). The exact hybrids have changed over time, but the variety types have remained the same. In the first year, the local hybrid yielded more poorly than the other two. In 1998, the local hybrid outyielded the hybrids from the better-known company. As Table 7 shows, 1999 was a repeat of the previous year. The local number needed a bit more drying than the other two hybrids, but its greater yield and cheaper price made it the financial winner. A picture is emerging: if you choose carefully, you can find value in local seed.

Dordt College students hear from Ron Stertler (right, with clipboard) about custom processing specialty varieties.

A picture is emerging: if you choose carefully, you can find value in local seed.

Responding to rising interest in specialty markets, the Dordt Stewardship Center also evaluated a number of light-hilum, food-type soybeans. The Asgrow number yielded the best of the six varieties (Table 7). For a producer marketing food-type soybeans, economics of these varieties would depend not only on their yields and seed costs, but also on the preferences of the buyer. Until now, many buyers of beans for the Japanese tofu market have preferred Vinton-81. That presents a quandary for growers, since Vinton yields do not measure up to modern varieties (as in this trial). That's just another

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Multiple Treatment Variety and Planting Trials

TREATMENT "B"					TREATMENT "C"					
DESCRIPTION	YIELD (bu. or T)	STAT.	TRT COSTS	$ BENEFIT	DESCRIPTION	YIELD (bu. or T)	STAT.	TRT COSTS	$ BENEFIT	OVERALL COMMENTS
NK 4640Bt	169.4	b	$55.54	($11.46)	VIKING 4921	180.1	a	$37.38	$25.86	LOCAL HYBRID > NK HYBRID > NK Bt HYBRID. LOCAL HYBRID NEEDED DRYING
VINTON 81	50.6	b	$22.94		IA1008	55.9	ab	~$22.00		
IA2016	54.4	ab	26.51		IA2034	51.3	ab	$22.66		
100 LBS N	137.4	a	$16.92		140 LBS N	138.7	a	$21.80		AVG. STALK NITRATE ADEQUATE IN ZERO-N, BUT 2 REPS YIELDED POORLY
GARST 8550	205.8	a	$29.39	$0.00	ALTERNATE ROW MIX	198.8	a	$29.39	$0.00	HYBRIDS TASSELED WITHIN 1-2 DAYS. 8550 FLEXED WITH LATE-SEASON RAIN

reason to make sales arrangements before the crop is planted.

Gary and Venita Wilcox, Correctionville, were, like Arlyn Valvick, stimulated by a magazine article – one in the John Deere *Furrow* describing how Minnesota farmers increased their corn yields by mixing hybrids in the field. The scientist who was involved with that work is Dr. Mark Westgate, and he is now at Iowa State University. As Mark explained to the field day audience, cross-pollination can lead to a yield increase of 5-8 bushels under the right conditions. It is important to find combinations of hybrids that do not share any inbred parent lines. In Minnesota, the farmers Westgate worked with tried many combinations of hybrids.

Mark Westgate traveled to the Wilcox field day to explain the cross-pollination effect.

Naturally seed companies do not readily share information about hybrid parent lines. Gary worked with Garst dealer Gary Manker to choose two appropriate hybrids, 8600-IT and 8550. Wilcox seeded the two hybrids in separate strips and in strips of alternating rows of the two hybrids. He reports that these two hybrids seemed to tassel within a day or two.

How did the trial turn out? Well, we will have to wait at least another year to see the yield boost Minnesota farmers found. The yield of the hybrid

... cross-pollination can lead to a yield increase of 5-8 bushels under the right conditions. It is important to find combinations of hybrids that do not share any inbred parent lines.

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Table 8. IPM and Seed Trials

COOPERATOR	CROP	TREATMENT "A"			TREATMENT "B"
		DESCRIPTION	YIELD (bu.)	TREATMENT COST	DESCRIPTION
GUTHRIE	SENECA DAYBREAK, SWEETCORN	OIL/Bt TREATED EARS	7,650	$798.84	NOT TREATED
GUTHRIE	BODACEOUS, SWEETCORN	OIL/Bt TREATED EARS	13,996	$798.84	NOT TREATED
GUTHRIE	INCREDIBLE, SWEETCORN	OIL/Bt TREATED EARS	16,800	$798.84	NOT TREATED
GUTHRIE	TENDER TREAT, SWEETCORN	OIL/Bt TREATED EARS	17,400	$798.84	NOT TREATED
NEELY-KINYON	CORN	TREATED SEED	117.0	$69.61	UNTREATED SEED
ROSMANN	CORN	TREATED SEED	99.7	$39.94	UNTREATED SEED
SPECHT	CORN	OP-NOKOMIS GOLD	98.2		FONTANELLE 1493

mix was almost exactly halfway between that of the two individual hybrids (Table 7). Although it's hard to pinpoint the problem in this trial, Mark Westgate is interested in working with more farmers to get information on silking times for hybrids. That knowledge could lead to future trials.

