

THOMPSON AGRICULTURE ALTERNATIVES 2009 REPORT

Thompson Research and Demonstration Farm

Abstract

Dick and Sharon Thompson live on a diverse crop & livestock 300 acre farm in Boone county, Iowa and have four children and eleven grandchildren. They started farming in 1958 and farmed conventionally for ten years. Since 1968 they have experimented with alternative methods of farming, human and animal nutrition. Since 1986, 331 farm tours have been given for 8,799 people from the U.S. and 62 foreign countries. During this same time they have traveled throughout the U.S., Canada, Mexico, and overseas to France, Italy and Australia giving 334 presentations to 31,811 people and helped develop the following.

*An alternative farming system that increased net income \$161 per acre and doubled the organic matter in the soil compared to conventional row crop agriculture. *Tested the idea of higher protein and lower carbohydrate people diet and found it works and fits with our farming system. *Farmer friendly on-farm research design with long narrow strips. *Ridge till farming system without herbicides. *Twin rows of rye fall drilled on ridges & removed with Buffalo planter without tillage or herbicides. *Early weeds control later weeds. *Ridge till planter runner for liquid fertilization two inches below seed. *A pyramid of loose soil over the corn and soybean seeds. *Buffalo ridge till planter modifications: Weed seed deflector was added in 1980's. Removal of coulter and depth bands from ridge in 1991 which makes this planter workable on both plowed and ridged fields. Added row cleaners in 1995 & 2002. New and heavier residue guards in 1999 & 2004. Removed sweep in 2003. *Double throwing of soil with Buffalo cultivator. *Flex Harrow ahead of grain drill planting oats in 1999. *Added hitch to grain drill to pull roller in 2002. *Rotation of tillage, moldboard plow after hay, ridge till corn & soybeans, fall disk, spring field cultivate, flex harrow prior to drilling oats. *Designed and built manure/bio-solids storage and application system. *Manure spreading and plowing system that greatly reduces odor. *Swine & beef management systems without antibiotics. *Flex harrow on pastures for management of horn flies and parasitic worms on beef cows. *Fall chisel pastures 3 to 4 times at 28 day intervals during last quarter of moon for Canada thistle management. *Winterized A Frame farrowing isolit. *Redesigned a low cost, longer lasting, easier to repair cattle oiler. *Designed a low cost self loading hog chute. *Made three modifications on rocking hog feeder. *Flail stacker replaces baler for picking up crop residues. *Engine exhaust for underground management of rats. *The addition of potassium chloride in beef cow rations to improve stamina. *Selling young lean bulls or late castrated steers with bands for direct marketing. *The concept of farmer/wife dual presentations, a farmer being a researcher and educator. *Get along but don't go along philosophy. *Liberty bib overalls with zipper pocket to keep data book. *Media-center on farm for tours (rain or shine), wall posters, wide screen for slides, videos and overheads, machinery display. *Co-founders of a grass root alternative farmer organization called Practical Farmers of Iowa. *Helped start sustainable farmer organizations in other states. *Promoted payment to farmers for research and education work. *Established a working contract between Practical Farmers of Iowa and Iowa State University. *Cooperative research on the Thompson farm with USDA and ISU scientists. *Publish and update a 222 page report "Thompson Agriculture Alternatives" found on PFI website. Type title in google search box.

INTRODUCTION

WELCOME to the Thompson farm, either by attending a farm tour or by reading this report many miles away. The report is written to be interesting and helpful to both farmers and the research community. This is not the final chapter on sustainable or alternative agriculture. You will find successes and failures described in the report. We strongly suggest that new ideas be tested on a portion of your farm before you change your entire farming operation.

This report updates all previous reports. All of the experiments conducted on this farm are in table form at the end of each chapter. The overall summary at the beginning of this report is the best place to start reading. Then read the summaries at the end of the chapters that match your interests. Next read the chapters and tables. Chapter 1 tells the “why” and the remaining chapters try to tell the “how”.

Research on this farm and the publication of reports has been supported by Rodale Institute for the years 1984 through 1992. Support continued from Mrs. Jean Wallace Douglas through the Henry A. Wallace Institute for Alternative Agriculture, Greenbelt, Maryland for 1993 through 2000. The results you read about in this report would not have happened without this support.

We also wish to acknowledge Rick Exner for teaching Dick how to use all the different software programs and solving computer problems.

