Pest & Crop

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Insects, Mites, and Nematodes

Impact of Corn Rootworm Soil Insecticides on Yield and Profit/Loss in Indiana – (*C. Richard Edwards, Larry W. Bledsoe, John L. Obermeyer, and Corey K. Gerber*) -

For more than 25 years, scientists in the Department of Entomology, Purdue University, have been evaluating soil insecticides for corn rootworm larval control. Initial studies included such compounds as the organochlorine soil insecticides, which were phased out in the 1970's, and some of the "newer" organophosphate products at that time, such as Counter® and Lorsban®, which are still with us today. In more recent times, other organophosphates have joined Counter and Lorsban, as well as synthetic pyrethroids and a fiprole product in making up the bulk of the soil insecticides presently used to control this pest. Although new chemistries, such as nicotinoids, or new ways of delivering old products, such as closed systems with metering devices and seed treatments, have joined the rootworm insecticide lineup, organophosphate and synthetic pyrethroids make up the bulk of today's rootworm products. Some of the newer chemistries or ways to deliver-products have not been tested for a sufficient amount of time to get a good read on how they impact the bottom line, that being yield and more importantly to producers, profit. However, over the past 11 years (10 years of actual evaluations since no tests were conducted in 1996), enough data have been generated on the primary rootworm larval control products to provide some insight into their impact on protecting yield and providing, hopefully, a positive economic return.

These corn rootworm soil insecticide evaluations were setup as follows: Prior to 2001, the only prerequisites to choosing test fields were that they followed corn and the absence of soil characteristics that would bias yield results (severe fertility disorders, nonrandom compaction patterns, etc.). In 2001, test fields following corn or soybeans were selected in areas where the rotation resistant variant western corn rootworm beetle was found. Corn rootworm abundance (by sampling) was not known prior to planting. These were production fields and not late planted rootworm "trap crop" fields.

Experiments were located at the Davis, Southeast, Northeast, Pinney and Throckmorton-Purdue Agricultural Centers (PAC) at Farmland, Butlerville, Columbia City, Wanatah, and Lafayette, Indiana, respectively. Each experiment was a randomized complete block design with four replications. The experimental unit was three rows in width by 300 to 500 feet in length depending on location and year. All tests were planted with John Deere MaxEmerge Model 7100 or 7200 planters that had been specially equipped to utilize bench-calibrated Noble® metering units for insecticide application. In 2000 and prior years, the production hybrid was selected by the respective farm manager to maximize yield. In 2001, the corn hybrid at all locations was restricted to NK N70-D5 to facilitate comparisons of ProShield® coated seed technology with other insecticides. The hybrid NK N70-D5 is adapted to all latitudes where the tests were conducted. None of the hybrids used in any year contained transgenic resistance to European corn borer. All insecticides were applied at the standard rootworm rate. Granules were placed as either 5-inch bands in front of the furrow closing wheels using skirted, all terrain banders, or in the seed furrow using drop tubes. Fortress® band applications were made using an Amvac Smartbox® applicator that had been modified to hold approximately 2 pounds of formulated product. Regent® applications were applied in furrow using the Aventis OnePass® system at 1 to 3 gpa depending on the year. Planting/application speed was 5.0 mph. Spring tines or chains were used for surface incorporation.

Ten randomly collected corn root systems were collected, washed, rated, and the ratings averaged from each plot (4 replications) to measure larval damage. Thorough washing of soil from roots was necessary to expose root surfaces and larval damage. The following root damage rating scale (Hills and Peters 1971, J. Econ. Entomol. 64:3) was used to characterize rootworm larval feeding:

Damage Category	Description of Root System
1	No damage or only a few minor feeding scars
2	Feeding scars evident, but no roots pruned within 1-1/2 in. of plant.
3	At least 3 roots pruned within 1-1/2 in. of the plant, but never a whole node or the equivalent thereof.
4	One node of roots destroyed
5	Two nodes of roots destroyed
6	Three nodes of roots destroyed

Plots were individually machine harvested using commercial combines and weighed using either stationary scales or combine-mounted yield monitors. Grain weights were converted to 15.5% moisture level and bushels per acre before comparisons were made.

Insecticide costs as shown in the table are based on pricing data provided by GROWMARK, Inc., Bloomington, IL, on January 17, 2002. It is understood that these prices can vary considerably based on quantity of product purchased, dealer incentives, time of purchase, etc. If the given numbers do not reflect one's insecticide costs, a few minor calculations using the information provided in the table can give one an idea of the impact of the adjusted figures on the bottom line, profit. Also, "Insecticide, Equip., & Labor Costs/A" and "Profit (Loss)/A" figures included in the table include an equipment and labor charge of $2 per acre. In the case of Regent, the application equipment may be provided by the insecticide manufacturer to producers who buy sufficient quantities of the insecticide and thus no charge for equipment is included (a $0.50 per acre labor charge is included in the cost, however). Where application equipment is not provided, cost data are based on the $2 per acre equipment and labor charge added to the cost of the insecticide. The number of sites where these data have been collected is indicated in the table under "Avg. Yield- Bu/A (# sites)."

It is important to remember that many factors can impact the performance of insecticides, influence corn rootworm larval populations, and affect corn establishment and development. Although the data presented in the table represent an accumulation of results from many sites over many years, therefore including varying levels of impact by biotic and abiotic factors, we feel that they are as representative of what might be expected over space and time based on careful attention to proper applicator calibration, application, and data gathering. However, the results that an individual producer may obtain under his/her local conditions, applicator setup, hybrid used, etc., will determine actual product performance and yield and monetary returns. So that producers have a better feel for the benefit of their chosen rootworm larval control strategy, we recommend that check strips be included in all corn fields where rootworms may be an issue. This includes untreated check strips in fields targeted for treatment and treated check strips in those where a soil insecticide will not be used. By following these guidelines, producers will accumulate a body of knowledge on rootworm management with and without insecticides that should pay significant dividends over time.

