OHIO STATE UNIVERSITY EXTENSION

2015
Corn/Soybean Day

Information Packet
And
Proceedings

THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

FULTON, DEFIANCE, HENRY, WILLIAMS AND PAULDING COUNTIES

MAUMEE VALLEY EXTENSION EDUCATIONS & RESEARCH AREA

Table of Contents

OHIO STATE UNIVERSITY EXTENSION

2015 Corn/Soybean Day

****This day will fulfill the 3 hour Ohio Fertilizer Applicator Cert. & Training****

Thursday, January 22, 2015, 8:30 am - 3:30 pm

Founder's Hall at Sauder Village 22611 St. Rt. 2, Archbold, Ohio

AGENDA

8:30 Registration and visit exhibitors
(Coffee and juice available)

9:30 Welcome, Local On-Farm Research Update
Eric Richer, Extension Educator, Fulton County

9:50 Nitrogen Management in Corn
Dr. Bob Nielson, Purdue Extension Corn Specialist

10:55 Phosphorus Discussion
Greg LaBarge, OSUE Agronomic Field Specialist

12:00 Lunch and visit exhibitors

1:15 2015 Weather update
Jim Noel, NOAA

2:20 Quality Soil Sampling for Quality Nutrient Recs
Bruce Clevenger, Extension Educator, Defiance County

3:30 Adjourn

3:45 * PAT CORE – Drift Reduction Strategies
Dr. Erdal Ozkan, OSU Extension Ag Engineer

4:45 * Category 6: Fumigation
Curtis Young, Extension Educator, Van Wert Co.

***Optional sessions but must attend for recertification credits.**

5:15 Adjourn for the day

DETAILS OF DAY

Provided in the $35 registration fee:

- Continental breakfast
- Lunch
- Presentation folder
- Complete Ohio Fert. Appl. Cert. & Trg. (FACT)
- Pesticide credits available (see below)

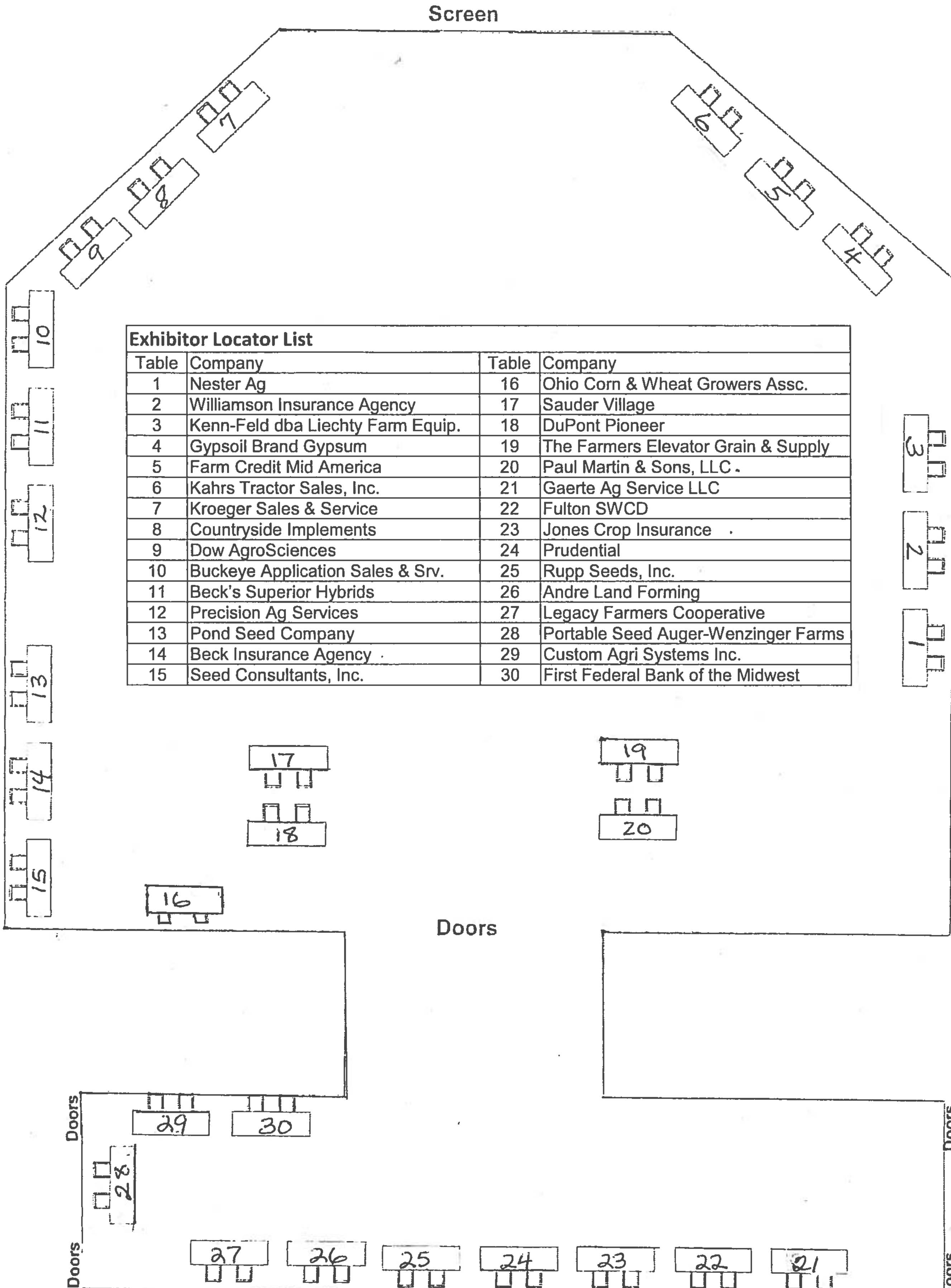
Ohio Private
1.5 Applied for in Core and Category 6 – Fumigation

Ohio Commercial
1.0 hr applied for in Core

Michigan Credits
1.5 hrs applied for

CCA Credits
4 hrs including NM & CM

Corn/Soybean Day coordinated by:
OSU Extension Fulton Co.