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2009 Update

What didn't work and what is still working now.

By Dick and Sharon Thompson

Dick and Sharon started farming in 1958 with high inputs of purchased fertilizer, herbicides and insecticides that were required with the continuous corn program. In 1968 we changed back to C-SB-C-O-H rotation using organic, alternative and sustainable practices. What we share is the research from **this farm** and you will have to decide what is doable for your farm.

Crop Management:

In the fall of 1983, half of the field was aerial seeded with rye and the other half with oats, all over soybean ridges. Corn was planted the next spring into dead oat mulch and living rye with a ridge till planter. The planter did not remove all the rye. The oat cover corn yielded 86 bu. per acre. The 1984 rye cover corn with compost yielded 45, manure + starters yielded 52 and rye with 50# nitrogen side dressed yielded 72. All manures were spread on top of ridges in the spring and covered with the planter. Rye ahead of corn and manures on top of ridges in the spring is not sustainable. Spreading manure in the usual wet spring when the neighbors are planting their corn is not sustainable for the people involved because of the huge workload and short time period. The average Boone County corn yield was 121, which was 69 bushel better than the top dressed compost yield of 45. **This is not sustainable. This program was not working.** This corn field was seen by over 500 people during our two day Rodale Institute field day in 1984. Thanks to the New Farm staff for advertising this event nationally. People came from all over the United States and some foreign countries. TV cameras, reporters, an organic meal, the whole nine yards. This may be the first alternative, sustainable, organic field day held in Iowa.

1993 was the flood year for central Iowa. Twin rows of rye fall drilled into soybean ridges seemed like a good idea. With all the rain the rye grew waist high and was shredded. Now the problem was with all this stuff that had to be digested to be available for the corn plant, plus the two-ton dry matter manure that was top dressed on the ridges. The corn was short of nitrogen and was side dressed late in the season. Our field #1 corn yield of 57 bushel was 27 less than the 84 Boone County average. **The yields are poor, too much rye, and still spreading manure in the spring on top of ridges, this program was not working.**

Six trials randomized with six replications were completed on this farm from 1988 through 2004. Twin rows of fall rye were drilled into soybean ridges. The average loss from these six trials was **\$21.99 per acre** coming from reduced corn yields, rye seed cost and drilling expense. **This was not a winner, forget rye cover prior to corn in your rotation.** There is not enough time after corn picking and harvesting all the cornstalks for cow feed and bedding for the animals. Four replicated trials of twin rows of rye on the corn ridges did not change soybean yields or weed numbers and cost **\$11.53 per acre.**

The cover crop question? If you are a continuous row crop farmer there is a place for cover crops. With our pasture rotation of C-O-6 yrs pasture, seven out of the eight years are completely covered 365 days a year, this is good enough. At this writing, the C-SB-C-O-H rotation is covered 2 years out of five. Is this adequate? Our experience broadcasting clovers at last cultivation is risky in establishing a good stand. With a poor stand of corn

you may have enough sunlight for a cover crop. With 30,000 plus corn plants per acre, there is not enough sunlight for the clovers.

Boone County yields increase from 121bu. in 1984 to a high of 191 in 2005 an increase of 70 bushel per acre probably due to improved genetics. Our yield in 1984 field #2 in the rye-compost strips were 45 bu. and increased to 228 (field average) in 2008 in the same field, an increase of 183 bushels per acre. This increase came about by dropping the rye cover, one year manure storage, plowing manure under in the fall following hay, and improved genetics. The 2006 corn was damaged by wind, 2007 yields stood straight and yielded 219 bushels per acre. No NPK fertilizers have been purchased for over forty years.

Our farm is a research farm and not certified organic. This freedom allows us to test many ideas. Why BT corn? Our first test with BT increased yields 15 to 19 bushels and the corn stood well. Our cows showed no preference in grazing BT and non BT cornstalks in the field or stacked cornstalks ate in the yard during the winter. In 5 trials, squirrels ate the non BT ear first in three trials, and eat the BT ear first in two trials. The corn that we raised in 2007 that is fed our livestock is now Round Up Ready. We sprayed corn plants around our ear corn storage twice with Round Up and the plants did not die. We have never bought any Round Up Ready seed corn. The neighbor's corn is cross pollenating our corn.