Note: The results presented in the table do not represent an endorsement of any of the listed products by Purdue University or its personnel. The data represent findings from unbiased research studies following the protocol listed above.

Impact of Corn Rootworm Soil Insecticides on Yield and Profit/Loss in Indiana

Insecticide	Avg. Root Rating[1,2]	Avg. Yield - Bu/A (# sites)[1]	Yield Advantage vs. Untreated - Bu/A	$ Value/A at $2.25/Bu Corn	Insecticide, Equip., & Labor Costs/A[3]	Profit (Loss)/A
Aztec 2.1G	1.88	143.3 (18)	6.1	$13.73	$19.51	**($5.78)**
Counter CR	1.67	135.8 (26)	9.4	$21.15	$21.30	**($0.15)**
Force 3G	1.89	142.4 (16)	9.5	$21.38	$21.36	**$0.02**
Fortress 5G	1.96	142.6 (13)	6.6	$14.85	$17.69	**($2.84)**
Lorsban 15G	1.90	138.0 (30)	10.8	$24.30	$19.02	**$5.28**
Regent 4SC	2.17	145.0 (13)	9.0	$20.25	$19.75[4]; $21.22	**$0.53[4]; ($0.97)**
Untreated	3.12	[1]Based on data from 1991-2001, no data for 1996; Butlerville site not included. [2]Hills and Peters 1-6 root damage rating scale. [3]Includes $2.00 per acre equipment & labor costs. [4]Equipment provided; value determined by the amount of product purchased.				

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Cool Spring, No Problem for Alfalfa Weevil in Southern Indiana – (*John Obermeyer, Rich Edwards, and Larry Bledsoe*) –

- Southern Indiana survey indicates that alfalfa weevil are quite active
- Freezing temperatures don't hurt the weevil
- Scouting techniques are given

Though the alfalfa weevil ceases feeding activity when temperatures dip below 48°F, they are quite cold hardy and will survive nestled among the folded leaves of the new plant growth. This became quite evident as Ron Blackwell, Pest Management Survey Specialist, found extremely high tip-feeding percentages in southwestern Indiana fields on April 3, 2002. This severe damage was not expected because of the lagging heat unit accumulations over the last several weeks. Obviously these pests haven't read the book, because heat unit models tell us that scouting should normally begin when approximately 200 heat units, base 48°F, have accumulated from January 1. As you can see on the "Weather Update" map (page 13), actual heat units aren't even close to that. Therefore, producers with alfalfa fields on sandy soils or with south facing slopes that warm quickly in the spring should begin scouting before this time.

Sampling a field to determine the extent of alfalfa weevil damage is best accomplished by walking through the field in an "M-shaped pattern." Five alfalfa stems should be examined in each of 5 areas of the field, for a total of 25 stems from the entire field. Each stem should be examined for 1) tip feeding by alfalfa weevil larvae, 2) presence of healthy larvae, and 3) maturity of the stem, i.e., pre-bud, budding and/or flowering. The average size (length) of weevil larvae should also be considered. Large alfalfa weevil larvae are relatively easy to find. Small larvae are difficult to see. Thus, very close examination of leaves may be required to detect "pin-hole" feeding and small larvae. If the application of an insecticide is required early in the weevil season, producers have the option of using a material that has good residual activity. Later in the season, short residual insecticides should be used and producers should pay close attention to harvest restrictions.

Alfalfa weevil pin-hole feeding

Alfalfa Weevil Larval Survey Gibson County - 4/3/02 (Ron Blackwell)		
Fields	Stem Ht. (in.)	% Tip Feeding
G 1	2.9	100%
G 2	4.3	92%
G 3	3.6	100%
G 4	2.8	96%
G 5	4.2	100%
G 6	4.9	88%
G 7	4.7	100%

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Black Cutworm Adult Pheromone Trap Report
Week 1 = 3/21/02 - 3/27/02 Week 2 = 3/28/02 - 4/3/02
(Ron Blackwell)

County	Cooperator	BCW Trapped		County	Cooperator	BCW Trapped	
		Wk 1	Wk 2			Wk 1	Wk 2
Adams	Roe/Price Ag Services	0	0	Lake	Kliene (1)	1	0
Bartholomew	Ludwig/Growers Service	0	7	Lake	Kliene (2)	0	0
Clay	Smith/Growers Co-op (Bzl)	0	0	Parke	Rule/Midland Co-op	0	0
Clay	Smith/Growers Co-op (CC)	0	0	Porter	Mueller/Agriliance	0	0
Clinton	Blackwell/Purdue	0	2	Putnam	Nicholson Consulting	0	0
Elkhart	Kauffman/Crop Tech (1)	0	0	Randolph	Jackson/Davis-Purdue Ag Center (S)	0	0
Elkhart	Kauffman/Crop Tech (2)	0	0	Randolph	Jackson/Davis-Purdue Ag Center (N)	0	0
Fayette	Schelle/Falmouth Farm Supply	0	1	Rush	Peggs/Pioneer	0	7
Gibson	Hirsch Farms	0	13	Shelby	Hudson	0	0
Fountain	Hutson/Vermillion Co. Extension	0	0	Sullivan	Smith/Growers Co-op (W)	0	2
Hendricks	Rule/Midland Co-op	0	0	Sullivan	Smith/Growers Co-op (E)	0	3
Henry	Schelle/Falmouth Farm Supply	0	1	Tippecanoe	Obermeyer/Purdue	0	2
Jasper	Manning/Jasper Co. Extension (S)	0	1	Vermillion	Hutson/Vermillion Co. Ext. (N)	0	0
Jasper	Manning/Jasper Co. Extension (C)	0	0	Vermillion	Hutson/Vermillion Co. Ext. (S)	0	0
Johnson	Truster/Ag Excel Inc.	0	4	Vigo	Smith/Growers Co-op	0	0
Knox	Smith/Growers Co-op (Oaktown)	0	0	White	Reynolds/Orville Redenbacher 1P	0	0
Knox	Smith/Growers Co-op (Freelandville)	0	2	White	Reynolds/Orville Redenbacher 2K	0	0
Knox	Smith/Growers Co-op (Edwardsport)	0	0	Whitley	Walker/NEPAC	0	1
Knox	Smith/Growers Co-op (Wheatland)	0	0				