Exhibitor Locator List

Table	Company	Table	Company
1	Nester Ag	16	Ohio Corn & Wheat Growers Assc.
2	Williamson Insurance Agency	17	Sauder Village
3	Kenn-Feld dba Liechty Farm Equip.	18	DuPont Pioneer
4	Gypsoil Brand Gypsum	19	The Farmers Elevator Grain & Supply
5	Farm Credit Mid America	20	Paul Martin & Sons, LLC
6	Kahrs Tractor Sales, Inc.	21	Gaerte Ag Service LLC
7	Kroeger Sales & Service	22	Fulton SWCD
8	Countryside Implements	23	Jones Crop Insurance
9	Dow AgroSciences	24	Prudential
10	Buckeye Application Sales & Srv.	25	Rupp Seeds, Inc.
11	Beck's Superior Hybrids	26	Andre Land Forming
12	Precision Ag Services	27	Legacy Farmers Cooperative
13	Pond Seed Company	28	Portable Seed Auger-Wenzinger Farms
14	Beck Insurance Agency	29	Custom Agri Systems Inc.
15	Seed Consultants, Inc.	30	First Federal Bank of the Midwest

Thanks to our 2015 exhibitors and sponsors!

Exhibitors			
Andre Land Forming	Paul Andre	419-337-8908	pdandre@bright.net
Beck Insurance Agency	Joe Beck	419-446-2777	info@beckinsurance.com
Beck's Superior Hybrids	Chad Vetter	419-487-0685	cvetter@beckshybrids.com
Buckeye Application Sales & Service LLC	Jim Wiedenheft	419-596-3883	jwiedenheft@buckeyeapplication.com
Countryside Implements	Gary Schmitz II	419-923-3961	Smitz25@yahoo.com
Custom Agri Systems Inc.	Gary Storch	419-599-5180	gstorch1@bright.net
Dow AgroSciences	Kenny Schilling	812-781-0291	keschilling@dow.com
DuPont Pioneer	Chasitie Euler	419-376-1382	chasitie.euler@pioneer.com
Farm Credit Mid America	Teresa May	419-267-3466	maky_oc289@e-farmcredit.com
First Federal Bank of the Midwest	Cathy Segrist	419-335-7911	csegrist@first-fed.com
Fulton Soil & Water Conservation District	Kim Bowles	419-337-9217	kbowles@fultoncountyoh.com
Gaerte Ag Service LLC	Mark Gaerte	419-769-6601	mark@gaerteagservice.com
Gypsoil Brand Gypsum	Ryan McBride	866-497-7645	rmcbride@gypsoil.com
Jones Crop Insurance	Curtis Jones	419-466-4619	jonescropinsurance@gmail.com
Kahrs Tractor Sales, Inc.	Todd Kahrs	419-335-1638	kts@fulton-net.com
Kenn-Feld Group dba Liechty Farm Equipment	Gary Aeschliman	419-445-1565	gary.aeschliman@kfgllc.net
Kroeger Sales & Service/Conklin Ag Products	Edwin Kroeger	419-296-0101	eakcca@hotmail.com
Legacy Farmers Cooperative	Logan Haake	419-438-6690	lhaake@legacyfarmers.com
Ohio Corn & Wheat Growers Association	Brad Moffitt	740-201-8088	bmoffitt@ohiocornandwheat.org
Nester Ag	Joe Nester	419-658-8866	nesterag@bright.net
Paul Martin & Sons LLC	Doug Martin	419-598-8675	sales@martinequipment.net
Pond Seed Company	Fred Pond	419-622-6141	fred@pondseedco.com
Precision Ag Services	Bill Copeland	419-490-8129	billcopeland@useprecisionag.com
Prudential	Jason Kryder	419-784-5728	david.kryder@prudential.com
Rupp Seeds, Inc.	Lynn Short	877-591-7333	info@rupps.com
Sauder Village	Todd Sterken	419-446-2541	todd.sterken@saudervillage.org
Seed Consultants, Inc.	John Cajka	419-260-1733	
The Farmers Elevator Grain & Supply Assn.	Gary Pennell	419-653-4132	farmers1912@gmail.com
The Portable Seed Auger by Wenzinger Farms	Gerry Wenzinger	419-653-4445	glwew@henry-net.com
Williamson Insurance Agency	Rex Williamson	888-399-5276	rex@cropcoverage.com
Sponsors			
Ag Credit	Lynn Geitgey	419-599-8656	lgeitgey@agcredit.net
A.G. Irrigation	Greg Dietsch	419-487-1221	greg@agirrigation.net
Archbold Equipment Company	Jeff Rutledge	567-341-0048	jeff.rutledge@archboldequipmentco.com
Aschliman & Co. CPA's	Bob Aschliman	419-446-2250	bob@aschlimancpa.com
Chuck Spallinger, Ag Consultant	Chuck Spallinger	419-438-2347	cspall2000@yahoo.com
Edon Farmers Co-op	Art Herman	419-272-2415	aherman@edonfarmerscoop.com
Farmers & Merchants State Bank	Jerry Borton	419-446-2501	jborton@fm-bank.com
Fulton-Henry-Williams-Defiance Co. Farm Bureau	Roy Norman	419-445-0723	fhwd@ofbf.org; rnorman@ofbf.org
Grelton Elevator Inc.	Tom Norden	419-256-6381	tomgrelton@bright.net
Jewell Grain Company	Brent Petersen	419-497-2101	brentp@jewellgrain.com
Lake Erie Conservation Action Project	Todd Hesterman	419-783-1845	hester@henry-net.com
Lund & Smith Insurance Services, LLC	Randy Riegsecker	419-276-8873	insuringcrops@windstream.net
Metamora State Bank	Joe Damman	419-644-2361	jdamman@metamorabank.com
Northwest State Community College	Mari Yoder	419-267-5511	northweststate.edu
Ohio Soybean Council	Kirk Merritt	614-310-1800	www.soyohio.org
POET Biorefining	Mike Knueven	419-943-9214	mike.knueven@poet.com
PNC Bank	Linda Wolf	419-335-2075	linda.wolf@pnc.com
Spartan Insurance	Rick Hall	419-576-6141	hallcrop@frontier.com
State Bank	Tim Moser	419-783-8023	tim.moser@yourstatebank.com
Stryker Farmers Exchange Co.	Neil Nofziger	419-682-3251	strykerfarmers@bright.net
The Hamler State Bank	Larry Maassel	419-274-3955	lmaassel@hamlerstatebank.com
Tri Flo Inc.	Justin Rufenacht	419-445-5602	justin@trifloinc.com
Wellman Seeds	Bill Gunn	419-230-9567	