Ridge Till has stood the test of time in weed management on this farm even though very few are using the system. **Combining ridge tillage and the moldboard plowing in the fall every 5 years makes a good pair.** Buffalo planter and cultivator were purchased in 1966. This is the only reduced tillage system that works without herbicides. Herbicides have been used on this farm on limited basis (spot spraying). Weeds have to be managed. **You can't grow two crops at the same time.**

If Dick would have been stubborn about all ridge till, fertility on top the ridges in the **spring** and broadcast rye, we would have moved off the farm long time ago. Maybe not together! When things are not working. Change to find something better. Sort through information! Keep what fits your situation and throw out the rest! **Sustainable Agriculture has to be people friendly.**

Our soybean yields from 1988-2008 have averaged 10 bushel over county average. 2008 was not a good year for soybeans because of weather, rain and more rain. This was the first year that we lost money on a soybean field. We could not rotary hoe. The beans were good size when we cultivated the first time (June 24). The cultivator threw soil in and around the bean plants, looked like an excellent job. It rained 1.25 inches two days later on June 26 starting all the weed seed we pushed into the row. We had grass in the row, which is not the norm, along with broadleaf weeds. **Throw soil against the soybean plants at last cultivation, not the first cultivation.** The field was a mess. The rope wicks attached our old hyboy filled with round up went up and back on the same rows to kill the weeds so that our small combine could harvest the field. The rope wick killed the weeds and the combine was able to handle the dead weeds. The yield was 37 bushel per acre, 7 bushel below county average of 44 (Table 5-2) and we lost \$49 per acre. The field was sprayed for aphids adding more expense.

Oat variety Don has been planted from 1988 through 2008. Oat yields have been 23 to 26 bushels above county average and a yield of 140 plus bushels has happened twice in

field 3 during this period. In 2007 our oat yield in field 3 was below county average. The variety Jerry will be planted in 2009. We were surprised Welter Seed & Honey Co. is still listing Don in their 2009 catalog @ \$8.15 per bushel.

Our hay yields have improved over the years. In the earlier years hay yields were in the 8000 pound range, after 2000 and using the flex harrow and roller, the yields average 14,504 pounds per acre (Table 5-4).

We **could not manage weeds** in the end rows of corn and soybean fields without herbicides. Twenty five feet on each end, without a crop, allows turning for machinery and better visibility of experiments in the field. These ends rows are kept clean with tillage.

Baling corn stalks and soybean stubble on ridges was the pits. The baler made very poor bales and the ridges were very hard on the pickup teeth. Now our Rotary Scythe windrows the cornstalks and the JD stacker sucks up more of the windrow between the ridges. This procedure increased yields and fits with the ridge till system.

Hay and pasture mixtures have changed. In the past the seeding mixtures have been 70% legumes and 30% grasses. The mix now is 70% grasses and 30% Legumes. It is hard to keep flesh on cows with high protein legumes. Two new varieties have been added, Alice white cover and Baridana Orchardgrass both from Barenburg. Hay yields during 2006, 2007 and 2008 in our 5 year rotation that legumes were dominant averaged 14,811 pounds per acre. Another smaller field during these same years, where orchardgrass was dominant, the yield was 15,426 pounds per acre.

An On-Farm scale is an important piece of equipment on this farm. We can weigh any thing and is very handy. Our weights are about as important as the crop. Weighing at the local elevator would get old very fast on replicated trials. The SARE program missed an opportunity by not paying half the expense for on-farm scales.

Fertility

Our hill side 176 foot long, 48 feet wide and 12 feet deep manure bunker was built in 1986 holding 3,755 cubic yards of manures and biosolids. There is no question this facility has increased our corn yields by taking better care of our nutrients. There are two gravel roads to the bunker with access 365 days of the year. We can clean pens in the rain, if needed. Spreading only once a year and plowing under the odor right away helps being a good neighbor.

Thanks to Doug Karlen and Keith Kohler at the National Soil Tilth Lab for sampling field 3 during years 1994 through 1998. We had not used the moldboard plow for 25 years. The first year to fall plow under manure was 1993. They took 2 inch soil samples to the 8 inch depth. They determined soil weed seeds and phosphorus and potassium numbers at each 2 inch depth. The fertility levels were high in the top 2 inches and low in the 6 to 8 inch depth, in spite of the deep tillage with the planter and cultivator. The moldboard plow evens out the fertility in the top 8 inches. A Kverneland plow, from Norway, was purchased to get better coverage of manure, reducing the odor and sending the weed seeds to the bottom of the furrow. Fertility of any kind needs to be placed 8 inches deep in the soil, not on top of the soil.