Agronomy Tips

Fertilizer Reckoning for the Mathematically Challenged - (*Bob Nielsen*) -

- Relative nutrient costs play an important role in the fertilizer selection process
- Examples are provided to help understand the fertilizer mathematics involved in calculating nutrient costs for single or multiple nutrient fertilizers

What do you think of when you see the numbers: 82-0-0, 46-0-0, 0-0-60, 9-18-9, and 3-18-18? No, they are not a list of winning Indiana Lottery numbers. Rather, they are examples of guaranteed analysis values for the percentages of nitrogen (N), available phosphorus (P_2O_5) and water-soluble potassium (K_2O) in common fertilizer sources. These values represent plant-available nutrients and are required by law to be publicly available when you purchase fertilizers in Indiana.

With these and so many other possible sources of fertilizer for use in Indiana row crop production, determining the least costly form of fertilizer can be challenging and unwieldy. When comparing potential sources of fertilizer, you ought to be calculating and comparing the relative costs per pound of nutrient, not the costs per ton of fertilizer product.

Unfortunately, fertilizer mathematics is not a strong suit for many agriculturalists. Sharpen your pencils and follow along with these examples of nutrient cost calculations. Remember, where appropriate, to substitute your own local fertilizer prices for those used in these examples.

Example 1: Single Nutrient Products

For single nutrient fertilizer products such as anhydrous ammonia (82-0-0) or 28% UAN (28-0-0), calculating the costs per pound of nutrient is simple. Fertilizer sources and retail prices used for this example are anhydrous ammonia ($285/ton) and 28% UAN ($225/ton).

This simple mathematical example also illustrates why anhydrous ammonia has historically been a popular source of fertilizer nitrogen for corn production in Indiana: It is typically a very inexpensive source of N.

Example 2: Multiple Nutrient Products (N & P)

Calculating the price per pound of nutrient for multiple analysis fertilizer products can be more challenging. Typically, the cost of one nutrient in the mix is of primary interest to you. Consequently, the costs for one or more of the other nutrient components of the mixture are set to standard values based on the cost of single nutrient sources.

For example, let's say that you wanted to compare the relative nitrogen costs of 28% UAN (28-0-0) and 10-34-0 for making an economic decision on starter fertilizer products. Assuming that the phosphorus component of the 10-34-0 is also of value to the crop, calculating the nitrogen cost share of the mix must therefore account for the cost share of the mix that can be attributed to the phosphorus.

Because the relative nitrogen costs are the ones of interest in this example, the phosphorus cost per lb. P_2O_5 can simply be set to a standard value. What value should this be? The simplest value would be that equal to the price per lb. of P_2O_5 in a common single nutrient source such as 0-46-0 (triple super phosphate).

Fertilizer sources and retail prices used for this example are 28% UAN ($225/ton), 10-34-0 ($260/ton), and 0-46-0 ($260/ton).

Example 1: Single Nutrient Products

First, calculate the lbs. of nutrient per ton of product:

- Pounds of N per ton of anhydrous ammonia = 2000 X 82% = 1640 lbs. of N
- Pounds of N per ton of 28% UAN = 2000 X 28% = 560 lbs. of N

Second, calculate the cost per lb of nitrogen:

- Cost per lb. of N in 1 ton of anhydrous ammonia = $285 ÷ 1640 lbs. N = 17 cents per lb. N
- Cost per lb. of N in 1 ton of 28% UAN = $225 ÷ 560 lbs. N = 40 cents per lb. N

Example 2a: Multiple Nutrient products (N & P)

First, calculate the lbs. of nutrient per ton of product:

- Pounds of N per ton of 28% UAN = 2000 X 28% = 560 lbs. of N
- Pounds of N per ton of 10-34-0 = 2000 X 10% = 200 lbs. of N
- Pounds of P_2O_5 per ton of 10-34-0 = 2000 X 34% = 680 lbs. of P_2O_5

Second, calculate the standard cost per lb. of P_2O_5 in 0-46-0:

- Pounds of P_2O_5 per ton of 0-46-0 = 2000 X 46% = 920 lbs. of P_2O_5
  Cost per lb. P_2O_5 = \$260 ÷ 920 lbs. P_2O_5 = 28 cents per lb. P_2O_5
  (This will become the standard value used in the next calculation.)

Third, calculate the phosphorus share of the total cost in one ton of 10-34-0:

- Cost of P_2O_5 per ton of 10-34-0 = 680 lbs. P_2O_5 X 28 cents per lb. = \$190
  (This value will be used in the next calculation.)

Fourth, calculate the nitrogen share of the total cost of 10-34-0 per ton of product:

- Nitrogen share = Total cost of 10-34-0 per ton minus phosphorus share
  Nitrogen share = \$260 minus \$190 = \$70 per ton
  (This value will be used in the next calculation.)

Finally, calculate the relative costs per lb. of nitrogen for the two nitrogen sources:

- Nitrogen cost in 1 ton of 28% UAN = \$225 ÷ 560 lbs. N = 40 cents per lb. N
- Nitrogen cost in 1 ton of 10-34-0 = \$70 ÷ 200 lbs. N = 35 cents per lb. N

This mathematical example indicates that the 10-34-0 fertilizer product would be a less expensive source of nitrogen for use in starter fertilizer programs. The caveat to this, however, is the recognition that with 10-34-0 you would be purchasing phosphorus in addition to nitrogen.

