excellence in

ORGANIC weed management:

insights from the field

WESTERN ILLINOIS UNIVERSITY

School of Agriculture at Western Illinois University

Western Illinois University's organic research program

proudly presented by the Organic Research Program

WIU's Organic Research Program

The Western Illinois University Organic Research Program is part of WIU's School of Agriculture. The program's main research site, the **Allison Organic Research and Demonstration Farm** is located in southwest Warren County, approximately 15 miles north and west of the WIU main campus in Macomb, IL. The land was identified as uniquely suited for organic research because of the Allison family's long history of farming without pesticides and has been rented from the family since 1989. Most research at the farm involves typical Illinois commodities: corn, soybeans, small grains, and forages, such as alfalfa. In recent years, crop rotations have been diversified to include sunflowers, purple-and-gold popcorn, and many new cover crops. **The 77-acre Allison Farm is one of the largest organic research farms in the United States.**

The **primary goal** of the WIU Organic Research Program is to identify, evaluate, and disseminate practical science-based solutions to challenges faced on organic grain farms in the Midwest region. In addition to field research, documentation of management strategies used on successful organic grain farms has become a key activity. Each year in early August, the WIU Organic Research Program hosts a **field day** to showcase recent research at the Allison Farm and offer a forum for outside experts to share their knowledge with both organic and conventional farmers.

Western Illinois University's
organic
research
program

organic weed management

INTERVIEWS

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Andy Clayton, research technician & farmer | Knoblauch Hall 303 | AW-Clayton@wiu.edu | 309/298-1172

Andy Ambriole

Farm location
Roanoke, IN

Organic crops & acreages

- 485 acres of corn, soybeans, & wheat
- 28'x 96' greenhouse for tomatoes

Years farming: 7

Years farming organically: 7

Conventional crops & acres
None personally, but he helps with his family's 1,500-acre conventional farm.

Organic certifying agency
ICO (Indiana Certified Organic)

Livestock enterprises: None.

Standard crop rotation for organic crops

- Year 1: Soybeans
- Year 2: Wheat with clover inter-seeded
- Year 3: Corn with ryegrass in fall as a cover crop

Standard tillage practices for organic crops
Andy uses a Rotavator in the spring.

Most challenging weeds in organic fields
Giant ragweed.

Direct weed control tactics

Cultivation tools
A Kovar tine weeder is used at 5-8 mph in corn and soybeans usually 3-5 days after planting and again 3-5 days later. The most aggressive setting is used pre-crop emergence, and the middle setting is used post-crop emergence. Andy finds that it works best in sandy or dry soil but does not work well in high residue. In addition, a Hiniker cultivator with rotary shields is used at about 5-8 mph, which is a good choice in dry conditions but slabs if the soil is too wet. Andy employs an AcuraTrak guidance hitch for cultivating and would not cultivate without it. Further, a Trimble RTK Autopilot is used to plant near-perfectly straight rows, which makes every operation thereafter easier and more efficient. Andy believes that the rotary hoe also has its place, but it is mostly used on his farm to break the soil crust so that other tools will work better.

Experience with flame weeding
He has tried a 1-year trial of flaming. While Andy believes that he still has a lot to learn, he thinks it is a promising tool.

Experience with organic herbicides
He has sprayed liquid calcium and molasses as a weed suppressant, with mixed results.

Manual labor
Andy employs manual labor occasionally for weed escapes. Andy believes it does not pay to hand weed if the weed pressure is high.

Cropping system strategies for reducing weed pressure

Primary tillage
Andy does not do any fall tillage.

Crop rotation
Andy mostly uses a small grain to help control summer annual weeds.

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Cover crops
Cover crops are Andy's primary approach to weed management. He calls cover crops "weeds with a purpose": bare land wants something growing on it, and he would rather choose which "weeds" grow rather than have nature take over. Andy has found that his cleanest crops have always followed a cover crop.

Depleting soil seed bank
Andy has tried depleting the soil seed bank for a few years but had no success and burned a lot of fuel. Andy looks at his conventional neighbors who have clean fields year after year with no weed seed produced, yet weeds still emerge the next year. He feels the soil seed bank is much bigger than we realize, and killing a few early-emerging weeds does nothing in the long run.

Clean-up strategies
Andy follows the motto "Disk and don't look back!" He asserts that farmers should learn something from their failures, plan for next year, and move on.

Crop genetics for competitive advantage
Andy chooses bushy bean varieties for his farm's 30" rows.

Additional information

Unusually wet conditions
Andy finds that weather ruins the best plans. The last 3 springs have been horrible in his area of Indiana, and he is moving away from intensive tillage weed control for this reason. Andy believes that a weed-suppressing cover crop goes a long way for early season weed control and does not require multiple field passes. Flame weeding is more effective than any tillage tools are when working with wetter soil, but the field still cannot be saturated. Extended saturated conditions lead to anaerobic soil, in which weeds love to grow. Improving soil drainage, naturally and artificially, helps this condition, but it is a long-term solution.

Similarities / differences with local organic farmers
Andy believes that his practices are in line with what other farmers are doing.

Characteristics of effective weed managers
Andy asserts that good organic weed control requires a top-notch manager and several years to correct soil problems.

> "Disk & don't look back! Learn something from your failures, plan for next year, & move on."

Favorite information sources
He prefers networking with other farmers and seeking advice from practical publications.

New weed management strategies
This year Andy is trying a rolling cultivator and a crust buster.

Weed management research needs
Andy would like to see more information about electric weed control and living mulches.

Additional comments
Andy contends that weeds are the primary problem on organic farms, but that they are only a symptom of a soil issue. Andy thinks it would be nice to have a few more effective tools in the toolbox, but he notes that sometimes struggling through a problem is the only option. Additionally, he maintains that a year of properly-planned and well-executed cover crops can do wonders for a problem field.

Glen Borgerding
consultant

Business name
Ag Resource Consulting, Inc.

Years consulting
Glen started consulting in 1984, and his business expanded into organics in 1988. The company became especially busy in the 1990s due to organic exports to Japan.

Main professional activities other than consulting
In addition to consulting, Glen has run a soils lab, worked as a Certified Crop Advisor (CCA), and served as a Technical Service Provider (TSP) for the USDA's Natural Resources Conservation Service.

Main crop rotations used by clients in the Midwest

- Year 1: Corn
- Year 2: Soybeans (sometimes replaced by edible beans)
- Year 3: Small grains (sometimes replaced by an alternate hay crop)
- Sunflowers may follow the small grains

Most common tillage practices used by clients in the Midwest
Glen finds that there are still a number of farmers who use a moldboard plow sparingly, but chisel plows are used more commonly, especially to kill alfalfa. He also has noticed that many field cultivators, disks, and rippers are in use. While quite a few Rotavators are employed, Glen notes that farmers tend to either love them or hate them. His advice is to rotate tillage methods.