Black plastic covered with white limestone did not work for controlling weeds around our farm buildings. These areas still need herbicide spraying to control the weeds. The black plastic and rocks forced rainwater into our ear corncrib, machine shed and under sliding doors. The plastic and rock is being removed.

Livestock Management

Beef cows were thin coming off pasture in 98 and were wormed with ivomec. During the 98-99 winter, the cows were on half hay and half cornstalks with 5# of ground ear corn per day and free choice mineral. Some cows were weak and went down and never got back up. The thinnest cows were sorted off and fed more grain. The cows were always hungry and not satisfied. We lost 8 head before things turned around. We credit the turnover to the change in feeding minerals. Free choice potassium chloride costing \$0.14 cents per pound was made available to the cows along with a standard mineral mix for beef cows. Sometimes they consumed more straight KCl than the standard mineral. It has taken a year before they consumed more mix than straight KCl. Cows were not wormed for the 99-00 winter. Cows were in much, much, much better condition in 99-00 winter. Three changes have been made during 1999, the addition of free choice KCl, flex harrow pasture management of horn flies during the summer, and the well water was treated with 30 ppm hydrogen peroxide for a short period of time. Tests on 3/17/00 detected very few parasitic worms in the cows or calves. Hydrogen peroxide did not control worms in the nursery and finish hogs. Potassium shortage will cause weakness in cows as stated above and also weakness in corn plants and people. The last 4000 pounds KCL we bought was in July 2006 @ \$0.13 per pound. When that load was used up, we quit because of the price increase.

Cows were thin during the winter of 07-08, rough hair coats and not cycling. No free choice potassium. Wormed the cows once in January 08, cows came in heat and calved in October though February. **Never again.** We finally figured out a place to shut the bulls away from the cows from March 1 to July 20. Now cows will start calving in late April and finish December 1. During winter of 08 and 09, one cow when down and never got up. No free choice potassium. No flex harrow was used on the paddocks for the last two years. Started feeding 10# ground ear corn per head every other day and wormed the cows twice in January 09. Started feeding potassium @ \$0.43 per pound free choice in March 09. Cows should be wormed when removed from the pastures in the fall and then again 3 weeks later if needed. **Paddocks will be half lap flex harrowed between each move of the cows in 09.**

Our cows are too big and hard to keep flesh on their backs. The hay and pasture seeding mixture has been changed as mentioned before. A smaller frame Red Angus bull was purchased from Kit Pharo to use on heifers. His offspring look like the cattle Dick showed in 4-H back in the 1940's. A bigger/longer Black Angus (show type) bull was also purchased. These two bulls run with 100 crossbred cows. We now have black and red calves. Our new livestock trailer has a moveable rolling inside divide gate so we can keep the two bulls offspring separate when selling, using two different names. We now keep heifers separate from the steers in the trailer so we can know live weight, carcass weight, quality grade and cutability score for each group. If the heifers and steers are mixed and

some grade select and some prime and there are some 4's, to which group do they belong? There will be times when the two groups will not be equal, with the rolling moveable gate any combination will work. Stay Tuned.

The MiraFount cattle water lid was removed so small calves could drink. A ¾' plywood cover was made to cover the float area. The plywood was falling apart and was replaced with ½" PVC in 2007, if the water freezes up and the cattle drank the water down, spray hot water from the spray bottle up underneath to thaw out the float and water pipe. There has to be a better way. A 1 ½" hole was drilled through the PVC cover right over the float in 2008 (Figure 8-15). Pour hot water through the hole, the float will drop and water will start running. If this does not work, use an oil funnel with flexible spout to direct the hot water over on the frozen water pipe. So far this procedure has never failed.

The new cattle oiler purchased in 2001 fell apart in three months. The \$28 replaceable mop was in the manure, the flimsy metal straps that held the wire mesh, canvas and pad together was a joke. All this stuff was replaced with a large beach towel that cost \$10.50 and two angle irons (Figure 8-15). The first towel lasted 7 years. A real winner.