So, remember to finish this mathematical exercise by calculating the per acre cost for the two products. In order to do so, it is important that you calculate the per acre costs considering identical rates of starter nitrogen (apples to apples). Let's assume a starter fertilizer nitrogen rate of 20 lbs. N for both products:

Example 2b: Multiple Nutrient products (N & P)

First, calculate the per acre cost of the single nutrient 28% UAN product:

- 20 lbs. N per acre as 28% UAN X 40 cents per lb. N = \$8 per acre cost

Second, calculate the per acre cost of the multiple nutrient 10-34-0 product:

- 20 lbs. N per acre rate would require 200 lbs. of product.
- 200 lbs. of product = (200 lbs. ÷ 2000 lbs. per ton) X \$260 per ton = \$26 per acre

So, while 10-34-0 is technically the cheaper source of nitrogen (per lb. N) in this example, the total cost per acre would be greater than that for using 28% UAN as a starter fertilizer source because of the additional costs due to the phosphorus component of 10-34-0. But hold on, the story does not end here.

IF the phosphorus component would be beneficial to the corn crop because of less than adequate phosphorus soil test levels, the additional cost per acre ($19) may be rewarded by increased corn yields. However, IF the phosphorus soil test levels were above the critical value for corn (greater than 30 lbs. P per acre, Bray P1), then the inclusion of the phosphorus in the starter mix may be of little value to the corn crop and, thus, the less expensive starter N source of 28% UAN would be the economic choice.

Example 3: Multiple Nutrient Solution Products (N, P, & K)

Calculating per pound costs for nutrients in products that contain nitrogen, phosphorus, AND potassium is slightly more challenging but similar to that described above for products containing two nutrients. Depending on which of the three nutrients is the one of interest, you simply set the price of the other two equal to that calculated from single nutrient sources. For example, if you wanted to calculate the nitrogen cost of a multiple analysis product such as 9-18-9, you would first subtract the relative costs of the phosphorus and potassium portions from the total cost.

Assume you wanted to calculate the nitrogen share of the cost of a 9-18-9 liquid fertilizer. The phosphorus and potassium share of the fertilizer product cost will be calculated using standard costs per lb. for P_2O_5 and K_2O, calculated from the single nutrient sources 0-46-0 and 0-0-60.

This example also illustrates how to calculate nutrient price per pound when the product is priced on a per gallon basis, not on a per ton basis. Fertilizer sources and retail prices used for this example are the common single nutrient sources 0-46-0 ($260/ton), 0-0-60 ($175/ton), and 9-18-9 ($3/gallon).

Example 3: Multiple Nutrient Solution products (N, P, & K)

First, calculate the standard cost per lb. of P_2O_5 and K_2O:

- Pounds of P_2O_5 per ton of 0-46-0 = 2000 X 46% = 920 lbs. of P_2O_5
  Cost per lb. P_2O_5 = $260 ÷ 920 lbs. P_2O_5 = 28 cents per lb. P_2O_5
  (This value used in the third step below.)
- Pounds of K_2O per ton of 0-0-60 = 2000 X 60% = 1200 lbs. of K_2O
  Cost per lb. K_2O = $175 ÷ 1200 lbs. K_2O = 15 cents per lb. K_2O
  (This value used in the third step below.)

Second, calculate the lbs. per gallon of 9-18-9 for the nitrogen, phosphorus, and potassium nutrient components of this fertilizer product. This product, like many fertilizer solutions, weighs about 11 lbs. per gallon.

- Pounds of N per gal. of 9-18-9 = 11 X 9% = 1 lb. of N
  (rounded to nearest whole number)
- Pounds of P_2O_5 per gal. of 9-18-9 = 11 X 18% = 2 lbs of P_2O_5
- Pounds of K_2O per gal. of 9-18-9 = 11 X 9% = 1 lb. of K_2O

Third, calculate the relative cost shares of P_2O_5 and K_2O in one gallon of 9-18-9:

- Cost of P_2O_5 per gal. of 9-18-9 = 2 lbs. P_2O_5 X 28 cents per lb. = 56 cents
  (Using the standard P_2O_5 cost calculated in the first step.)
- Cost of K_2O per gal. of 9-18-9 = 1 lb. K_2O X 15 cents per lb. = 15 cents
  (Using the standard K_2O cost calculated in the first step.)

Finally, calculate the cost per lb. of nitrogen in 9-18-9:

- Nitrogen cost share per gal. = Total cost minus P_2O_5 share minus K_2O share
  Nitrogen cost share per gal. = $3 minus $0.56 minus $0.15 = $2.29 per gal.
- Cost per lb. of N of 9-18-9 = $2.29 per gal. ÷ 1 lb. N per gal. = $2.29 per lb. N

Surprised? Many liquid fertilizer products sold on a per gallon basis can be quite expensive on a per pound of nutrient basis, yet are no more effective or efficient in supplying nutrients to crop plants. This fact alone makes it worth your while to become skilled at fertilizer mathematics.

Summary

These examples provide you with some guidelines to follow in order to calculate nutrient costs on a per pound basis. Working with single nutrient sources is simple and straightforward. Working with multiple nutrient sources is somewhat more complicated, yet also fairly straightforward if you follow the steps.

Remember that most fertilizer products are equally effective in their use as crop plant nutrient sources. Part of your decision process for fertilizer inputs involves calculating and comparing the relative costs among alternative products. Taking the time to do the type of fertilizer reckoning described in this article will better enable you to compare the relative costs of different fertilizer products.

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Considerations for the Day of Planting - (*Bob Nielsen*) -

- The day of planting requires some decisions on planter adjustments and crop management

Corn and soybean planting are just around the proverbial corner for Indiana growers. Based on 1983-2001 crop reporting data (Indiana Ag. Stats. Service), about 20% of Indiana's corn crop is typically planted by 30 April and 50% by 10 May. Last year, we were spoiled by the earliest ever completion of planting; about 98% completion by 10 May.

While recent snowy and rainy conditions will likely limit much planting in early April this year, soil conditions will hopefully improve by the usual late April time period that typifies the start of serious corn planting in Indiana. Regardless of planting date, certain crop management decisions need to be made on the day of planting on a field-by-field basis.