Most challenging weeds in organic fields
Glen has observed Canada thistle, cocklebur, patches of giant ragweed, and mustard (seeds of the wild variety can lie dormant in soil for 10-15 years) to be the most challenging weeds.

Regions of service
Approximately 90% of his clients are in Minnesota, and he has some clients in Wisconsin.

Main crops & approximate acres / farms you provide services for annually
On approximately 50 farms that he has served, the main crops are corn, soybeans, wheat, barley, oats, alfalfa, edible beans, and vegetables.

Direct weed control tactics

Mechanical cultivation tools
Glen finds that Buffalo ridge-till cultivators and other heavy duty cultivators work well. Rotary hoes are effective on crust soils, but on loose soils, he believes that tine harrows work better than hoes. Einbock and Hatzenbichler harrows are used more by farmers today (though they can plug due to tighter spacing), whereas Melroe harrows were preferred in the past. Glen notes that Kovar harrows with a 25" tooth and a 45-degree bend near the end are similar in performance to Einbock and Hatzenbichler harrows. While the Kovar's 3-point-mount version allows the operator to use more weight and be more aggressive, it can start hopping at about 4 mph. Although it can be easier to replace tines on the Einbock versus on the Kovar, the Kovar tends to do better in high residue. He also notices that Lilliston cultivators do not seem to be as popular as they were in the past (partially because there are limited replacement parts now available), whereas Buffalo cultivators seem to be much more commonly employed.

Glen finds that hydraulic cat whiskers used to guide cultivators mechanically can be beneficial, but GPS is a much better system. While GPS is expensive, those organic farmers who have developed an effective cultivation method with it tend to be able to work faster, experience less fatigue, and have much cleaner fields.

When working with clients, Glen would like to see harrowing done pre-emergence (at about 4-5 mph) and rotary hoeing once emergence occurs (at about 8-10 mph), followed by tine harrowing twice (about 5-7 days apart). He notes that while corn should not be buried by this process, it is acceptable for soybeans to be partially covered.

Experience with flame weeding
Glen has used flame weeding since the early 1990s. He suggests using a more traditional approach first, wait until the corn is knee high, and then proceed with flame weeding at 3-5 gallons of propane per acre. To finish off the stunted weeds, repeat the process 3-5 days later.

When corn is approximately 3" tall, he recommends flaming a 6-8" swath in the row at about 3 gallons per acre without harrowing or hoeing before, followed by cultivating about twice more. While Glen finds that this approach works well primarily for broadleaves, the presence of a lot of grasses may also require

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harrowing, hoeing, or a mixture of the two methods. He also notes that flamers are not an effective way to kill cocklebur.

Experience with organic herbicides
Glen tried working with acetic acid. A mixture of 30-35% acetic acid was common, but it did not work well. He had to spray often, the plants would turn brown, but would recover 7-10 days later.

Manual labor
He believes that the organic farmers who have the best weed control hire hand labor. About one-third of his clients use this method, and some even pay as much as $150 per acre.

Management on farms with above-average weed control

Characteristics of effective weed managers
Glen believes that some of the most effective weed managers are those who have the right equipment and keep it well maintained; for example, it is critical to make sure that the teeth are long enough if using a tine harrow. Also, it is important to be able to choose the right tool for a particular situation or soil condition, and effective use of a weed flamer will add to a farmer's success. Glen also recommends planning a good crop rotation to control weeds instead of chasing the market, as well as strategically planting near livestock facilities so crops can get adequate nutrients.

Methods for above-average weed control

Primary tillage practices: Primary tillage ranks high in terms of successful weed control.

Crop rotations: Crop rotations are of high importance.

Cover crops / cover cropping systems: While cover crops rank high, Glen notes that they do not always behave as intended and can hurt crop production in some cases.

Soil amendments: Glen finds soil amendments to be of medium importance. Lime, gypsum, and humic acid can improve both soil structure and microbial activity, and gypsum can also help with correcting soil deficiencies. Some farmers also claim that gypsum can decrease weed growth, but it does not produce the same effect on all soils.

Specific methods of depleting the soil bank: He considers depleting the soil seed bank to be of moderate importance. The process of leaving land fallow can cause organisms to go dormant, which can cause phosphorus deficiencies the following year. Further, most farmers cannot afford to leave their ground to lie fallow.

> "A method that works on one farm may not work on another."

Specific clean-up strategies following weed control disasters: Glen notes that cleaning up after weed disasters ranks high in importance, and the process may need to involve disking under the crop. He suggests taking care of any weeds appearing in fields, since failure to do so may cause problems for years.

Selecting specific crop varieties / hybrids for competitive advantage over weeds: He finds selectively choosing crops to be of medium importance, since the process can help with weed control but will not solve existing problems.

Timeliness of direct weed control practices: Glen ranks timeliness extremely high in terms of controlling weeds.

Cultivator adjustment & operation skill: Cultivating is also of high importance, though he notes that a farmer needs to be very accurate in how close he or she is to the neighboring row when cultivating.

Additional information

Unusually wet conditions
Glen suggests trying flaming, but he notes that more propane will be needed for the process when there is a lot of water in the canopy and soil.

Favorite information sources
He consults books, browses websites, and attends conferences. His preferred method of learning about weed management, though, is talking with farmers, although he recognizes that a method that works on one farm may not work on another.

Weed management research needs
Glen would be interested in seeing more research regarding the correlation between weeds and nutrient/mineral levels. He would like to know more about how the diversity of crops and cover crops affects weed pressure.

Lynn Brakke

Farm location
Moorhead, MN

Organic crops & acreages

- 1064 acres of corn
- 365 acres of soybeans
- 678 acres of alfalfa
- 147 acres of kidney beans

Educational background
2 years of college (production ag)

Years farming: 31

Years farming organically: 19

Conventional crops & acres
None.

Organic certifying agency
Oregon Tilth

Livestock enterprises
Lynn has a cow-calf operation consisting of about 90 head of grass breed mixes and sells about 35 head per year as organic/grass-fed beef. He has a 6-month waiting list for customers.

Standard crop rotation for organic crops

- Year 1: Corn
- Year 2: Soybeans
- Year 3: Corn
- Year 4: Soybeans
- Year 5: Corn
- Year 6: Soybeans
- Years 7-9: Alfalfa (for 3 years)

Standard tillage practices for organic crops
Tillage with a chisel plow occurs immediately after harvest, if the weather permits. Lynn will occasionally use a moldboard plow, when needed. A field cultivator is employed 1 or 2 times in the spring, and sometimes a coil packer is used if the soil needs to be firmer prior to planting.

Most challenging weeds in organic fields
Foxtail.

Direct weed control tactics

Cultivation tools
Lynn uses a row crop cultivator with 18" sweeps and rolling shields for controlling weeds in crops on 22" rows. He can cultivate within 1.5" on each side of the crop row using RTK guidance, and mechanical guidance on the cultivator allows the machine to move side-to-side independently; he can cultivate as fast as 10 mph. He may use a rotary hoe for weed control, up to 4 times per year, if needed. A Melroe spring tooth harrow is sometimes used, especially when the weeds are too big for the rotary hoe and if grass is too abundant; he finds that this tool can be used on soybeans as tall as 10".