We are still banding bulls at about 800 pounds. When we wean the bull calves they get their first tetanus shot along with the other shots. The second tetanus shot is given when the bands are put in place. **Be sure to give two shots of tetanus vaccine.** Late banding improves daily gain, a leaner carcass and we have not had any problem of making these bulls/steers grade choice.

H2O2 has been discontinued in the drinking water for cattle and hogs. H2O2 did not stop the coughing in the cattle and ate up the pressure reducer and nipple waters and it was expensive. We gave 10cc or 7 squirts from a spray bottle of 3% H2O2 orally to new born calves. This is a winner for scours and spraying the naval and ear tags. **Make sure the product is fresh.** We were using some old stuff brought years ago and it finally quit taking care of the scours. One quart bottle of 3% at Wall Mart cost \$1.06.

All five Apache Hay Feeders were sold in 2008 at a good resale value. These feeders were always too full when they needed to be dumped over. We made three hay feeders ourselves out of 1 ½" X 1 ½" square tubing 3/16" thick. One bale hay feeder for the bull/steer fat yard and another for the heifer fat yard. The metal cost was \$591 each at the \$2.38 per foot price (Figure 8-52). The metal cost was \$756 priced at \$2.38 per foot for the three bale cow feeder (Figure 8-53). A new three bale Apache would cost \$4660 or more. All three of these feeders were made so that the rear panel could swing open at the bottom by removing two bolts for clean out. As of March 1, 2009 we have not removed any bolts. The cattle clean up the hay inside and around the outside. We also made a one ton cornstalk feeder for the cows costing \$1000 priced at \$3.99 per foot (Figure 8-54). All these feeders have a hook on top, a chain loop on the tractor loader catches the hook so the feeders can be moved without leaving the tractor.

Ground Ear Corn is an excellent feed for livestock and has a built in roughage program. Our finish program free choice hay and GEC. The majority of the finished heifers and steers marble enough to make the choice grade and a few prime. The cutability scores are mostly 2's and 3's and a few 4's.

Keeping tags in the cows ears has been a problem. The cows are tagged in each ear. How much are the strings on the hay bales contributing to this problem? The length of the twine on a big bale is about 500 feet. When the strings are cut once across the bale the twine is reduced to about 20 feet in length. If the strings are cut on both sides of the bale the length is about 10 feet. In 2007, with one cut across the bale, 47 tags were replaced. In 2008, with two cuts across the bale, 35 tags were replaced out of 200. In 2009, the strings are being removed. Stay Tuned. We do not have any numbers for 2006 with all the strings left in place, but there were way to many.

We have used Z ear tags in the calves and cows. Starting in 2008 the lost Z tags were replaced with two piece tags. Some cows still have Z tags in both ears, some have two tags in both ears, and some cows have both kinds. Stay Tuned.

The other livestock we have on this farm are the cats, rats, coons, squirrels, pheasants and etc. The cats and the engine exhaust from a four wheeler keep the rats in check. The coons chew holes in the filler doors of the wire ear corn crib. The plywood doors will be replaced with ½" PVC. We use a wire cage to catch coons. The pheasants and squirrels eat out of the wire crib.

The 30 A-Frame Isolits have replaced the Cargill Isolits. The engineer that designed the Cargill farrowing hut **never cleaned one out**. A box is a poor design to be outside in the weather. The triangle is a much better design and having each sow and her pigs isolated from other sows and pigs is sound husbandry. The ration has been changed to add more bulk in the diet by feeding ground ear corn and oats, soybean meal and minerals are hand fed for gestating sows. The lactating sows are on self feeders and have some ground **shelled** corn added to the ration (**Table 8-7**). The baby pigs eat from the sow feeder and do real well. The protein level is lower and that solves lots of problems. **Table 8-6** shows the breeding schedule for 60 sows farrowing spring and fall. The isolits are empty in the hot summer and cold winter.

Soil Erosion:

We are not impressed with the neighbors no till. More water is moving off the no till system than their previous deep chisel practice. The cornstalks end up in the fence row and ditches. Our moldboard plow used once every five years opens up the soil so the water goes into the soil and not across the neighbor's field. In some cases our plowed fields take in too much rain and remain too wet for good yields. We know several other farmers who have made the same observations. There is no one certain tillage practice that meets all the needs of a farm. We have real old tillage equipment like a disk, chisel plow, field cultivator. Along with somewhat newer equipment like Buffalo planter and cultivator, Norway moldboard plow and we use all of them every year.