IPM and Seed Trials

Gary and Nancy Guthrie, Nevada, raise vegetables for their own CSA (community supported agriculture), Growing Harmony Farm. As the son of a corn entomologist, Gary keeps a particular eye on challenges from the insect world. In their organic operation, the Guthries look for cultural and biological solutions to these problems, so when Gary read about an biological remedy for corn earworm, an on-farm trial was born. Gary writes:

In 1998 I treated two varieties, Bodacious and Incredible using a mixture of vegetable oil and Btk (three teaspoons/quart oil). I discovered then that applying a small squirt of the treatment at full brush stage of the silk just as the silk was turning brown could be effective in controlling corn ear worm damage. In Bodacious the treatment dropped damage from 47% to 15%, but

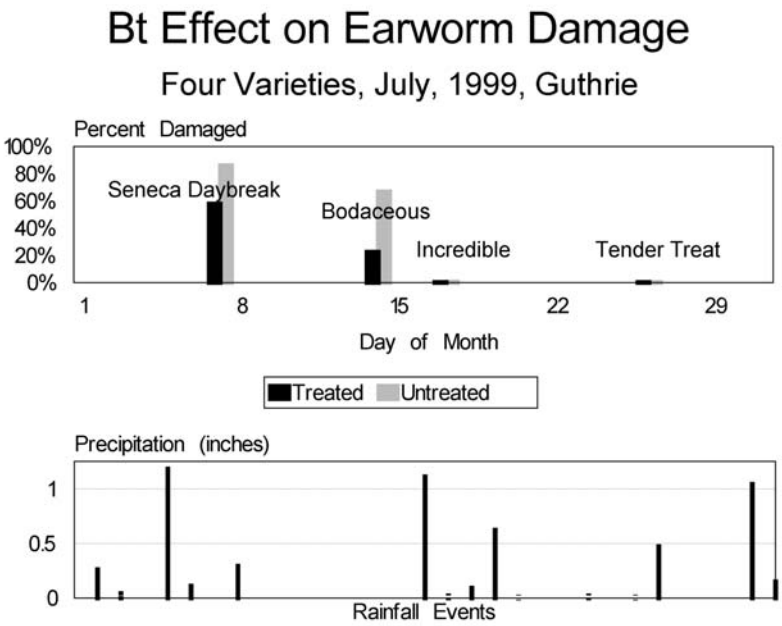

Figure 3. Growing Harmony Farm 1999 earworm trials.

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IPM and Variety Trials

TRT "B"		DIFFERENCE				COMMENT
YIELD (bu.)	TREAT-MENT COST	YIELD DIFF.	YLD LSD (bu.)	YLD SIG.	$ BENEFIT OF TRT "A"	
2,550	$0.00	5,100	8,250	NS	($798.84)	$476 Bt BENEFIT IF YIELD DIFF WERE SIGNIFICANT
6,037	$0.00	7,959	3,641	*	$1,190.94	YIELDS IN UNDAMAGED EARS PER ACRE. ECONOMICS BASED ON UNDAMAGED EARS.
12,450	$0.00	4,350	2,019	*	$288.66	
17,550	$0.00	(150)	1,104	NS	($836.34)	
127.3	$61.75	-10.3	13.1	NS	($7.86)	$ DIFFERENCE FROM 2.7% MOISTURE DIFFERENCE
103.1	$39.94	-3.4	9.0	NS	$0.00	1-3,000 HIGHER POP W. TREATED, PLANTED 5/14
160.7		-62.5	7.2	*		PLANTED 6/3 AT 27,800. WEEDY

there was virtually no corn ear worm infestation in Incredible.

In 1999, I wanted to follow up last year's experiment with a broader experiment treating four varieties. On May 1st, Seneca Daybreak (65 days), Bodacious (75), Incredible (85), and Tender Treat (95) were planted at a population of 25,000 plants/acre.

Gary demonstrates how he applies the oil-Bt mix to sweetcorn silks.