Experience with flame weeding
Lynn has several flamers. He sometimes uses a flamer on soybeans, but only at the cotyledon stage. A flamer is used for corn at spiking if the rotary hoe does not work well enough, as well as when the corn is about 3' tall.

Manual labor
Hand weeding is important at Lynn's farm, especially if there is thistle in the corn. Soybeans typically are walked 2 times using about 15 people.

Cropping system strategies for reducing weed pressure

Primary tillage
Lynn believes it is critical, and he prefers to do it in the fall.

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Crop rotation
Crop rotation is very important to Lynn. He would like to see 5 to 7 crops in rotation if it is possible, in order to have that many cash crops on his farm.

Cover crops
Lynn finds that cover crops do not seem to work that well as far north as his farm in Minnesota.

Depleting soil seed bank
Lynn tried leaving some fallow fields in the past and is thinking about having more fallow fields again.

Clean-up strategies
He sometimes moldboard plows if too many weeds go to seed.

Crop genetics for competitive advantage
Lynn looks for this in soybeans. He quit raising natto beans, because they were not competitive enough against weeds.

Additional information

Unusually wet conditions
Lynn uses a flamer and tine harrow when conditions are wet.

Similarities / differences with local organic farmers
Lynn finds that many practices are similar, but some organic farmers plant winter rye in the fall and either clip or roll it prior to planting soybeans into the rye. The rye is clipped at about 6".

Characteristics of effective weed managers
Lynn believes that RTK guidance seems to help. Also, farmers who have good attention to detail and start organic farming with a clean seed bank seem to do well.

Favorite information sources
Lynn attends conferences and talks to other farmers, but he does not feel there is enough information about organic weed management. Lynn asserts that there needs to be new and different information pertaining to organic weed management based on research.

> "Farmers who have good attention to detail & start with a clean seed bank seem to do well."

New weed management strategies
Lynn has been experimenting with a 1970's John Deere machine that had been used to thin sugar beets. He hopes he can modify it to take weeds out of crop rows, but he cannot get it to accurately sense the corn plant yet.

Weed management research needs
Lynn would like to see the economics of having fallow ground in organic farming and wants to know if it is worth it over a period of years. He would also like to learn why certain crop rotations bring about certain weeds, as well as what is taking place in the soil that affects the weeds.

Additional comments
Lynn finds that a controlled traffic system, using 33'-wide (planter and row crop cultivators) and 99'-wide (flamer, rotary hoe, and spring tooth harrow) equipment, seems to help with weed control. Lynn recently changed his track size on his tillage tractor and went from 16" to 25" wide to reduce psi and ground compaction, because there were too many weeds growing in the traffic areas. He also went back to angling the tillage passes; since doing these two things, he has seen fewer weeds in the track areas. The recent addition of front duals on his planter tractor has also seemed to reduce weed pressure and increase yields.

Mike Findlay

Farm location
Caro, MI

Organic crops & acreages

- 750 acres of corn
- 500 acres of spelt
- 850 acres of beans (snap, dry, & soy)

Educational background

Some college

Years farming: 40

Years farming organically: 15

Conventional crops & acres

100 acres of transitional.

Organic certifying agency

GOA (Global Organic Alliance)

Livestock enterprises

None.

Standard crop rotation for organic crops

- Year 1: Spelt (small grain) / frost seeded clover
- Year 2: Corn
- Year 3: Beans (mainly dry)

Standard tillage practices for organic crops

Mike plows in the fall every year, field cultivates 2-3 times before planting, and disks only if weeds are too tall for the field cultivator or sometimes to work in straw if too thick. He notes that 1-1.5 tons per acre of poultry litter is broadcast after the harvest of small grains and beans, and then moldboard plowed.

Most challenging weeds in organic fields

Grass (mainly foxtail) in the last couple years.

Direct weed control tactics

Cultivation tools

Mike has 2 Orthman single-sweep cultivators, which had 16" sweeps before he began using RTK guidance on his tractor. He is now on 22" row crop spacing and can cultivate as fast as 5 mph with GPS guidance, using 18" sweeps and leaving only 2" on either side of the crop to get weeds that are close to the crop.

He feels that having a 16-row mounted planter (on 3 point hitch) also helps keep the planter from moving off a straight line especially on rolling ground, helping to make cultivating even more successful. A 60'-wide tine weeder is used about 4 days after planting to control small weeds. He also made a double rotary hoe a couple years ago that is used for weed control.

Experience with flame weeding

Mike has 2 flamers. He started out with 2 burners over the top of each row, but with RTK guidance can get by with only one burner for each row, which covers an 8" burn area. The flamers are used every year for both corn and beans with a pressure of about 45 psi.

The corn is burned only at the 2- to 3-leaf stage while the growing point is still below ground and the weeds

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are about 1-2" tall. Beans are also flamed at a very young stage.

Experience with organic herbicides

Mike tried one, but without any success.

Manual labor

Manual labor is used mainly for beans on Mike's farm, but it can get very expensive. The cost can be as high as $150 per acre, but also as low as $10 per acre depending on the year and rainfall.

Cropping system strategies for reducing weed pressure

Primary tillage

Mike thinks primary tillage is very important. Moldboard plowing is done every fall. Disking and chisel plowing are also performed, but infrequently.

Crop rotation

Mke considers crop rotation to be a key part of his weed management.

Cover crops

Mike does not use many cover crops. Just clover is used, but it is primarily grown for its nitrogen-fixing abilities.

Depleting soil seed bank

Mike has had success with controlling quackgrass and sow thistle with a lot of tillage after the small grain has been harvested in July. He might chisel plow the wheat stubble, disk if necessary to prepare for field cultivating, and then field cultivate as many as 4 or 5 times.

Clean-up strategies

Mike does not have any specific clean-up strategies.

Crop genetics for competitive advantage

Mike does not really use this practice.

Additional information

Unusually wet conditions

Mike finds that the flamers are good tools to use in these situations, and he believes that having tiled fields for proper drainage is helpful.

> "Farmers should not be afraid to try new things."

Similarities / differences with local organic farmers

There are about 10,000 acres of organic ground in Mike's area, and most of the farmers operating that ground seem to be using very similar practices.

Favorite information sources

Mike learns primarily from other farmers and some field days.

Additional comments

Mike believes that farmers should not be afraid to try new things. He has cultivated beans that were only about 1" tall, throwing soil to form a slight ridge on each side of the row. He then rotary hoed it the same day, leveling the ridges and thus covering small weeds in the row. This resulted in many small weeds within the row being covered without covering the crop.