Today's lunch supported by: The Ohio Soybean Council, Ohio Corn & Wheat Growers Association and Farm Bureau

SOY OHIO
Ohio Soybean Council

Ohio Corn & Wheat
Growers Association

OHIO FARM BUREAU

Key Dates-- OSUE Agricultural Programs:

Young Farmer Series
Mondays in February, 6:30-9 pm, Robert Fulton Ag Center, $10 per night

Williams – Fulton Cover Crop and Soil Health Workshop
Wednesday, February 11, 8:00 a.m. to 4:00 p.m., Williams Co. SWCD, 1120 W. High St., Bryan, $25 (includes lunch)

Soybean College – An Intensive Soybean Management Workshop
Tuesday, February 17, 9:00 a.m. to 4:00 p.m., Robert Fulton Ag Center, $70 (includes lunch)

Private Applicator Recertification and Fertilizer Certification
Tuesday, February 19, Robert Fulton Ag Center
9:00 a.m. to 12:15 p.m. – All categories offered, $35 pre-registration, $60 at the door
1:30 to 3:30 p.m. – Fertilizer Certification Training, no charge

Good Agriculture Practices Training
Thursday, February 26, 9:00 a.m. to 12:00 noon, Robert Fulton Ag Center, $20

Community Supported Agriculture (CSA) Lunch and Learn
Thursday, February 26, 12:00 noon to 2:30 p.m., Robert Fulton Ag Center, $10

Grafting/Pruning Workshop
Thursday, March 26, 3:30 to 5:30 p.m., Robert Fulton Ag Center, $20

Breakfast on the Farm
Saturday, June 13, 9:00 a.m. to 1:00 p.m., Sandland Dairy Farm, Swanton

2015 NW Ohio Precision Ag Technology Day – Nutrient Management Focus
Tuesday, August 4, Fulton County Fairgrounds, $25

Area for Notes/Questions for Presenters:

PURDUE

Thoughts on Nitrogen Management for 2015

R.L. (Bob) Nielsen & Jim Camberato
Purdue University Agronomy

Nielsen's email: rnielsen@purdue.edu
Nielsen's Twitter: @PurdueCornGuy
Chat 'n Chew Café: www.kingcorn.org/cafe

PURDUE

Nitrogen is not a cheap input

- Nitrogen cost = 18% to 25% of total variable production expense for corn.
  - Nitrogen cost per lb of actual N is historically variable, but currently* ranges from about 44 to 59 cents per lb of actual N.
  - Rotation corn @ 180 lbs ~ $79 to $106 per ac
  - Con't corn @ 220 lbs ~ $97 to $130 per ac

* USDA-IL Dept of Ag Market News, 1/8/15. http://www.ams.usda.gov/mnreports/gx_gr210.txt

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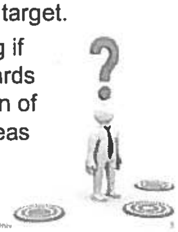
Nitrogen rates are elusive

- Accurately predicting "optimum" N rates for a whole field feels like you are chasing a continuously moving target.
- Even more aggravating if you want to move towards variable rate application of nitrogen to different areas within fields.



More and more folks worry about the potential effects of fertilizer N on surface & ground water quality; plus greenhouse gas concentrations.

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What N rate is "just right"?

- Rates that are "too high" waste your money & can damage the environment.
- Rates that are "too low" may limit yields & profit severely.
- Fertilizing "just right" means finding the best compromise between profitability and environmental stewardship.
  - But, what is "just right" ?????

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A rate that was "just right"...