"I wonder if it might be worthwhile to treat the first several varieties and not the last one or even two, depending upon what

Table 8 and Figure 3 show the yield of undamaged ears (on a per-acre basis) for treated and untreated corn of the four varieties. By the way, Gary suspects that his Bt wasn't the freshest at the first treatment date. Besides the effectiveness of the oil-Bt treatment, weather, the natural cycle of the insect, and the physiology of the varieties all play a part in earworm infestations. Although every year is different, experience will show which vanities and

(Earworm and Bt, continued on page 44.)

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Cropping Systems

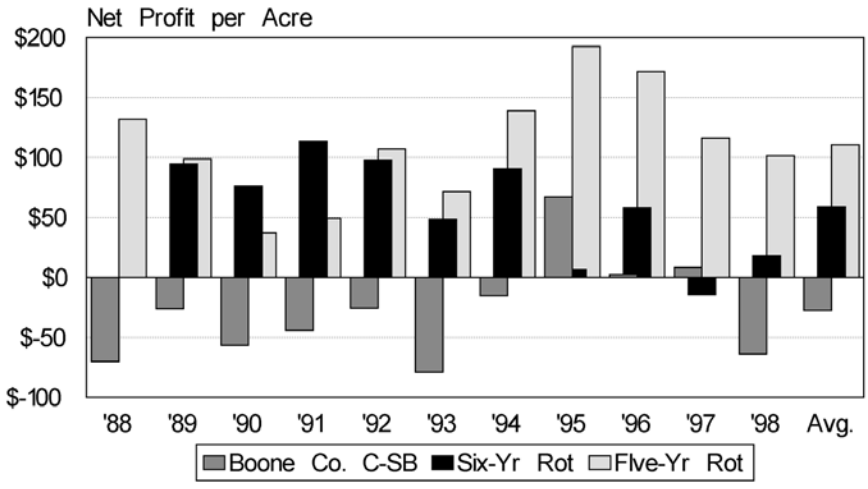
Jeff Klinge and Deb Tidwell, Farmersburg, have documented the economics of cropping as they transitioned to organic production. Jeff's reports have appeared in these PFI annual publications, but in the past the "conventional" comparison came from his own farm. As he writes below, that was not possible for this soybean comparison. The figures in Table 9 come from 1998 because he didn't sell the crop until recently. Jeff writes:

1998 was the first year that I ever grew soybeans. To do it organically made it more of a challenge. Despite problems with black nightshade and a 10% hail loss, things turned out quite well. I compared my organic soybeans to a neighboring farmer's conventional beans because I do not have any conventional crops. I based this information on actual sales from 32.5 acres of organic soybeans which were not sold until June of 1999. That is why this material is a year behind. The conventional information came from actual sales from 110 acres.

Checking the quality of harvested soybeans for the organic tofu market at the Klinge/ Tidwell field day

Richard and Sharon Thompson, Boone, have kept close track of yields and farming operations for more than a decade. Dick has put this information together in a way designed to allow comparisons to other farming systems. Leaving out government price supports, and using local land rental rates and custom charges for the operations, he generates net profit for each crop in each year of his two crop rotations and for a hypothetical corn-soybean rotation that is representative of Boone County. This approach was described in "Can You Afford a Crop Rotation," in *The Practical Farmer*, Vol. 11, #4, winter 1996-97.

As Figure 4 shows, when you take away the outside support, the Boone County corn-soybean rotation has not kept pace with the more diversified rotations on the Thompson farm. Dick is interested in seeing more producers learn to use this tool. He believes that over time it can be a way of tracking a farm's progress toward its goals and to compare farming systems.



Five-year rotation: corn-soybeans-corn-oats/hay-hay
Six-year rotation: corn-soybeans-oats-meadow-meadow-meadow.

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Table 9. Soybean production budgets, organic and conventional, Klinge farm, 1998 Crop Year.