Gary McDonald
consultant

Business name
Gary McDonald

Years consulting: 28

Years of organic farming experience: 28

Main professional activities other than consulting
Farming and sales

Educational background
High school

Main crop rotations used by clients in the Midwest

Year 1:
- Alfalfa
- Clover
- Grass mix

Year 2:
- Corn (inter-seeded with cereal rye)

Year 3:
- Soybeans

Year 4:
- Wheat or oats (inter-seeded with alfalfa, clover, and grass mix)

Most common tillage practices used by clients in the Midwest
Gary notes that offset plowing disks are used as the primary tillage process, tandem disks are secondary, and field cultivators are used just prior to planting to remove a flush of weeds.

Most challenging weeds in organic fields
Cocklebur, giant ragweed, and foxtail are most predominant, but Gary finds that they can be fairly easy to control.

Direct weed control tactics

Mechanical cultivation tools
Gary recognizes that GPS is coming into the picture and will offer more precision for many farmers. He believes that it is very important to invest time in choosing the right tool and making sure it is set properly. When it comes to row crop cultivators, it is critical to select a tool that can be set precisely. He prefers a shovel row crop cultivator with solid shanks and slide fenders. This can be used for row crops, like corn and soybeans; he suggests first setting the speed to a minimum of 4.75 mph, properly setting the depth for best soil flow (noting that soil moisture will affect the depth setting), and then adjusting the pitch of the shovels to achieve the desired speed. No matter how small the crop is, it is very important to maintain a minimum speed of 4.75 mph, and as crops grow, more speed will help to eliminate unwanted plants. For the best timing, Gary suggests watching for a time when there is the most differentiation between the size and height of the unwanted plants versus the crop.

Regions of service
Illinois and Indiana

Main crops & approximate acres / farms you provide services for annually
Gary consults for approximately 2,500 acres on 10 farms. The main crops are corn, soybeans, oats, wheat, alfalfa, clover, and grasses.

Experience with flame weeding
Gary does not have experience with flame weeding.

Manual labor
Gary's clients use very little if any manual weed control.

Management on farms with above-average weed control

Characteristics of effective weed managers
Gary observes that farmers can become more skillful on the topic when they have the chance to work with someone who has more experience. He enjoys assisting the clients to help them find solutions for successful weed management.

Methods for above-average weed control
All of the farms that Gary presently works on have been farmed in such a way that unwanted plants are very dominant. He finds that with excellent row crop cultivation, though, clean crops can be achieved as early as the first year.

Primary tillage practices: Gary thinks that proper primary tillage techniques are essential. They are some of the first decisions made with the goal of achieving control of unwanted plants. How

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a farmer manages crop residues has a defining effect on soil biology, chemistry, and physics, all of which affect which plants grow, how many plants grow, and the rate of growth.

Crop rotations: Crop rotations are an essential ingredient, but proper understanding of why and how to rotate in order to arrive at the desired results is necessary. Gary notes that different crop mixtures do different things for the soil biology, chemistry, and physics.

Cover crops / cover cropping systems: Not unlike crop rotations, cover crops are another essential ingredient in weed control. Knowing what the practitioner desires to accomplish, and combining that with a strong knowledge of what each specific cover crop can achieve, can help to create the desired results.

Soil amendments: In Gary's opinion, soil amendments are a wild card. Many can aggravate the situation, while some can prolong the inevitable. On the other hand, proper choice of such amendments can speed up the process of achieving a soil where unwanted plant pressure becomes manageable.

Specific methods of depleting the soil bank: While Gary find this to be less essential, it does deserve its place on the list of techniques for controlling unwanted plants. Certainly it goes without saying that plants that are not allowed to go to seed, and plant flushes that are eliminated before planting, will decrease the number of viable candidates waiting in line to take their turn to grow and strike fear in the farmer.

Specific clean-up strategies following weed control disasters: Gary's advice is to return to step number one and repeat.

Selecting specific crop varieties / hybrids for competitive advantage over weeds: Gary thinks it is important to be aware of overall pressures from nature's soil-building plants, pressures from unwanted plants, and the operator's own skill level. If an operator's skill is very high, he or she will have more options when choosing plant species or hybrids. An operator with less experience should stick with a fast-emerging crop that has early fast-growth capabilities.

Timeliness of direct weed control practices: In some operations this is of the utmost significance, according to Gary; however, due to wet soil conditions, some if not many steps of the weed control system may not be performed at the ideal time. This increases the importance of doing all of the steps as well as possible, so success can still be achieved even when some or many steps cannot be done to excellence.

> "Different crop mixtures do different things for the soil biology, chemistry, & physics."

Cultivator adjustment & operation skill: In Gary's opinion, this is a make-or-break step. He considers it to be a rescue some years, when it can make the difference between a miserable failure and a smashing success. In a year when at least 50% of the steps leading up to it are a success, cultivation can create a near-perfect field that is free of all natural soil-building plants.

Additional information

Unusually wet conditions
Gary finds that all methods addressed earlier in this interview are beneficial, even in wet conditions.

Favorite information sources
While Gary gains knowledge from books, websites, and conferences, his preferred source of information is through conducting farm observations.

Weed management research needs
Gary looks forward to seeing more research done on companion planting, and cover crops or plants that possess allelopathic properties.

Additional comments
Gary believes that natural plants have a divine purpose in the ecosystem, so we have a choice. We can either work at assisting the fulfillment of that divine purpose, or we can get used to having a "nature conservatory" (a weed patch) for a farm. He stresses that the first and foremost plant control tool is the human brain, so we are at a great advantage over plants: they grow according to their set of responses to specific stimuli characteristics, and while they do mutate, thankfully they do not have a brain. Since humans have dominion, Gary asserts that it is our choice as to whether or not we have unwanted plants.

Scott Shriver

Farm location
Jefferson, IA

Organic crops & acreages

- 700 acres of corn
- 700 acres of soybeans
- 300 acres of small grain
- 100 acres of alfalfa

Educational background
Construction Engineering, Iowa State University

Years farming: 17

Years farming organically: 13

Conventional crops & acres
None.

Organic certifying agency
OCIA (Organic Crop Improvement Association) Chapter 1 of Iowa

Livestock enterprises
None.

Standard crop rotation for organic crops

- Year 1: Corn
- Year 2: Soybeans
- Year 3: Corn
- Year 4: Soybeans
- Year 5: Small Grain

Standard tillage practices for organic crops
Scott believes that nothing is "standard". At his farm, they do a lot of tillage with 40'-wide equipment to manage residue, incorporate cover crops, and control weeds.

Most challenging weeds in organic fields
Foxtail and waterhemp.

Direct weed control tactics

Cultivation tools
After planting but before emergence, Scott likes to "blind harrow" with an Einbock Tined Weeder. This can be done fairly quickly (4-6 mph). After crop emergence and before the crop is large enough to cultivate, they will either rotary hoe or tine weed the crop; the hoe is fast but not as thorough as the Einbock, which operates at only 2 mph. Their first cultivation is done with a Danish Tine style cultivator, which has 5 shanks per row. The shanks next to the row are points (not shovels), allowing them to run very closely to the row and not throw dirt over the crop.