A number of these decisions are related to planter adjustments and operation. Other day-of-planting decisions relate to seeding depth, seeding rate, and hybrid planting order. Factors that impact these decisions include soil moisture & temperature conditions, surface soil conditions, short-term weather forecasts, and variability among your available seed lots for hybrid vigor, seed quality and seed size.

Planter Decisions. For pneumatic planter metering systems (some blow and some suck), you should prepare a checklist for every seed lot you have in the shed prior to planting that includes each seed lot's seed weight (seeds per lb.), the appropriate air or vacuum pressure, and the appropriate seed disc or drum. The latter two items require that you find the planter operations manual that has been collecting dust since last year. Keep this checklist with you during planting and refer to it when you change hybrids to ensure that you adjust the planter accordingly and avoid variable seed spacing.

Adjustments to the down pressure of the furrow closing devices (wheels, fingers, etc.) should be made according to the soil conditions of every field you plant, and may vary day by day during the season. Use only enough down pressure to firmly close the seed furrow. Excessive down pressure can compact the soil above the seed and restrict the emergence of the corn seedlings. Obviously, inadequate down pressure may leave open furrows, especially in no-till systems.

Adjust the depth and tension of no-till coulters to match soil conditions. Do not cut deeper with the coulter (in line with the disc opener) than the depth of seeding. Excessively deep coulter action can disturb too much soil below where the seed lands, making it difficult for the closing wheels to adequately firm the soil around the seed.

Remember that excessive down pressure at the parallel linkages (i.e., heavy-duty no-till springs) can lift the planter frame AND the drive wheels, resulting in uneven operation of the planter transmission and subsequent uneven seed spacing or seeding population. Ensure that the planter units are parallel or level to the ground when the planter is in operation to avoid problems with disc opener depth, press wheel efficiency, and seed to soil contact.

Planting speed should not exceed the manufacturer's recommendations because of the risk of uneven seed spacing. For most planters, the optimum range of speeds is 5 to 6 miles per hour. If you're hell-bent on planting faster than this, at least do yourself a favor and check seeds in the row once in a while for accuracy in spacing and depth.

Remember to faithfully use graphite lubricant with finger-pickup seed meters at a rate of 1 tablespoon per bushel of seed. If you discover excessive seed treatment is building up on the fingers or meter backplate, then use more graphite. Remember to faithfully use talc powder with vacuum seed meters at a rate of 1 cup per bushel to prevent sticky seed, especially under humid conditions.

Diligently lubricate the chains and bearings of the planter every day. This is best done at the end of a planting day when the chains and bearings are warm.

Use a multi-purpose spray lubricant on the planter chains, not chain lube or old motor oil, because such lubricant dries better, is less sticky, and is less of a dirt magnet the following day.

Crop Management Decisions. Choose an appropriate seeding depth according to the field conditions & weather forecast. The primary goal is to aim for a depth that will ensure placement of seed into uniform soil moisture. Spatial variability for moisture in the seed zone is probably the most common cause of uneven germination and emergence of corn. As a rule of thumb, I recommend seeding depths no less than 1 1/2 inches. If necessary, do not hesitate to plant as deeply as 2 or 3 inches if that is what it takes to reach adequate and uniform soil moisture. Check the actual depth of seeding frequently from field to field or day to day. Actual seeding depth can vary from the targeted planter setting as soil conditions change.

Remember that rapid and uniform corn germination and emergence will not occur when soil temperatures are less than 50˚F. Seedling establishment will also not occur rapidly and uniformly if soil temperatures remain cold. Cool soils are especially likely when planting early and/or in no-till with heavy surface trash.

For these reasons, improve the odds of successful stand establishment when planting early in the season by strategically planting the various hybrids at your disposal. Early in the planting season, plant hybrids with excellent seedling vigor ratings and warm germination ratings. Save the hybrids with merely average seedling vigor ratings and warm germination ratings for later in the season when soils have warmed significantly. If you have access to cold germination ratings for your hybrids, similarly begin planting with the best cold germination seed lots and end with the average lots.

Avoid planting early with seed lots whose seed size is excessively or unusually small (e.g., 35 lb. 80k bags). Most of the time, seed size is of no consequence in performance of a given seed lot. However, evidence from research in Wisconsin years ago suggests that such unusually small seed can be at a disadvantage when germination/emergence and early stand establishment conditions are severely limited by cold soils.

Generally, most Indiana corn growers should aim for final plant populations at harvest in the range of 26- to 30,000 plants per acre. Under 'normal' planting conditions, this target requires seeding rates between 28- and 33,000 seeds per acre to account for normal rates of germination failure and seedling mortality. Early in the season, consider using seeding rates that are 5 to 10% greater than what you would normally use if you expect greater than normal mortality rates due to cold and 'crappy' conditions with early planting.

The use of starter fertilizer is especially helpful when planting early into cold and 'crappy' conditions. Purdue research suggests that starter nitrogen (N) is the primary nutrient of interest where soil phosphorus and potassium levels are adequate for crop growth. Aim for no less than 20 lbs of actual N per acre to maximize the probability and magnitude of a yield response to starter fertilizer. This rate would be equal to 6.5 gallons of 28% UAN per acre or 200 lbs. of 10-34-0 per acre applied in a traditional 2 x 2 placement with the planter. Such rates obviously restrict the use of starter placement with the seed because of the risk of fertilizer salt injury to the seed or seedling.

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A Recipe for Crappy Stands of Corn - (*Bob Nielsen*) - Every year, I get a lot of phone calls from folks wanting to know why their neighbor's fields of corn ended up with such poor uneven lousy-looking stands. Since some seem so ecstatic about this happening to their neighbors, I figured they might want to know how to create a crappy stand of corn themselves.

The following recipe will prepare one helping of a crappy stand of corn. Add more acreage as desired.