- ...can be easily identified after the season is over and the crop is harvested.
- The "just right" rate is hard to predict for next year, primarily because we cannot reliably predict the weather.
  - Weather impacts how much nitrogen the soil will supply and / or "hang on to".

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Efficient N management involves…

- Choice of N fertilizer rate, obviously
- Balancing cost, N loss risk, & logistics
  - Choice of N fertilizer source
  - Choice of N application timing
  - Choice of N application method
- Managing soil water effectively
  - Tile or surface drainage in poorly drained soils
  - Irrigation scheduling in coarser soils

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Nitrogen for corn is not just fertilizer

- But also includes the current or future nitrogen supply in the soil
  - Soil N released by mineralization of organic matter or plant residues.
  - Residual N from previous crops.
  - Residual N from manure applications.

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Jim says…

- We can estimate the soil N contribution to the corn crop by analyzing the data from our Purdue plots where we typically include zero sidedress N rates.
  - **Total N supply** available to the crop = soil N + fertilizer N.
- Interestingly: Yield response to **total N supply** is fairly consistent across locations!

Jim Camberato, Purdue Extension Soil Fertility Specialist
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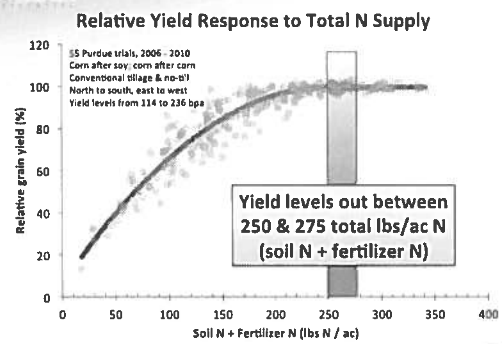

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If we could predict soil N supply…

- …then we could calculate how much fertilizer N to apply by simply subtracting the soil N supply from the total N required for optimum grain yield.
  - For example:
    Predicted soil N = 100 lbs/ac
    Required total N = 275 lbs/ac

    Fert. N needed = 175 lbs/ac

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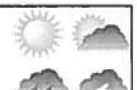
But, the problem is…



- Soil N supply is influenced by rainfall, temperature, soil drainage, plant residues.
- It is difficult to predict how much N the soil will supply for a given field in a given year.
  - Primarily because it is difficult to predict the weather between now and the end of the season.

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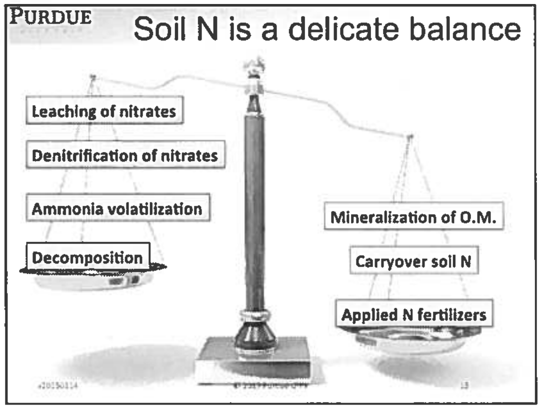

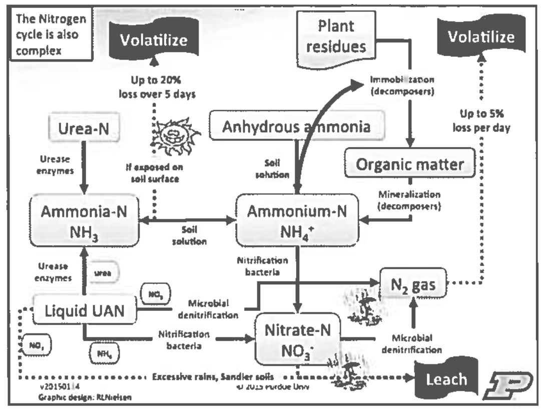

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Prevent or minimize urea volatilization

- Prevent the risk of volatilization
  - Incorporate or inject urea-based products
  - Apply immediately ahead of rain
  - Irrigate after application
- Minimize the risk of volatilization
  - Urease inhibitors
  - Surface-apply urea-based products in a concentrated dribble band.

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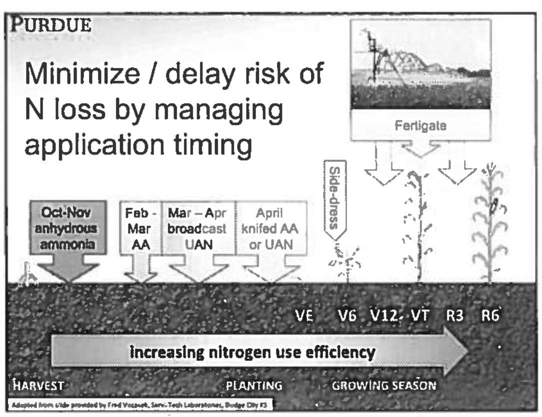
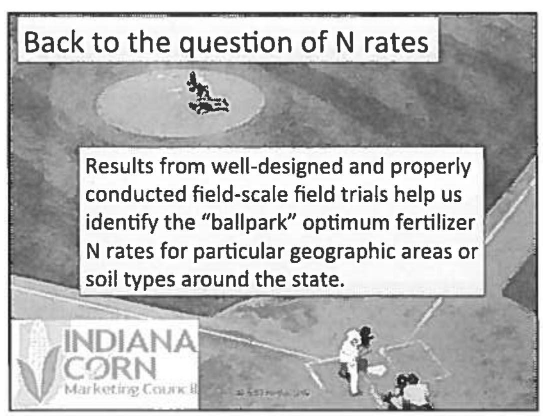
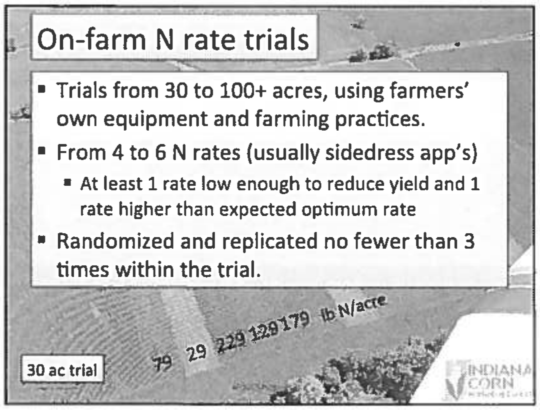
Delay conversion to nitrate