Scott's farm also has a cultivator (3 shanks per row with standard shovels) with tunnel shields for small crops. Additionally, there are 2 rolling cultivators (Lilliston style), one set to pull dirt away from the row and one set to roll dirt into the row. They also have a couple of cultivators set for medium sized crops (3-5 mph) and a couple of single-sweep cultivators for "lay by" or final cultivation (run at a maximum speed of 6-8 mph). Scott believes that having lots of tools with different purposes allows them to fine-tune each one for a specific purpose. Once a cultivator is set for a specific task, there is not a lot of adjustment needed later; they can just pick the cultivator for the job, hook it up, and go.

Scott's farm has 4 tractors that can run in the crop, and at times all 4 are in use. Two of these are set up with RTK guidance. They plant with the guidance to make the rows straighter, which in turn makes the cultivating easier and allows them to set the equipment more tightly. Cultivating with the guidance is not completely automatic, but it lets them run faster and look behind more without doing as much damage to the crop. Scott also highly recommends a hydraulic third link on a tractor. This makes changing cultivator depth, rotary hoe, and tined weeder pressure adjustments much easier, so they can be done more frequently and on the go.

Experience with flame weeding
Scott has a 16-row flamer that they initially used only as a rescue tool but now use a lot more. It is a must-have tool for them, but at the same time Scott feels that the crop can be set back as much as the weeds, especially when flaming small crops.

Experience with organic herbicides
Scott has no experience with organic herbicides.

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Manual labor
Scott has hired crews to walk both corn and soybeans. The corn has been done rarely, mostly to catch patches of bad weeds like cocklebur, sunflower, and ragweed every year. The soybeans are done almost always, although this past year they needed to be walked very little. Scott has also found that late-planted soybeans (after June 20th) are easier to keep clean and do not need to be walked; however, they suffer in yield loss due to late planting.

Cropping system strategies for reducing weed pressure

Primary tillage
Scott's definition of "primary tillage" has more to do with residue management and eliminating compaction than with weed control. He has noticed that plowed ground seems to stay somewhat cleaner at times.

Crop rotation
Scott believes the small grain year really changes the timing of tillage and weed emergence, which keeps the weeds from adapting to the same weed control methods every year.

Cover crops
Although cover crops are supposed to express some allelopathic effects against weeds, Scott has not observed this. He employs cover crops mostly for soil building and erosion control.

Depleting soil seed bank
Scott does not really use any specific methods.

Clean-up strategies
Scott prefers to plow fields deeply, in order to bury the weed seed and residue.

Crop genetics for competitive advantage
Scott tries to pick fast-emerging and vigorous early-growth crops. He believes the most important thing for weed control is to keep the crop ahead of the weeds.

Additional information

Unusually wet conditions
The farm experienced 3 extremely wet years in a row, and Scott found the most important thing was to be ready with multiple rigs so that when the weather did allow them to be in the field, they were there in full force. They discovered that the flamer could run a day or two before the cultivators, because it does not till the ground. Another thing that helps them is running Caterpillar tractors with tracks and all 16-row equipment; this makes a traffic pattern that is hard enough to run on more of the time, but it eliminates any compaction everywhere else.

Similarities / differences with local organic farmers
In Scott's view, everybody does things a little differently in order to fit their equipment and style, but there are similarities among practices, too.

> "The most important thing for weed control is to keep the crop ahead of the weeds."

Characteristics of effective weed managers
Scott sees that other farmers are similar in that everyone experiences successes and failures. He cannot identify a particular "edge", except that when he sees failures it is usually due to the farmer not being timely with his or her practices.

Favorite information sources
Scott prefers conferences, field days, and consulting with other farmers.

New weed management strategies
Scott is building another flamer that will have tunnel shields and tops to hold in the heat. This is following the research conducted by the University of Nebraska.

Weed management research needs
Scott is not sure of any specific research topics but is interested in the effects of nutrient imbalance, or gypsum application on weed seed emergence.

Additional comments
Scott believes that timeliness is the most important aspect of controlling weeds.

Larry Shrock

Farm location
Middleton, MO

Organic crops & acreages

- 350 acres of soybeans
- 200 acres of corn or popcorn
- 40 acres of hairy vetch & rye for seed
- 26 acres wheat
- 70 acres of hairy vetch with wheat for seed
- 45 acres of sunflowers

Note: 4 sons and 2 sons-in-law are also part of the farming operation

Years farming: 38

Years farming organically: Since mid-1990's

Conventional crops & acres
None.

Organic certifying agency
OEFFA (Ohio Ecological Food & Farm Association)

Livestock enterprises
Larry has a few beef cattle.

Standard crop rotation for organic crops
Close to half of the Shrock farm is planted to soybeans every year. All soybeans are over-seeded with hairy vetch and tillage radishes, which are broadcasted the first part of September with a High Boy rig. Larry started using the radishes in 2011.

The rest of the Shrock farm is planted to corn or popcorn, and a small amount of grain such as rye or wheat inter-seeded with hairy vetch. The ground with hairy vetch will be double cropped to buckwheat the first of August, and all are harvested for seed. A Carter Day separator is used to separate the hairy vetch seed from the grain (rye or wheat) seed. Sunflowers are occasionally planted on ground intended for corn if the hairy vetch cover crop stand or vigor is weak. Sunflowers are also occasionally double cropped after the small grain crop.

Standard tillage practices for organic crops
Hairy vetch cover crop is flail mowed the same day corn is planted. Then a dry chicken litter blend with a dry humate product is broadcast using a litter truck spreader equipped with GPS guidance. Next, they use an IH 490 disk with 22" blades at 9" spacing to incorporate the vetch and litter blend. The 9" disk blade spacing allows the disk to till deeper than 7.5" spacing will allow, which does a better job of incorporating the cover crop. Lastly and just prior to planting the corn, a Lely power harrow is used for the final tillage at 4.5-5 mph. This tillage tool creates a good seed bed and handles cover crop residue well.

In the fall (following soybeans) where the small grain and hairy vetch will be grown, tillage will only be done if a weed such as cheat is present; otherwise the small grain and hairy vetch are no-till drilled. In the fall (following corn) the corn stalks are flail mowed, sprayed with Organic Gem liquid fish fertilizer and molasses, and tilled with an offset disk, leaving the ground rough over the winter.

Oats are broadcast in the spring on the rough disked ground, and the seed is incorporated with a Landoll Tilloll. This tillage tool is good at creating a smooth soil bed and stimulates a flush of weeds. Prior to planting the row crop, the flush of weeds will be eradicated by the same tillage employed to till under the cover crop oats. Larry tried tilling weeds and oats in the past using the Landoll Tilloll at 3-4" deep, but it plugs if the oats are more than 8-10" tall. He has better success, in this scenario, by first disking the oats followed by tilling with a Lely Power harrow with the power harrow set at 2-3" deep. If the oats have headed out at the time that the soybeans need to be planted, the oats will be flail mowed before tilling them. Soybeans are usually planted on the same day that the oats or rye as cover crops are incorporated.