What works & what did not.xls

	A	B
1	THOMPSON ON-FARM RESEARCH	
2	Things that worked	Things that did not work
3	One year manure/biosolids storage bunker	Biologicals
4	Diverse Rotation, C-SB-C-O-H	Manure spread on top of ridges in the spring
5	Kverneland plow for manure & hay coverage	Rye cover before corn
6	Ridge Till system without herbicides	Starter fertilizers
7	Half-lap, pre emerge, rotary hoe reduces the most weeds	Side dress nitrogen
8	Rotary Scythe for hay & cornstalks harvest	Composting, too many loses
9	Modified stacker for cornstalks	Spreading manure into a pile
10	No end rows	Round baling on ridges
11	Manures meet the fertility needs	Black plastic under white rock
12	Scale is a must	Added potassium fertilizer
13	Yields increased	Manure spread on top of ridges in fall-odor
14	Net profit increased	Z screens fly trap
15	Electrical zapper fly trap	Epps fly trap
16	Modified Mirafount cattle water	Two Upright Silos
17	Feed tub behind head gate when teaching new calf to nurse	Bunker for silage
18	Flex harrow paddocks after moving cows each time	Continuous Corn Rotation
19	Intensive grazing	Liming with buckets
20	Oral 10cc H2O2 for new calves before scours develop	Open pollinated corn
21	Free choice hay & ground ear corn feeders	Freeze branding on red cattle
22	Raw soybeans in the cattle ration	Poisons for rat control
23	Banding bulls at 800 pounds	
24	Engine exhaust to rid rats	
25	Windbreaks improve life	
26	Drip line replaces foggers for cooling pigs	
27	Winterized A frame isolit	
28	Modified B & W hog feeder	
29	Modification of grinder mixer	
30	Concrete walls for hogs & cattle	
31	Prong to hold up rear gate on cattle corral	
32	Research strips all the way across the field	
33	Cutting twine on bales saves ear tags	
34	Wheels on sorting gates	
35	Twin rows of rye in the fall on ridges before soybeans	
36	Early weeds control later weeds	
37	Modification of Ridge Till planter	
38	Flex harrow ahead of oats drilling, finer seed bed	
39	Roller attached behind grain drill for oats.	
40	Swine production without antibiotics	
41	Farmer/wife presentations	
42	Practical Farmers of Iowa	
43	Working relationship between PFI and ISU	
44	Cooperative work on this farm with USDA and ISU scientists	
45	Get along, but don't go along philosophy	
46	Modified cattle oiler for longer life	
47	Double throwing of soil with Buffalo cultivator	
48	Lime on floors as disinfectant	
49	Ground corn cob, straw, lime storage shed-Tractor loader	
50	Rod/Ring Gate Chain	
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Summary

Alternative Farming Systems

Inspiration, Documentation and Education

The new ideas we share came by inspiration and perspiration. The ideas then need to be tested. The replicated and randomized long narrow test strips that are farmer manageable, has helped us determine what practices are right for this farm. We tell other farmers to use the same process on their farm. Since 1986, 331 farm tours have been given for 8,746 people from the U.S. and 62 foreign countries (**Table 1-1**). Listing of the countries is found **Table 1-3 and 1-4**. During this same time we have traveled throughout the U.S., Canada, Mexico and overseas to France, Italy and Australia giving 334 presentations to 31811 people. We helped start a grass root farmer organization called Practical Farmers of Iowa in 1985, which promotes testing of new ideas in alternative agriculture. There have been 25-30 PFI cooperators throughout Iowa doing replicated and randomized experiments, also demonstrating sound practices, having field days and keeping records for systems analysis. The organization has about 700 members.

Alternative Weed Management Strategies.