- Delay the conversion to susceptible nitrate form by delaying the onset or rate of certain steps in the fertilizer N cycle.
  - Nitrification inhibitors
  - Urease inhibitors
  - Slow release compounds
  - Coated slow release products






On-farm N rate trials
Trials from 30 to 100+ acres, using farmers' own equipment and farming practices.
From 4 to 6 N rates (usually sidedress app's)
At least 1 rate low enough to reduce yield and 1 rate higher than expected optimum rate
Randomized and replicated no fewer than 3 times within the trial.
79 29 229 129 179 lb N/acre
30 ac trial
INDIANA CORN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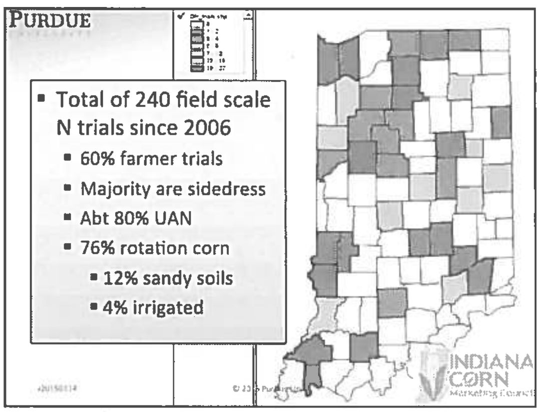
GPS & GIS simplify trial logistics
We can design a trial for just about any size or shape of field.
We can create N rate "prescription" designed specifically for the trial.
Yield monitors, not weigh wagons, used for harvest of trial.
75 ac trial; 24-row plots
INDIANA CORN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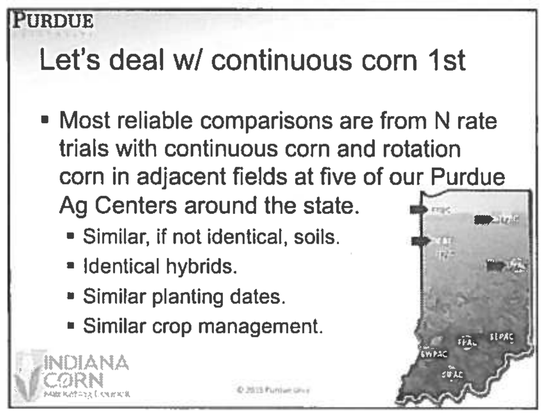
Total of 240 field scale N trials since 2006
60% farmer trials
Majority are sidedress
Abt 80% UAN
76% rotation corn
12% sandy soils
4% irrigated
INDIANA CORN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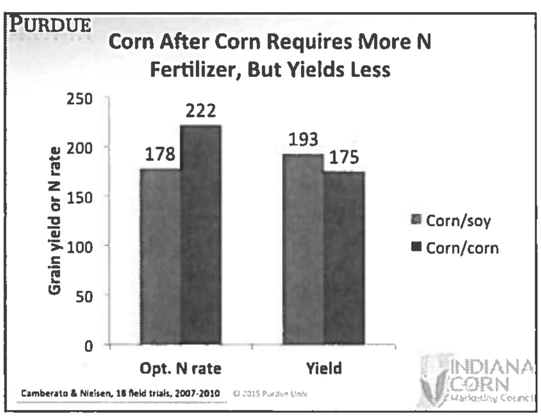
Let's deal w/ continuous corn 1st
Most reliable comparisons are from N rate trials with continuous corn and rotation corn in adjacent fields at five of our Purdue Ag Centers around the state.
Similar, if not identical, soils.
Identical hybrids.
Similar planting dates.
Similar crop management.
INDIANA CORN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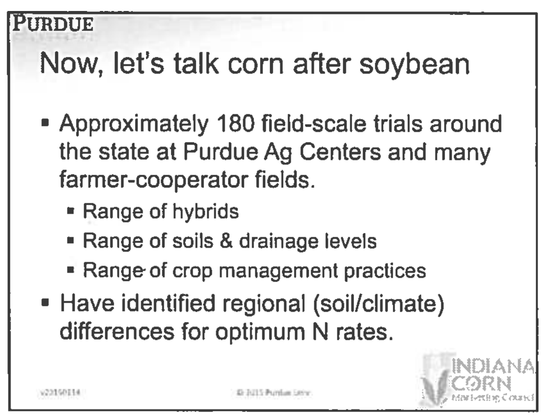
Corn After Corn Requires More N Fertilizer, But Yields Less
Grain yield or N rate
250
200
150
100
50
0
178
222
193
175
Opt. N rate
Yield
Corn/soy
Corn/corn
Camberato & Nielsen, 18 field trials, 2007-2010
INDIANA CORN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Now, let's talk corn after soybean
Approximately 180 field-scale trials around the state at Purdue Ag Centers and many farmer-cooperator fields.
Range of hybrids
Range of soils & drainage levels
Range of crop management practices
Have identified regional (soil/climate) differences for optimum N rates.
INDIANA CORN