Most challenging weeds in organic fields
Cockleburs.

Direct weed control tactics

Cultivation tools
Larry feels that he has very good weed control. A rotary hoe is used for soybeans and sometimes in corn if it has foxtail, since the flamer is not as good as the rotary hoe at killing foxtail. Soybeans are rotary hoed when they can be "rowed" and not earlier, because the soybeans can be damaged too much when they are in the more vulnerable hook stage. If a rain occurs shortly after the first hoeing, a second one might be needed.

Larry usually cultivates corn and beans two times. He has two 8-row (36" row spacing) S-tine cultivators, which work well with cover crop residue and do not plug. The first cultivation is done at about 5-5.5 mph (in 2-3" tall beans) with a cultivator that has five 7.5"-wide sweeps (per row) where the outside tips are positioned 6" apart, or 3" apart on each side of the row. This first cultivator also has modified rolling

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shields that are rotary hoe wheels/spoons, angled with a front opening of 8" and a rear opening of 2" to allow the crop row to feed through the openings. The second cultivation is done as fast as 7 mph with no rolling shields. This second cultivator has 4 sweeps (per row) that are positioned 11" apart, or 5.5" on each side of the row. An earlier model Hiniker cultivator is used during wet seasons. It has hillers that can throw a lot of dirt, which covers the taller weeds.

Larry emphasizes it is important to have good cultivator sweeps. The sweeps behind the wheel tracks (more compacted ground) are replaced at 75-100 acres and the others at around every 200 acres of use. The sweeps still look good when they are replaced, but they do not work as well for weed control as new ones.

Experience with flame weeding
Larry uses flame weeding every year for corn using a 24'-wide, 8-row flamer. Each burner on the flamer is 6" wide and spaced 8" apart.

Larry feels the best time to flame corn is when the third leaf is sticking up or soon afterwards if you cannot flame on time. The position of the burners is such that the whole corn plant as well as the weeds surrounding it are burned. The result is corn that appears severely damaged but grows out of it and is fine. In contrast, most of the weeds do not survive.

If a second flaming is needed, he tries to flame when the corn is 6-8" tall without flaming into the whorl. He flames below the whorl; otherwise the corn plants will suffer significantly. The burners are set at about a 35-degree angle, both at this time of flaming and the first time, although they are brought upward the second time by shortening the top link of the 3-point tractor hitch. Since the gauge wheels are on the front of the flamer unit by about 3.5-4', he can use the gauge wheels as a pivot point to raise the flamers when the top link is reduced.

Experience with organic herbicides
Larry has tried Restore Extra, which seemed to weaken cockleburs but was not powerful enough to get an effective kill.

Manual labor
Larry hires youth from church at $9-$10 an hour to weed beans, but they do not make the technique a priority. Their costs were about $3,000 last year over approximately 100 acres.

Cropping system strategies for reducing weed pressure

Primary tillage
The Shrocks rarely use a moldboard plow, which is used only in sod ground or pasture that is going to soybeans. Most of the primary tillage tools are used to incorporate cover crops. Larry finds that secondary tillage is more important than primary tillage for eradicating weeds.

Crop rotation
Larry considers crop rotation to be very important.

Cover crops
Larry feels cover crops are an important weed management strategy. He grows hairy vetch prior to corn as well as oats prior to beans, which are both incorporated into the soil the same day of planting the crop. Larry feels if you have a good dense cover crop (like hairy vetch) turned under and have ideal soil moisture the crop (such as corn) will do very well and have very little weeds. This ideal situation occurred for Larry a couple of times, and he had to cultivate the crop only once. Too many times the ground seems to dry too quickly for the method to work just right. It seems to Larry that having the right amount of heat building up during this decomposition process is important for weed control and good for the crop seed/seedlings. Larry notes that it is important to plant the crop the same day of incorporating the cover crop, or there will be issues with seedling emergence and vigor. He suggests that if you cannot plant the same day, then it is best to wait at least two weeks.

Larry also broadcasts oats, as a cover crop, over slightly rough ground in mid- to late-April, allows them to grow for around a month, and tills them under just hours before planting soybeans because they seem to suppress weeds in the soybean crop. Fall seeded cereal rye has been used as a cover crop prior to planting soybeans, but Larry prefers to use oats as a spring cover crop since it is easier to till under and eradicate.

Depleting soil seed bank
One method Larry tried about 10 years ago worked very well with benefits lasting for years. In a 40-acre field he had a 12-acre section that had an unacceptable amount of weeds, so he tilled under the weeds 3 or 4 times throughout the season and never allowed the weeds to produce seed. In August, he planted buckwheat and harvested the seed from it in the fall. Allowing multiple flushes of weeds to get terminated and growing the buckwheat apparently provided excellent results for this 12-acre section previously plagued by weeds, because the following 5 or 6 years it had much fewer weeds and higher crop yields.

Larry also tills the ground in the summer, after the small grains with hairy vetch have been harvested in order to eradicate weeds as they emerge, and he discontinues by the first of August in time to plant the buckwheat. Eradicating the weeds will lead to soil

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moisture conservation, which is essential to get the buckwheat established well.

Clean-up strategies
If necessary, Larry will destroy the crop and weeds and replant. If it is too late to replant beans, he might plant buckwheat for seed around the first of August.

> "Organic farmers have had to learn a lot on their own."

Crop genetics for competitive advantage
Larry tries to get more vigorous varieties of crops so they can compete well with the weeds.

Additional information

Unusually wet conditions
The Shrocks built bed hillers on their planter that consists of two disks per row placed ahead of the planter unit. This allows them to plant on a 3"-tall ridge/raised bed, which leads to better water drainage and a good air-to-water ratio near the crop seed. The ridges even stay mellow after heavy rains, but still form a crust for effective rotary hoeing.

It is possible to be delayed by rain until late June and still get good soybean yields. Larry has planted a group 4.2 soybean on June 25th that yielded 56 bushels per acre. Soybeans planted this late might be filling out the pods in early September when it typically starts to rain more. Timely rains during pod fill will boost the yield enough to compete with the earlier planted beans.

Similarities / differences with local organic farmers
Larry feels he is probably a little more particular in all the steps. His soybean population might also be higher than what most organic farmers use. He plants 210,000 soybeans per acre on 36" row spacing and believes he gets better weed control and bean yields as a result.

Characteristics of effective weed managers
Larry works with a lot of organic farmers, and he believes that the more successful weed managers have livestock in their operations and do a lot of rotating out of hay and pasture into row crops.

Favorite information sources
Larry's preferred sources of information are books, conferences, other farmers, and on-farm experimenting.