Ingredients:

- One (1) field, level and poorly drained.
- No-till is preferred, but conventional tillage will suffice if soil is 'on the wet side' when worked.
- A hybrid of your choice, but poor seed quality and low vigor will ensure success of recipe.
- Plant early, when soils have yet to reach 50˚F.
- Plant 'on the wet side' to ensure good sidewall compaction.
- Do NOT add any starter fertilizer to the recipe.
- Add a dash of seed rot or seedling blight organisms.
- Add a pinch of wireworms or seedcorn maggots.
- Flavor with acetanilide herbicides as desired.
- Top off with a thick soil crust.
- Add minimum of 0.5 to 1.0 inch of rain per week after planting.
- Maintain average daily soil temperatures at 50˚F or less for three weeks or more after planting.

Will serve 6 people: (farmer, dealer, industry rep, seed dealer, county agent, university specialist)

Don't forget, this and other timely information about corn can be viewed at the Chat 'n Chew CafÈ on the World Wide Web at <http://www.kingcorn.org/cafe>. For other information about corn, take a look at the Corn Growers' Guidebook on the World Wide Web at <http://www.kingcorn.org/>.

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Soybean Inoculation – (*Ellsworth P. Christmas*) -

- When should I use inoculants?
- How have inoculants and soybean production changed?
- How should I use inoculants?

Inoculation is usually not necessary if a well-nodulated soybean crop has been grown in the field within the past 5 years. The absence of nodules or poor nodulation may be the result of soybeans being planted in a field with no history of soybean production or low soil pH (usually below 5.6). During the past 10 years, several studies have been conducted in Indiana and other eastern corn-belt states to evaluate the response of soybeans to inoculation when grown in fields with a corn-soybean rotation

During the past 10 to 15 years, production technologies and the complexion of agriculture have undergone many changes on Indiana farms. Included among these changes are; a) the increased use of no-till in the production of soybeans, b) an increase in the use of narrow rows, c) earlier planting of soybeans, d) an increase in seeding rates with the narrow rows, e) a conversion of continuous corn acreage to rotational corn-soybeans, f) improved planting equipment, g) an increase in grain yield and h) larger farms.

The changes in soybean production in Indiana coupled with the improvements in soybean inoculants suggest that the use of inoculants in the production of soybeans should be reevaluated. Evidence gathered from inoculant studies over the past 9 years in Indiana indicates that soybean yields can be improved by the use of inoculants when soybeans are grown in a soybean-corn rotation. Table 1 presents a summary of the yield response of soybeans to inoculation over this nine-year period. The annual summaries may include multiple sites and/or multiple products, with over two-thirds of the sites being no-till fields.

Table 1. Soybean yield response to inoculants in Indiana when planted in fields with a native population of *Rhizobium*

Year	Yield Response Above Control
1993	1.92 Bu/Ac
1994	2.42 Bu/Ac
1996	0.00 Bu/Ac
1997	1.40 Bu/Ac
1998	0.25 Bu/Ac
1999	1.99 Bu/Ac
2000	0.51 Bu/Ac
2001	1.48 Bu/Ac
Average	**1.25 Bu/Ac**

All indications are that the new improved products all perform equally well when evaluated over time and locations. The average yield response, when compared to a non-inoculated control, was equal to 1.25 bushels per acre per year for the nine year period. The cost of the products ranges from $1.50 to $2.75 per acre when used as a seed applied product.

Most soybean inoculants are seed applied. However inoculants can be soil applied, but it is important to maintain the recommended concentration per 1000 linear feet of row to be effective. If a row spacing less than 30 inches is used, the cost increases accordingly and usually is not cost effective.

Liquid inoculants are becoming more popular with the increased use of bulk soybean seed. Bulk seed is usually transferred from the bulk container to the planter or drill using an auger. The liquid inoculant can be metered onto the seed at the base of the auger and is thoroughly mixed with the seed by the time the seed reaches the planter of drill box. The manufacturers of the liquid inoculants provide specific instructions related to calibration of the delivery auger and the metering of the inoculant onto the seed. Liquid inoculants can also be used as a seed box treatment. Place about 3 inches of seed in the bottom of the planter or drill box and sprinkle the appropriate quantity of the inoculant onto the seed and thoroughly mix. Continue filling the box by placing layers of about 6 inches of seed, the appropriated quantity of inoculant, and mixing until the box is full.

The most commonly used inoculants use powdered peat as the media. The newer products on the market use a peat media that is sterile and therefore contains a much higher number of cells per ounce. Many of these products also contain a sticker that permits the inoculant to adhere much better to the seed. The method of application will vary depending on the product being used. The products with the built-in sticking agents may be applied directly to the seed in the planter or drill box. This is best accomplished by placing a 3-inch layer of seed in the bottom of the box and adding the appropriate quantity of the inoculant onto the seed and thoroughly mixing to get good coverage. Continue filling the box by placing 6 inches layers of seed, the appropriate quantity of inoculant and mixing until the box is full.

Some of the companies selling peat based products recommend that the seed be dampened with water prior to adding the inoculant to promote better adherence of the inoculant to the seed. Other products will have a recommendation that the inoculant be mixed with water to form a paste and then the paste is added to the seed and mix well. For best results when using any of these products, read and follow the instructions printed on the container.

Inoculants are living organisms that are killed by direct sunlight and heat. The inoculant should be stored according to the manufacture's instructions to preserve its' viability. Once the seeds have been inoculated, they should be planted within two hours. The rhizobia begin to die as the inoculant begins to dry. In general, inoculants CANNOT be mixed with fungicides and applied together to the soybean seed. The one exception to this is ApronMaxxRTA fungicide.