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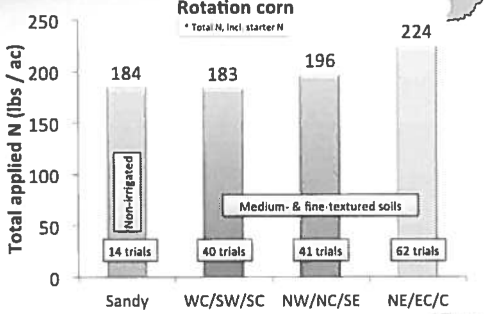
"Ballpark" Optimum N Rates*

Rotation corn

* Total N, incl. starter N



Camberato & Nielsen, Purdue, 2006 - 2014 © 2015 Purdue Univ

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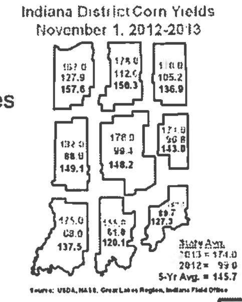
Why the regional differences?

- One might logically think that it is related to regional differences in yield level or productivity…



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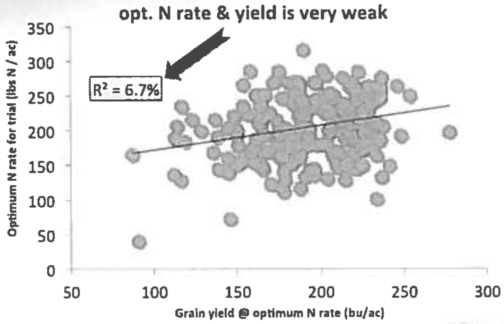
But, relationship between opt. N rate & yield is very weak



Camberato & Nielsen, Purdue, 2006 - 2014

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Why the regional differences?

- Primarily due to relative risks of soil nitrate-N losses (N use efficiency)
  - Soil drainage
  - N fertilizer applic. timing, source, placement
  - Soil compaction
  - Weather, esp. rainfall

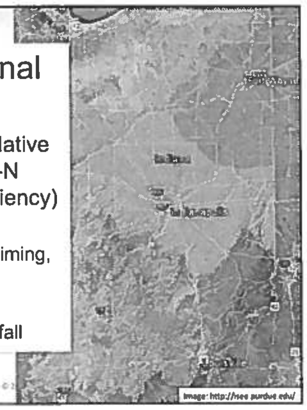

Image: http://iaee.purdue.edu/

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Optimum N rates & soils

- Higher optimum N rates tend to occur in those trials where soil drainage was poor.
  - Higher risk of soil nitrate loss by denitrification
    - Less available soil N for plant
  - Higher risk of soil compaction from field operations on "slightly wet" soils.
    - Leads to even poorer soil drainage, higher risk of denitrification, restricted root development, overall poor plant growth.

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Whereas, with better drainage…

- …lower optimum fertilizer N rates are partly due to lower risk of denitrification losses and, thus, more available soil N.
- …lower optimum N fertilizer rates are also partly due to the fact that better drainage means lower risk of soil compaction and restricted root systems….. Happier plants.

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"Happy" plants…

- …are physiologically more efficient and produce more grain with the same inputs.
- Plants that are struggling, challenged, or otherwise compromised are less efficient physiologically and require more inputs even though they produce less yield.

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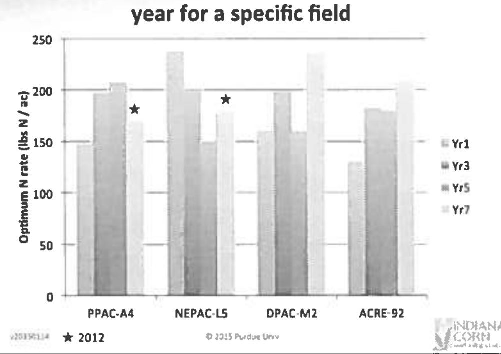
Optimum N rate can vary a lot year to year for a specific field



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Why would optimum N rate vary one year to the next in the same field?

- Availability of soil N varies year to year.
  - Variable weather means variable soil N loss due to leaching or denitrification.
  - To a lesser degree, also variability in the amount of N released by mineralization of organic matter.
- Overall vigor of the crop varies every year because crop stresses vary every year.

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What about the economics?