New weed management strategies
Larry recently bought an old detasseling machine. He plans to equip it with an orbit motor and blades to cut weeds above the bean canopy. The machine is also used to seed hairy vetch over the top of standing soybeans.

His main double rotary hoe has wheels/spoons that are 1.75" apart from each other and consist of 5 per row. This double rotary hoe is good for soybeans but a little too aggressive for corn, so he is thinking of using just a single rotary hoe for weed control in corn.

Weed management research needs
Larry wishes universities had been doing more organic weed control research decades ago. Organic farmers have had to learn a lot on their own, but he is glad to see the research that is currently going on. He would like to know more about soil imbalances or soil conditions that make certain weeds thrive or be suppressed.

Additional comments
It is important to plant beans, not corn, after sod. Beans will do well but corn does not seem to, according to Larry and other organic farmers. Larry prefers to have a system in place, such as his fall-applied materials, to promote decay of residue and weed seeds while on top of the ground. Immediately following the fall crop harvest, he will spray 2 gallons per acre of fish emulsion, a humic acid material or gypsum, molasses and a biological product to promote this process. In the spring, he might also add a micronutrient package to the mix if tests indicate there is a need.

Larry emphasizes it is important to include cover crops in the system and handle them properly. He does his best to incorporate the cover crop and plant the cash crop the same day.

Having a good fertility plan in place is important and can ultimately affect weed control. For his corn ground, Larry first flail mows the cover crop such as hairy vetch, next apply chicken litter (1-1.5 tons per acre) with dry humic acid material (about 75 pounds per acre), followed by a disking, then use a Lely power harrow, and plant the same day. He will use a compost turner to mix the chicken litter and humic acid material and/or gypsum. The gypsum is used when the soil needs sulfur according to soil test results. Another important practice Larry utilizes is concentrating 2/3 of the fish/humic acid mixture into a 9-10" band in the row, at planting, while 1/3 of the mixture is dribbled underneath the crop seed. This provides more fertility for the crop and less for the weeds outside the band, thus giving the crop a competitive edge over the weeds.

Victor Shrock

Note: Sons Kendall and Derek farm with Victor

Years farming: 52

Years farming organically: Started transitioning in 1997, and everything was certified organic in 2003.

Conventional crops & acres
None.

Organic certifying agency
ICO (Indiana Certified Organic)

Livestock enterprises
Kendall has 150 beef cows (the feed is organic, but not certified). Derek has 12,000 organic layer chickens.

Standard crop rotation for organic crops

- Year 1: Corn
- Year 2: Soybeans
- Year 3: Small grain (wheat, oats, or barely) that is frost seeded with alfalfa or clover

Standard tillage practices for organic crops
Victor uses a disk ripper on corn residue and chisel plows soybean residue. He plows some of his heavier ground with a mini moldboard plow and chisel plows his lighter ground. Most of the tillage is done in the fall, but in the spring he runs a soil finisher, a diskavator, one or two times prior to corn. On his alfalfa and clover ground he uses the mini moldboard plow and sometimes uses a chisel plow.

Most challenging weeds in organic fields
Giant ragweed, which came in from the perimeters, has become the primary weed in the last 3 or 4 years. Victor has discovered that growing buckwheat, which he plants after oats around the first of August, decreases the amount of giant ragweed. He then harvests the buckwheat. Victor considers velvet leaf to be the second worst weed on the farm.

Farm location
Tampico, IL

Organic crops & acreages

- 472 acres of corn
- 534 acres of soybeans
- 251 acres of oats
- 125 acres of wheat
- 315 acres of hay & pasture
- Last fall (2011): he had 40 acres in barley

Direct weed control tactics

Cultivation tools
Victor uses RTK GPS guidance for both planting and cultivating, and he uses a nudge button to move the cultivator 1" to the side if needed. The cultivators are 40' wide to match up with the 40' wide planter. The first time he cultivates corn (when it is about 3" tall) he uses a Lilliston rolling cultivator, and he travels 4-5 mph with rolling cultivator units about 5-6" away from each other. A Sukup single sweep cultivator and Hiniker cultivator are used on the second cultivations at 2-3 mph with sweeps also set 5-6" away from each other. The same two cultivators are also used on the third cultivation, but a ridging wing is attached and used in corn. He cultivates at 4-5 mph during this cultivation and is able to throw an 8-10"-tall ridge of soil around the corn plants. He does not do this because he is in a ridge till system, but because he wants to cover as many weeds in the rows as possible. On the third cultivation he also draws in the top link to raise the sweep tips enough to avoid pruning crop roots. Victor is satisfied most of the time with how the cultivators control weeds.

He rotary hoes his soybeans when they are just emerging, again when they are a few inches tall, and a third pass when needed. The corn is rotary hoed usually at the spike stage. He tries not to rotary hoe corn more than this one time, because the hoe can damage the corn stand too much. The 40'-wide rotary hoe will operate 4,000-5,000 acres until the steel wheels and bearings should be replaced.

Experience with flame weeding
Victor uses a homemade flamer when corn is small and sometimes when corn is taller with flame aimed

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under the leaves. Dennis Lutteke provided the burners. Initially, he used an 8-row cultivator tool bar for the flamer set up and later converted to a 40' flamer. Flaming at about 4-4.5 mph, his flamer is set at 35 psi and uses about 5-7 gallons per acre of propane fuel. He varies the speed depending on how big the weeds are; for example, slower speeds might be needed for controlling giant ragweed. He checks the effectiveness of the flaming on weeds by seeing if his thumbprint shows up on the leaf. If he sees his thumbprint, he knows the weed has been damaged enough to most likely terminate it.

> "Most organic farmers seem to have similar challenges with weeds."

Manual labor
Almost every year, Victor hires people to walk soybeans, which costs about $40-$60 per acre.

Cropping system strategies for reducing weed pressure

Primary tillage
Victor finds that primary tillage is important.

Crop rotation
Crop rotation is also vital on his farm.

Cover crops
Cover crops are important. Victor uses buckwheat, clover, and oats in spring ahead of soybeans. Sometimes he grows rye before soybeans, but it can be more risky because rye grows quickly and is more difficult to eradicate.

Depleting soil seed bank
Victor has better luck in corn ground just tilling once in the spring within a day or two of planting. The bean ground usually requires two tillage passes due to being planted later.

Clean-up strategies
Victor commonly uses the weed flamer and one time had to till 25-30 acres of weedy soybeans before the weeds produced mature seeds. The main problem was giant ragweed. In this case, soybeans were planted in early May and tilled under at the end of May.

Crop genetics for competitive advantage
Yes, Victor found a couple of good bushy beans that he prefers to plant because they grow faster than most other varieties, which helps them to compete better with the weeds.

Additional information

Unusually wet conditions
Victor uses a flamer, but he finds that it can even be too wet for that at times.

Similarities / differences with local organic farmers
Other than perhaps the bean weeder he fabricated (as described in the next-to-last question, below), Victor believes that his practices are similar to those of other farmers.