On the average Iowa farmers spend \$30 per acre each year for herbicide weed control in corn and soybean production. Ridge tillage without herbicides, reduces tillage and weed control costs and manages the weeds quite well. Three years' data collected on the Thompson farm, showed a \$54 per acre increase in management net when ridge tillage without herbicides replaces mulch tillage and broadcast herbicides. There are several reasons for reduced weed pressure with an alternative weed management system. 1. There is no tillage between last year's June cultivation and this year's May planting. The weed seeds are not exposed to oxygen or light and do not germinate. 2. Cover crops planted in the fall, winter annual weeds and surface weed seeds are allowed to express themselves in early spring in order to inhibit later germinating weeds. 3. The Buffalo planter sweep cleans off top-dressed manure, weeds and weed seeds over the row area providing a low weed density planting zone. 4. The Buffalo planter leaves loose soil over the firmly planted corn or soybean seed. The loose soil is not a good environment for weed seeds. 5. Crops are planted thicker, soybean seeds at 12 seeds per foot and corn at 6 inch spacings. 6. A high residue rotary hoe is used before and after crop emergence. 7. A high residue Buffalo cultivator with hillers is used to remove weeds between the rows. 8. Post emergence herbicides can be used as the last resort if all cultural techniques fail.

Rotation of crops and tillage

The rotation of corn, soybeans, corn, oats and hay helps keep weeds, insects and diseases in balance. The diversity of crops helps reduce financial risk and spreads out the work load. With this diversity of crops, a livestock system is needed to make use of the residues from the grain and hay production. The diversified crop and livestock enterprise fully uses the farm family labor supply and these labor charge monies remain on the farm to pay family living expenses.

A rotation of tillage is used to help reduce weed pressure. After being idle for 25 years, the moldboard plow has come back into use for plowing down hay and solid manures. The fertility needs to be lower in the soil profile so the crop's roots have better use of the nutrients. The chisel plow is used on Canada Thistle patches in pastures and hay fields in late summer. The chiseling is done during several of the last quarter moon periods. Ridge-till equipment is used during the three years of row crops. The diversity of tillage has been very helpful in putting more balance into this farm.

Cover Crops

Fall cover crops are used for three reasons. 1. Reduce weed pressure with the allelopathic properties of certain crops. 2. Reduce leaching of soil nitrate nitrogen in the off cropping season. 3. Reduce wind and water soil erosion during late fall and early spring.

Corn following plowed under hay:

Grain rye is dribbled on by applicators, at 20 pounds per acre, while plowing in September. The leveling bar on the plow covers the rye. In the spring, the four to six inch rye will be destroyed by a field cultivator equipped with a scratcher bar. The cultivator and scratcher bar leave the rye on the surface for weed control. The second pass, one week later, with the field cultivator will destroy any remaining rye and new germinating weeds. Plant with Buffalo planter before it rains. The disk method of tillage **should not** be used because it brings up weed seeds near the soil surface to germinate. Cover crops that are planted too thick and grow too tall in the spring can bring additional problems.

Soybeans following corn ridges:

Grain rye is drilled, at 20 pounds per acre, in twin-rows on top of ridges immediately following corn harvest. The spring rye growth of 18 inches is shredded just before planting.

Corn following soybeans

Grain rye ahead of ridge-till corn without herbicides is not compatible. Research funded by the Leopold Center demonstrated that two to four bushels per acre of broadcast oats over soybeans at leaf yellow produced the most cover and did not reduce corn yields the following year. The oats will winter-kill in Iowa. Our early cover crop work on the Thompson farm in 1984 also showed oats to be a low cost and low risk cover prior to corn production.

Weeds serve as a cover crop before planting, weeds between the rows between cultivations act as cover and then become green manure after cultivation.

Livestock and Manuring

The beef cow herd and the farrow to finish hog operation use all the grains and residues from this farm. The livestock manure and the bio-solids from the city of Boone provide the fertility needs of this 300 acre farm. These products are stored in a cement bunker to preserve the nutrients and spread twice a year and covered with the moldboard plow in the fall and with the ridge-till planter in the spring.

Economics-

The economic data from Thompson's farm since 1988 shows a \$174.52 per acre per year increase in the labor and management return for the manure fertilized alternative grain system compared to the conventional corn, soybean rotation without the government farm program or premiums (**Table 7-7**). The alternative system management return was a positive \$138.98 per acre and the conventional system had a loss of \$35.53 per acre (**Tables 7-6 & 7-7**). We are only comparing cropping systems. The profits or losses for the livestock systems are not included in these numbers.