- Last time I checked, nitrogen fertilizer was not being given away for free*…
  - $728 Anhydrous = $0.44 / lb actual N
  - $459 Urea = $0.50 / lb N
  - $330 UAN28 = $0.59 / lb N
- Last time I checked, corn was not worth as much as it once was…
  - Less than $4 / bu

* IL Production Cost Report, USDA-IL Dept of Ag Market News, 1/8/15

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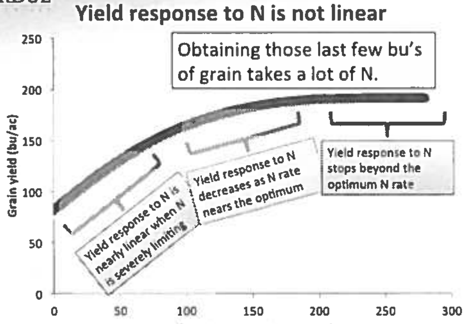
Yield response to N is not linear



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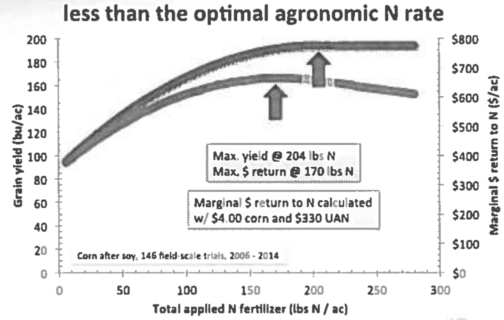
The optimal economic N rate is usually less than the optimal agronomic N rate



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Driven by grain $ and nitrogen $

- Generally speaking…
  - Lower grain prices decrease EONR
  - Higher N costs decrease EONR
- Specifically, it is the ratio of N cost to grain price that drives the marginal $ return to N
  - Higher ratios = Lower EONRs
  - Lower ratios = Higher EONRs
- Details in our online summary.

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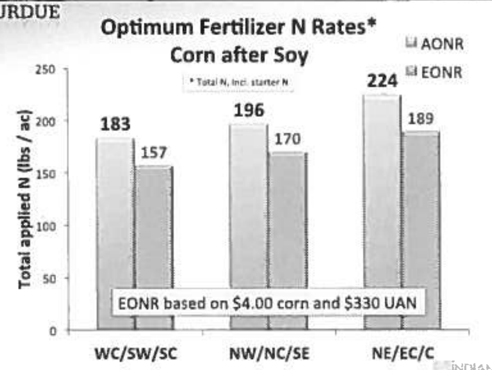

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Summary and Guidelines

www.kingcorn.org/news/timeless/NitrogenMgmt.pdf

Purdue University Department of Agronomy

Applied Crop Research Update

Updated January 2014

URL: http://www.kingcorn.org/news/timeless/NitrogenMgmt.pdf

Nitrogen Management Guidelines for Corn in Indiana

Jim Camberato[1], RL (Bob) Nielsen, & Brad Joern
Agronomy Department, Purdue Univ., West Lafayette, IN

8-YEAR SUMMARY OF CORN RESPONSE TO NITROGEN FERTILIZER

This report summarizes the yield response of rotation corn to fertilizer nitrogen (N) rate in field-scale trials conducted around the state of Indiana since 2006. These results are applicable to situations that implement efficient methods and timings of N ferti application. The average Agronomic Optimum N Rate (AONR) for 37 trials cc

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How can you fine-tune or "dial in" the accuracy of the predicted optimum N rate for your fields?

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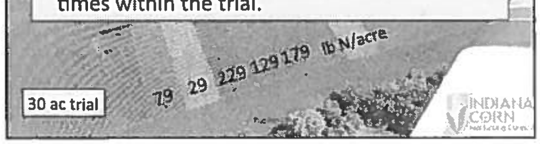
Options for "dialing in" the correct N rate

First of all, identify your own "ballpark"…

- By collaborating with us, your local Extension educator, and/or your local CCA in conducting your own on-farm N rate research trials over several years.

Consider on-farm N rate trials

- Trials from 30 to 100+ acres, using farmers' own equipment and farming practices.
- From 4 to 6 N rates (usually sidedress app's)
  - At least 1 rate low enough to reduce yield and 1 rate higher than expected optimum rate
- Randomized and replicated no fewer than 3 times within the trial.



PURDUE

Join us in 2015…

- Collaborate with us to conduct an on-farm nitrogen rate trial. It's fun! It's easy!
- Contact me or visit the Web site below.

PURDUE Purdue Collaborative On-Farm Research

http://www.agry.purdue.edu/ext/ofr

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PURDUE Options for "dialing in" the correct N rate

The "educated guess" option…

- Begin with our estimate of the average AONR for your general region, then make an adjustment based on your educated guess about the relative risk for N loss so far this season…
  - Results from your own on-farm trials will help identify the N rate to begin with.

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PURDUE Options for "dialing in" the correct N rate

The "educated guess" option…

- Adjust the average AONR according to your judgment of the risk for N loss…
  - Wet year prior to applic. = more N loss. Bump N rate by 20 - 30 lbs/ac as a guess.
  - Dry year prior to applic. = less N loss. Decrease N rate by 20 - 30 lbs/ac as a guess.

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PURDUE Options for "dialing in" the correct N rate

Soil nitrogen tests?

- The Pre-Sidedress Nitrate Test (PSNT)
  - Soil samples collected prior to sidedressing and sent to analytical lab for soil NO_3 determination.
  - A viable option, but one best suited for manured fields or soils with very high organic matter levels.

www.extension.purdue.edu/extmedia/AY/AY-314-W.pdf

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PURDUE Options for "dialing in" the correct N rate

Stalk nitrate tests?

- Lower stalk segments collected from fields within 1 to 3 weeks after kernel black layer and sent to analytical lab for nitrate test.
- Limited use for "hindsight" evaluation for historical trends, but not terribly predictive of optimum N rate for next year.

www.soilfertility.info/news/cornstalknitrate.pdf

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PURDUE Options for "dialing in" the correct N rate

Complex computer models

- Several organizations, including Purdue, have worked hard to develop computer models that predict current soil N availability, future soil N losses, and ultimately optimum rates of N fertilizer.
  - Involves very complex modeling of biological and physical functions in the soil.
- From our perspective, the "jury is still out" on their accuracy or validity.