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Soybean Planting Date—What is Early/Too Early??
- (*Ellsworth P. Christmas*) -

- Based on weather data and the physiology of the soybean plant, the ideal window for planting soybeans in Indiana is from May 5 to 20
- Abnormally early planting will result in unnecessary stresses on the soybean plant that can adversely impact the performance of the plant and the final yield

The ideal soil temperature for the most rapid soybean germination and emergence is 77°F. Soil temperatures at a 2 inch depth in the Northern corn-belt do not reach these levels until early to mid June. However, soybeans will begin to germinate at soil temperatures around 50°F at 2 inches, or about mid April in northern Indiana. It is not unusual that at such a low temperature, three or more weeks may be required for emergence. The major risk of slow emergence at low temperatures is the increased probability of injury to the seedling from fungi and/or insects. Sudden Death Syndrome is an example of a disease that tends to be more severe in early planted soybean fields. Additionally, early planted fields tend to have a higher incidence of some of the virus diseases. An additional risk from planting soybeans in early to mid April is possible death of the plants from freezing temperatures following emergence. Extension recommendations of optimum planting dates for soybeans begins with the date at which the mean soil temperature reaches 55 to 60°F, or early to mid May. Some years, soil temperatures will reach this level in late April and soybean planting can safely begin. This assumes that the soil temperatures will continue to rise, that growing conditions for the soybean seed will continue to improve, and that emergence will not be greatly delayed.

Why Plant Early? The Pros and Cons

A number of reasons have been expressed by producers to support or justify early planting of soybeans. The most common among these include the fact that many producers are using no-till drills and have the equipment present on the farm to simultaneously plant corn and soybeans. With two separate pieces of planting equipment, a small amount of added labor will permit a producer to expand the number of acres farmed. Secondly, with early planting additional days are available for field work. This permits the spreading of the work load over a greater length of time or the use of smaller equipment on more acres. The net result could be an increase in the number of acres farmed. In both of these cases the producer can spread certain fixed costs over a greater number of acres, hence lowering the fixed costs per acre and hopefully increasing the net profit for the total farm. In nearly all cases, producers are assuming very little if any yield reduction. Another reason cited by producers for early planting is related to no-till production of soybeans. Many farmers state that they can physically plant no-till fields in advance of conventionally tilled fields. And finally, some producers believe that soybeans are less sensitive to cold or freezing temperatures following emergence than is corn.

Equally convincing arguments are presented by those who advise against early planting. The most common of these arguments is the fact that soybeans do not begin to actively grow until soil temperature reach 55 to 60°F. If soybeans are planted at lower temperatures, the seed will absorb moisture but remain in the soil and be unnecessarily subjected to conditions that promote seedling diseases and other stresses resulting in a reduction of the stand and perhaps yield. Secondly, the soil temperatures under no-till production will usually run several degrees cooler than conventionally tilled fields and in many years no-till fields dry slower in the spring. Therefore, in most years no-till fields should be planted 4 to 5 days later than conventionally tilled fields. Finally, even though soybeans will tolerate lower temperatures after emergence than corn, if planted very early, soybeans can be killed by freezing temperatures since the growing point is above ground level as soon as the plant emerges.

The Effect of Low Air and Soil Temperatures on the Soybean Plant After Emergence

Low nighttime air temperatures can cause injury to the soybean plant or can result in very slow vegetative growth. Many times a soybean plant can tolerate temperatures as low as 28°F without injury, but under certain conditions temperatures well above freezing can result in plant injury or death. Cold conditions can result in water stress in the plant and can be one of the causes of low temperature injury to the soybean plant depending on the length of time the plant is exposed to the low temperatures and the relative humidity. Research data shows that chilling the soybean plant for one week at temperatures at or below 50°F can result in reduced leaf elongation, rate of leaf emergence, and CO_2 uptake. Usually, all of these will return to normal when temperatures return to levels at or above 75°F.

Low soil temperatures also result in a reduction of nodule formation and activity and may even produce nitrogen deficiency symptoms in seedlings prior to the development of functional root nodules. Soybean plants that had just emerged prior to the cold soil temperatures may exhibit nitrogen deficiencies once air temperatures return to normal and the plants begin to grow rapidly. This is the result of a demand by the plant for nitrogen greater than that available from the cotyledons and the soil. Once soil temperatures warm to a level suitable for nodule activity, the leaves well become a darker green color and the plant will resume normal growth.

The Effect of Planting Date on the Reproductive Development of the Soybean Plant

The onset of flowering, or the beginning of the reproductive stages of growth of the soybean plant, is determined primarily by the hours of darkness to which the plant is subjected. Hence the soybean plant is considered a short day species. For a given geographic area, most full season soybean varieties will begin flowering around the summer solstice if planted on or before May 20. Early planting will alter the date of flowering very little and will have essentially no effect on date of maturity. Delayed planting will delay both the date of flowering and the date of maturity. A good rule of thumb is that for each three day delay in planting, maturity will be delayed one day.

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Bug Scout

"Safety with pesticides is important, but don't you think the suit of armor is going a bit too far?"