Using year 2000 (**Table 7-9 & Figure 7-10**) for an example, the major part of the additional profit comes from increased crop and residue income. The corn plus residue in year one and three of the rotation generate \$147.33 and \$123.90 per acre more income than conventional corn and soybean rotation. The soybean plus residue generate \$79.48 per acre more than conventional. The oats plus residue adds \$152.88 more and the hay crop adds \$254.82. The average income for the five year rotation is **\$151.68** more per acre than row crop corn and soybeans. . Cost savings in fertility are \$25.71 per acre, weed management savings \$24.47, tillage savings \$14.33, miscellaneous savings \$11.83. Harvesting costs are higher by \$54.56 per acre because of baling of residues. However, the average cost savings is still **\$24.81** per acre for the alternative system (**Figure 7-9**). The additional labor in the alternative system produces another **\$19.56** per acre added income. Adding the increased income of \$151.68 with cost savings of \$24.81 and additional labor income of \$19.56, this all adds up to **\$196.06** per acre advantage in 2000 for the alternative system. **The alternative system money maker makes room for more farmers which will improve rural communities.**

Table 7-7 shows a positive difference in all the years from 1988-2008 for the alternative system. Also the positive difference is increasing in the later years. The difference during the 1988-2000 years was \$138.63. The difference increased to \$222.37 in the 2000-2008 time period.

Farm Policy

The demand for farm products is inelastic which means a 20 percent increase in production will produce a 60 percent decrease in price or a 20 percent decrease in production will bring a 60 percent increase in price. The ratio of 1 percent production change results in a 3 percent price change in the opposite direction. Farmers do not understand this principle. The price for food is very erratic because people have to have food regardless of price. On the other hand, when food is in abundance, you can't give the excess away. The surplus production of U.S. food products for the past forty years has kept the farm gate price very close to the cost of production and sometimes the price is below the cost of production. The idea of increasing production per acre and/or the farm size with the present narrow or even negative margins will not solve the agriculture problem. It only exacerbates the problem. Production has to be reduced enough to raise prices for a profitable enterprise. The only way price can increase is by decreasing production when supply and demand are the controlling factors.

Communities

The size of a farm will be restricted when the major part of weed control depends on the rotary hoe and the cultivator. Two cultivations of the 150 acres of row crops with a four-row cultivator are **enough** along with hay making and caring for the livestock. An eight-row cultivator will handle 300 to 400 acres of row crops very easy, but not thousands of acres. The word "cultivator" should be a positive word, not a negative word. The air-conditioned tractor cab of today, with a guidance system, pulling a four or an eight-row cultivator makes this operation much, much easier than a one row horse drawn cultivator of the past. Harvesting ear corn puts another restraint on farm size. Picking 100 acres in the ear is **enough**. Mowing and baling 40 acres of hay three or four times during the summer is **enough**. Looking after 75 beef cows during calving is **enough**. There is no desire to have 150 cows. **Including the cow in the farm operation keeps the farm and communities in balance. When the cow leaves the farm, the oats and hay crops leave also. The remainder is row crop corn and soybeans without manure for fertility which calls for purchased fertilizer and herbicides to control the weeds. As a result, farms can get larger and the rural communities decline.** Cleaning pens every two weeks for a 75-sow farrow to finish hog operation is **enough**. This 300-acre farm with livestock is **enough** and there is no desire to farm the neighbor's land. The higher labor charges stay in the farmer's pocket making smaller farms profitable, and therefore results in **more** farm families. More farm families mean expansion of schools, churches, services and communities. The greater management return per acre of the alternative system is enough to support the smaller acreage and rebuild the rural communities. A larger percent of labor charges and management returns will remain in the rural communities with the alternative systems.

Environment

The alternative system is kinder to the environment. The alternative farm system soil loss is **four** tons per acre per year, while the conventional corn and soybean rotation produces **eleven** tons per acre per year. Our alternative cropping system has been managed without insecticides and herbicides for more than 25 years. Less soil erosion and no pesticide use will lessen the agricultural environmental impact. The National Soil Tilth Lab. compared our alternative system to a neighbor's conventional practices and found the following results. The alternative system had 68 times more earthworms, 61.5 percent more stable soil aggregates, and 3.2 percent higher organic matter content.

Conclusion

The alternative farm system compares very favorably in the environment, economics and the people questions. Why doesn't everybody do it? The alternative practices take more physical and mental effort, and human nature gravitates toward the easy way. The effort in the less crowded practice is being reimbursed economically, environmentally and socially. The conventional continuous row crop practices do not pass the test.

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