Item		Organic	Conventional
Pre-Harvest Machinery		$27.50 †	$15.50 ‡
Seed			
Organic	@$15.50/50# bag x 1.8 bags, Dyna-grow 3233	$27.90	
Conventional	@$22/50# bag x 1.5 bags, Roundup Ready™		$33.00
Fertilizer		$0.00	$0.00
Weed Control			
Organic	hand weeding (3 hrs x $8/hr)	$24.00	
Conventional	herbicide (Roundup)		$12.00
Crop Insurance		$10.00	$10.00
Interest	Pre-harvest expense, 9.0% for 8 months	$5.36	$4.23
Pre-Harvest Total		$94.76	$74.73
Harvest Machinery	Combine	$25.00	$25.00
	Haul grain from field	$0.50	$0.50
	Dry Grain ($0.05/bu x 42 bu)	$2.10	$0.00
	Trucking	buyer pd.	$6.84
Harvest Total		$27.60	$25.50
Labor	@$8.00/hr	$40.00	$24.00
Land	cash rent equivalent	$160.00	$160.00
Certification & user fees	(approx. 1% of sales)	$8.00	$0.00
Extra Handling		$4.00 §	$0.00
6 months interest and storage		$14.00 ¶	$0.00
Total Cost per Acre		$348.36	$291.07
Crop Yield (bu/acre)		42	57
Cost per Bushel		$8.29	$5.11
Sale Price (per bu)		$19.00	$6.00
Field Border Harvest	(½ bu @$6/bu)	$3.00	$0.00
Insurance Claim	(10% hail loss)	$40.00	$0.00
Gross Income/Acre		$841.00	$342.00
Net Profit/Acre		$492.64	$50.93

† Organic: tandem disk, chisel, field cultivate (2x), harrow, plant, cultivate (3x).

‡ Conventional: chisel plow, field cultivate, harrow, plant, cultivate (1x).

§ First load of beans was rejected because of black nightshade, shipped back to the farm, and the entire crop was dried until the nightshade berries were completely dried up. Extra handling included the costs of trucking and drying.

¶ The organic soybeans were not marketed until June, 1999. Costs included storage and interest on all expenses.

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Table 10. Weed Management Trials

COOPERATOR	LOW RATE TREATMENT					HIGH RATE TRT
	DESCRIPTION	TREATMENT COST	YIELD	BROADLEAF WEEDS/ACRE	OTHER WEED INFORMATION	DESCRIPTION
ABBAS	ROW CULTIVATION ONLY	$0.00	139.1	2,656	WEEDS COUNTED ON 8/3	FLAME CULTIVATED
NEW MELLERAY	ROW CULTIVATION ONLY	$12.00	135.5	20,300	GRASS RATING SIGN. GREATER	FLAME CULTIVATION
MUGGE	CONTROL – NO COVER CROP	$0.00	41.9	—		SPRING RYE ON RIDGE

(Earworm and Bt, continued from page 41.)

which silking times are most likely to reward treatment. Gary writes: *I wonder if it might be worthwhile to treat the first several varieties and not the last one or even two, depending upon what one's tolerance level is for infestation.* Of course, beyond the arithmetic, there is the intangible benefit of being able to present the customer an ear of sweetcorn that hasn't already been a worm's breakfast.

The **Neely-Kinyon Research Farm** in Greenfield has responded to a number of concerns expressed by farmers who grow – or are considering growing – organically. One of the current issues in organic agriculture is seed treatment. Some certifying organizations prohibit seed treatment, others merely discourage it. Some evidence suggests that corn yields can be severely limited without seed treatment (see below). In 1999, the Neely-Kinyon Farm planted treated and untreated corn seed at 28,000 per acre on May 27. As Table 8 shows, there was considerable variability in the field, with a 13-bushel LSD that exceeded the 10.3 bushel advantage to the untreated seed.

Some certifying organizations prohibit seed treatment, others merely discourage it.

Ron and Maria Rosmann, Harlan, repeated their seed treatment trial of 1998. In that year, a severe storm shortly after crop emergence reduced the population of corn in the untreated strips, leading to a 43-bushel yield loss. After planting on May 14, Ron carefully evaluated the crop stand over the course of 1999, looking for treatment effects. The treated seed did lead to a population advantage that varied from one to three thousand plants per acre over the growing season. However, there was no difference in yield between the two treatments (Table 8). Seed treatment does provide some "insurance," but these trials suggest that in many instances untreated seed can perform satisfactorily.

Weed Management Trials

The flame cultivator is a tool for weed management that has received interest in recent years. On August 3, **Dennis and Eve Abbas**, Hampton, counted weeds in corn that had been flamed on July 1 (Table 10). The flaming had significantly reduced weeds, and to Dennis' surprise, had also affected quack grass and Canada thistle. Even if these perennial weeds are still surviving underground, Dennis is happy he has fewer to look at.