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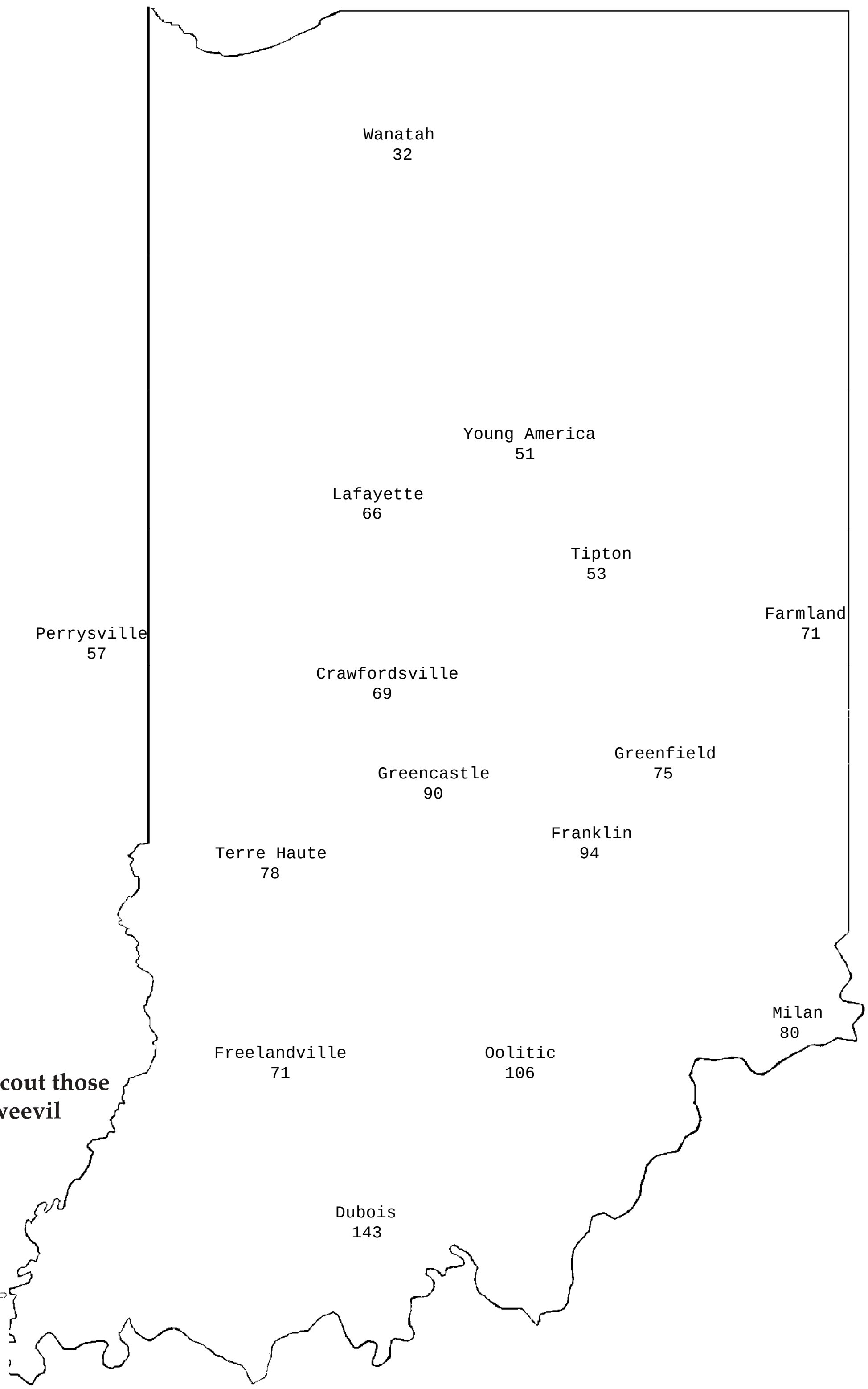
Weather Update

MAP KEY
Location HU48

Temperature Accumulations from Jan. 1 to April 4, 2002

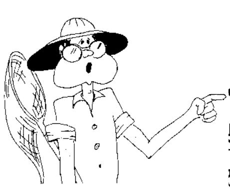
HU48 = heat units at a 48ºF base from Jan. 1, for alfalfa weevil development (begin scouting at 200)



4" Bare Soil Temperatures 4/04/02

Location	Max.	Min.
Wanatah	47	38
Columbia City	44	38
W Laf Agro	45	37
Tipton	42	41
Farmland	44	37
Perrysville	46	40
Crawfordsville	41	36
Terre Haute	44	35
Oolitic	46	46
Dubois	50	36

Bug Scout says "Scout those alfalfa fields for weevil damage soon!!!"



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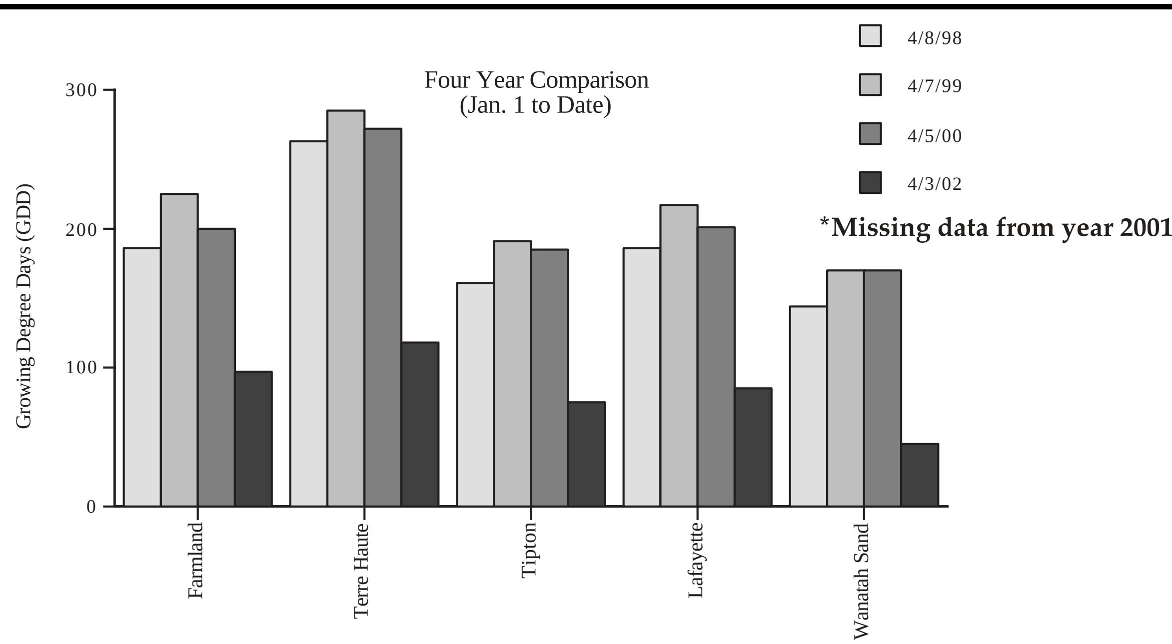

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