Characteristics of effective weed managers
Victor thinks that most organic farmers seem to have similar challenges with weeds.

Favorite information sources
Victor likes attending the ACRES conference and the MOSES conference.

New weed management strategies
Victor made a 20' weeder, on which individual row units are moved side to side by hand, by means of 8 people for the 8 rows. The spinning weeders are made from the pickup teeth on a John Deere baler with the bottom inch bent almost at a 90-degree angle. He uses the top link to adjust the pitch of the weeders. Victor first made a 4-row weeder in 2010 and then made an 8-row version in 2011. He uses this equipment mostly in beans, but some in corn.

Weed management research needs
Victor would like to see more research done using Bezzerides wheels to control weeds when the crops are small.

Allen Williams

Farm location
Cerro Gordo, IL

Organic crops & acreages

600 acres total:

- Corn
- Soybeans
- Cereal grain

Educational background
Bachelor's of Science in Accounting

Years farming: 40

Years farming organically: 16 (Ridgeline Farm Inc.)

Conventional crops & acres
1,000 acres total:

- Corn
- Soybeans

Organic certifying agency
ICO (Indiana Certified Organic)

Livestock enterprises
None.

Standard crop rotation for organic crops

- Year 1: Corn
- Year 2: Soybeans
- Year 3: Cereal grain (usually wheat, but can also be barley, oats, and rye)

The markets have a strong influence on what crops Allen grows.

Standard tillage practices for organic crops
When working with corn, Allen tills cover crops 3 times with a Case IH True Tandem vertical tillage tool, and he tills with a field cultivator just prior to planting corn. He then rotary hoes 3 times, cultivates the crop twice, and chisel plows following harvest. For soybeans, Allen works the ground with the true tandem, field cultivates twice, rotary hoes 3 times, and cultivates the crop 2 or 3 times. Following soybeans and prior to planting wheat, Allen will spread 2 tons per acre of chicken litter and will till the ground once with the True Tandem vertical tillage tool.

Allen's tillage practices differ when working with wheat. First, he works the ground with the True Tandem for the seedbed. Following wheat harvest, the ground is tilled with the True Tandem twice for weed control if the frost seeded clover did not establish. Another pass with the True Tandem will occur in September to prepare the seedbed for establishing rye with hairy vetch, so there will be a cover crop through the winter and into early spring. This same tillage tool will be used around late April to kill the cover crops. If conditions and time allow, Allen likes to use a culti-packer / mulcher just prior to planting the crop, in order to provide a firm and uniform seedbed. He finds that it also seems to help the soil to preserve moisture and will encourage a flush of giant foxtail, which can usually be controlled by rotary hoeing. Allen notes that he currently is using 24'-wide and 34'-wide Case IH True Tandem vertical tillage tools, but he will be selling the 24' and using just the 34' next year.

Most challenging weeds in organic fields
Giant foxtail, velvet leaf, and Canada thistle.

Direct weed control tactics

Cultivation tools
Allen uses a 40' Yetter Rotary Hoe at 15 mph with no guidance. He finds that the first pass is the most important, which is for pre-crop emergence. It is also used during and after emergence, and Allen is satisfied with this technique. A 40' Case IH 1840 row crop cultivator for 30" row crops is used at 3-7 mph. The sweeps are set to get as close as 3" on each side of the crop. Prior to employing RTK, Allen used cat whiskers (wands) to sense the crop during cultivation, which in turn allows the mechanical hydraulic guidance on the cultivator to work. He has used RTK for various field operations for 4 years, and he uses RTK guidance to drive the tractor while he watches the cultivator most of the time. Because his seat rotates, watching the crop behind him does not cause any discomfort. If Allen sees that the cultivator needs to move over just a little, he will use a nudge button on the RTK guidance monitor to move the tractor and cultivator. The crop is planted using RTK, but the fact that the planter is farther back than the cultivator can lead to slight planter drift issues at times. This is a main reason why the cultivator does not always follow the same path as the planter, even though RTK was used for both. Allen notes that this particular cultivator

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needs improvements due to vine buildup during final cultivation, so he is not completely satisfied with it.

Experience with flame weeding
Allen tried flame weeding several years ago, but he thought it was too expensive and provided limited success.

> "Timing is critical. Don't wait even one day to control the weeds."

Manual labor
Each year Allen hires male and female migrant workers at about $10 per hour to hand weed all soybeans, and he spends $75-$175 per acre. There are usually 20 workers who will typically just pull or cut broadleaf weeds, but this year with the drought he feels it is important to target all of the weeds.

Cropping system strategies for reducing weed pressure

Primary tillage
Allen uses the Case IH 330 True Tandem, both to stimulate and to terminate weed flushes prior to planting.

Crop rotation
Allen considers crop rotation to be an important measure, especially if the weather does not allow timely rotary hoe use.

Cover crops
Allen does not utilize cover crops as much as he did in the past. He used to plant cereal rye after corn for weed control, but he found that chisel plowing was more beneficial and broke the hard pan developed from all of the other tillage passes. He believes when he has a rye cover crop, all of the extra tillage passes needed to establish and eradicate the rye lead to compacted ground, so he has been trying to stay away from the practice. Allen likes to frost seed medium red clover into his small grains using an ATV in early spring. It has a light bar for guidance that is connected to a hand-held GPS unit using the WAAS signal.

Depleting soil seed bank
Allen allows at least 2 weed flushes in spring before bean and corn planting, and also after wheat harvest.

Clean-up strategies
Most weed control disasters are due to wet weather, Allen has found. He had rented a high residue cultivator in the past to save crops from weed domination.

Crop genetics for competitive advantage
Allen tries, but any customer to whom he sells the crop has the choice as to what is grown. He always strives to grow for a market, and that can limit his decisions.

Additional information

Unusually wet conditions
Allen recognizes that wet conditions are the primary reason for his weed control failures. Delaying planting seems to be the best practice, but with global warming and climate change, he finds the method to be a tricky gamble.

Similarities / differences with local organic farmers
Allen is uncertain about this, since nobody else in his county is farming organically. However, he is familiar with Jack Erisman's organic farming practices; the main difference in their techniques is that Jack includes livestock in the system, while Allen does not.

Characteristics of effective weed managers
Timing always seems to be the key, in Allen's view.

Favorite information sources
Allen prefers to consult with other farmers.

New weed management strategies
Allen plans to purchase an Orthman high residue cultivator to move closer to the bean row and also to lay-by corn more efficiently. He foresees that this also will resolve the vine issues in later cultivation passes due to the coulter in each row.

Weed management research needs
Allen would appreciate seeing more research on Canada thistle weed control.

Additional comments
Allen emphasizes that timing is critical. He suggests that farmers should not wait even one day to control the weeds.

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Joel Gruver, Sarah Heller, & Andy Clayton
at the Allison Organic Research & Demonstration Farm

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