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Weed Management Trials

HIGH RATE TREATMENT				TREATMENT DIFFERENCES					COMMENTS
TREAT-MENT COST	YIELD	BROADLEAF WEEDS/ACRE	OTHER WEED INFORMATION	YIELD DIFF.	YLD. SIG.	YLD. LSD	BRDL. WEED SIG.	LOW RATE $ BENEFIT	
$5.05	136.6	1,557		2.5	NS	12.3	*	($5.05)	FLAMED JULY 1. REDUCTION IN CANADA THISTLE AND QUACK
$17.41	143.8	7,700	BROADLEAF RATING SIGN. LESS	-8.3	*	7.4	*	($19.15)	FLAMED JUNE 20
$16.74	39.2	—	LESS GRASS, BUT NOT SIGNIFI-CANTLY	2.7	NS	17.4	NS	$16.74	THREE REPS ONLY. TREND FOR GRASS REDUCTION AFTER RYE.

The flaming had significantly reduced weeds, and to Dennis' surprise, had also affected quack grass and Canada thistle.

At the **New Melleray Abbey**, farm manager **Joe Fitzgerald** flamed corn on June 20. The flaming significantly improved crop yield and cut the number of broadleafed weeds and grasses (Table 10). Each producer will decide whether and where flaming fits in the operation. Flamers, just like chemical burndowns, are not the answer to every weed problem. On the other hand in a spring like that of 1999, with conditions too wet to use the rotary hoe, a flame weeder could look like a magic wand.

Strip Intercropping – Taking Advantage

It has been nearly a decade since the rise in interest in strip intercropping, led in part by PFI. A reason many producers discontinued intercropping was the system's failure to consistently deliver the yield benefits inherent in that form of multiple cropping. One of the hidden drags on yields was rootworm larvae that migrated underground from strip to strip, a fact discovered by USDA/ARS entomologist Mike Ellsbury, working on the farm of PFI members **Paul and Karen Mugge**, Sutherland.

Set it on 'sear'! Getting ready for a flaming demonstration at the New Melleray field day.

Single- and double-width strips allow corn to "jump" from year to year on the Mugge farm.

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So if the rootworms are migrating, what do you do? Give 'em further to crawl! At least that was the plan when we set out two kinds of systems, "walking" and "jumping" strips, on the Mugge farm. In the traditional, walking strips, each crop moves over by a single strip every year. In the new jumping strips, corn moves one-and-a-half strips each year. The two systems were established in 1998, and '99 was the first year we could expect to see a difference – if any – between the two systems.

The border rows of the corn strips are where the big potential is in strip intercropping – yield potential because of the extra sunlight and damage potential because of rootworms visiting from the strip next door. So when the corn was threshed this fall, the yields told the story (Table 11). In the walking strips, border rows yielded no more than rows in the strip interiors. In the jumping strips, though, the border rows yielded on average nearly 40 bushels more than the strip interiors.

Stand counts suggest that plant population played an important part in the yields. All rows were planted at the same population. However in the walking strips border row stands trended lower than in strip interiors, while in the jumping strips the outside row populations were greater than in the strip interior. In the first instance, rootworms may have taken their toll on stand as well as crop growth; in the latter case, less competition in outside rows may have allowed a few more plants to survive and bear ears.

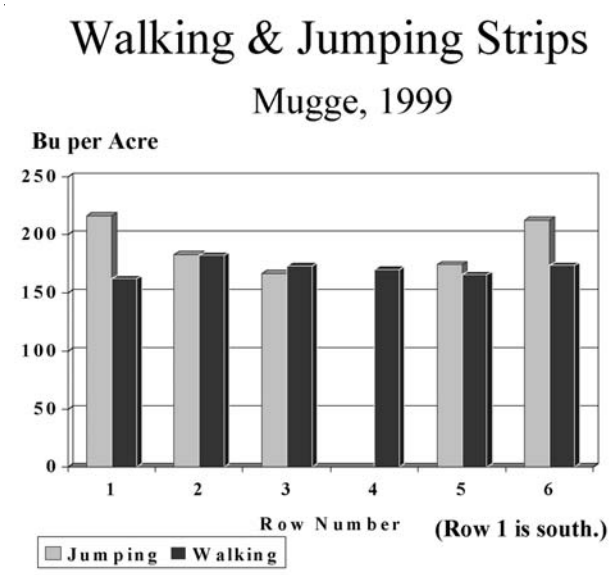

Figure 5. Mugge yields in jumping and walking strips.

In the jumping strips, though, the border rows yielded on average nearly 40 bushels more than the strip interiors.

TABLE 11. Strip Intercropping, Row Yields and Stands – "Jumping" vs. "Walking" Strips

EAST-WEST STRIPS	MUGGE			
	"JUMPING"		"WALKING"	
ROW	YIELD	STAND	YIELD	STAND
	BU/ACRE	PLANTS/ ACRE	BU/ACRE	PLANTS/ ACRE
(S)	(OATS)		(SOY)	
1	216.2	32,670	161.8	28,096
2	183.0	30,056	182.1	30,056
3	166.6	30,056	173.3	26,572
4	—	—	170.1	27,225
5	174.2	30,710	165.4	27,225
6	212.3	31,799	173.5	26,354
(N)	(SOY)		(SOY)	
STRIP AVG.:	190.5	31,058	171.0	27,588

Entomologist Ellsbury will help end the speculation in 2000. He plans to place traps in the field to catch the adult rootworms where they emerge from the soil. If jumping strips prove to be the key to productivity, that will be important to their use on Iowa farms. Fitting them into practical systems will be the next challenge after that.

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Grass-Based Dairy Farming in the Upper Midwest – Where do we go from here?

Matt Stewart, Oelwein

The grazing movement is at the end of its first stage of development. The "introduction" stage has brought fencing, watering systems, and grass-based animal systems. An infrastructure has been developed to supply farmers with fencing and watering supplies. Extension and NRCS have become fairly proficient at helping farmers institute managed intensive grazing systems and organizing pasture walks and grazing conferences. Grass farming has been embraced by sustainable agriculture groups, as grazing has the potential for a reduction of soil erosion and relies less on chemicals and petroleum. But the movement has stalled. I think we need to investigate the reasons.

LACK OF FINANCIAL INCENTIVE - Grass-based dairying has grown in spurts associated with periods of financial stress on dairies. The first leap of interest came about between 1987 and 1989. Many of Wisconsin's first grazing groups started after a drought in 1988. The second wave of interest in controlled grazing came in 1993-1995; dairy farmers experienced six years of low profitability between 1990 and 1995. $5 corn and $8 soybeans slowed the influx of new graziers and made row cropping look like a rosy alternative to pasture. At the same time, graziers anxious to profit after seeing good returns from their first efforts, expanded grass acres and herds. Then they had trouble keeping pastures from growing too mature. The widespread "gospel of grass" stated that no purchased seed, chemicals, or fertilizers would naturally yield lush pasture if farmers would just use managed intensive grazing. But pasture production of high quality feed has not grown in terms of more meat or more milk per acre as many believed.

Both confinement and grass-based dairies have had very profitable years in 1998 and 1999 as a result of milk prices. It's important to realize that those profits have come from selling milk, not necessarily from the production of grass. The toughest years in agriculture often follow a period of high commodity prices. Look at corn after the high prices of 1973-1974, milk after the high prices of 1989-1990, or hogs after a 16% return on investment between 1990-1995. Dairy graziers will face a problem caused by the *low* cost of concentrates. My feed cost per cwt. of milk is $2 less this winter as a result of purchasing a year's supply of corn at $1.55 and a winter's supply of hay at $55 per ton. Grass farmers need to realize that low feed prices will actually benefit confinement dairies more that grass based producers.

LACK OF INFRASTRUCTURE TO INCREASE PASTURE PRODUCTION – Two main topics are included here: 1) grass and legume genetics, and 2) balancing soils and pasture fertility. The next ten years of the grazing movement will be devoted to the development of these needs, I believe. The technical expertise for these two areas will have to be developed together. The nutrient puzzle for perennials is more complex than the fertility needs for annuals like corn and soybeans. It appears that the overwintering abilities of the most productive grasses and legumes may be linked to soil fertility. Cool-season grasses and legumes each have different nutrient needs at differing times of the year and seem to respond to more frequent applications of some fertilizers and calcium. Availability of these nutrients seems to be more of a problem than most of us have experienced in our previous lives as corn, soybean and alfalfa producers. The distribution system in place is structured around conventional producers. In my area, the fertilizers available are anhydrous ammonia, urea, diammonium phosphate, and potash. Even the pricing methods are set up to encourage large, one-time applications of these products in either fall or spring. Alternative products like ammonium sulfate or gypsum have to be purchased in semi-load lots and/or spread with your own equipment.

Our on-farm research will have to be aimed at improving the amount of energy and protein that we produce per acre.

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