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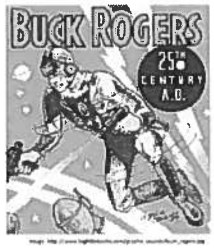
PURDUE
Options for "dialing in" the correct N rate

Today or tomorrow option…

- Optical reflectance sensors that estimate current crop N status might help fine-tune sidedress N rate decisions.
  - GreenSeeker® (Trimble)
  - OptRx® (AgLeader)
  - Aerial imagery



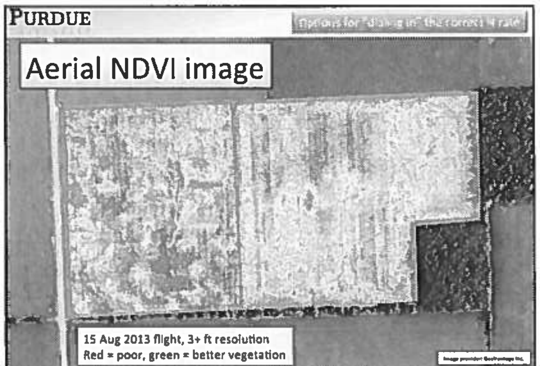
PURDUE
Options for "dialing in" the correct N rate

GreenSeeker NDVI

- Data collected 18 June w/ equipment-mounted GreenSeeker sensors in corn approximately 60 inches tall (four sensors for every 12 rows).
  - Red = Lower reflectance = Smaller plants and/or lighter green leaves

PURDUE
Options for "dialing in" the correct N rate

Aerial NDVI image



15 Aug 2013 flight, 3+ ft resolution
Red = poor, green = better vegetation

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Crop reflectance data…

- …not only can identify, but can also clearly quantify N deficiencies in trials with intentionally different N rates.
  - Especially once the plants reach waist-high or leaf stages V10 to V12.
    - Which makes sense because corn does not begin to take up significant amounts of N until about that point in the season.

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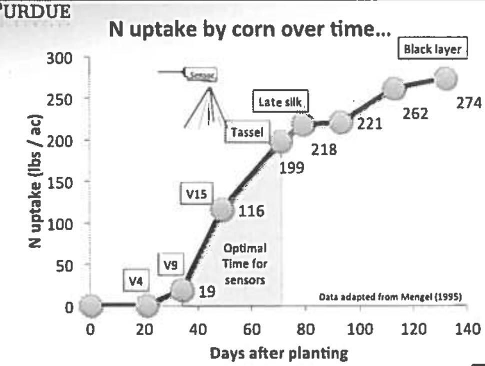
N uptake by corn over time…



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Such late N applications…

- …are certainly not attractive to many folks because of the fear of early N deficiency or the consequences of rain delays at those late dates.
  - Obviously would require a minimum base amount of N be applied early to sustain the crop until that stage; maybe 80 to 100 lbs N.
  - Probably require a "fall back" alternative to applying N quickly if delayed.

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Other challenges…

- In real-world fields, reflectance data clearly identifies "poor" and "good" areas within the field, but does not diagnostically distinguish between N deficiency and other causes of crop stress.
- The predictive algorithms need further refinement (i.e., need more field trial data).

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To summarize our research…

- Optimal agronomic N rates for rotation corn vary around the state.
  - Approx. 180 to 230 total lbs N / ac; influenced by soil drainage and risk of N loss.
  - Will vary plus/minus 25 to 50 lbs for a given location with variability in weather patterns.
- Optimum N rates for continuous corn are 30 to 50 lbs greater than for rotation corn.

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More precise fine-tuning..

- …is challenging because of the difficulty in predicting soil N levels in any given field.
  - Soil tests have their limitations.
  - Stalk nitrate sampling has its limitations.
  - Computer models have their limitations.
  - Crop reflectance tools have their limitations.

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Optimize N management..

- Improve tile or surface drainage to reduce risk of N losses to denitrification.
- Focus on late pre-plant N applic's, split-applic's (pre-plant + sidedress), or simply sidedress N applic's

- Avoid UAN or urea broadcast without incorporation.
- Avoid early spring (March) N applic's
- Avoid fall-applied anhydrous ammonia

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Online summary of our N management guidelines: www.kingcorn.org/news/timeless/NitrogenMgmt.pdf

Email: rnielsen@purdue.edu

Twitter: @PurdueCornGuy

Web: www.kingcorn.org/cafe

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2014 Review and 2015 Outlook

NOAA/NWS
Ohio River Forecast Center

Ohio State University
Corn and Soybean Day

Jim Noel – Service Coordination Hydrologist

January 22, 2015

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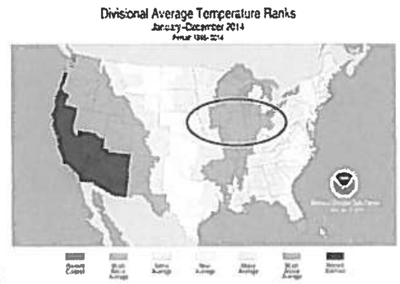
2014 Temperature Rank



2014 was colder than normal across the corn and soybean belt including Ohio.

The core of the cold was west of Ohio

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2014 Precipitation Rank

2014 was near normal to slightly wetter across the region.

Ohio experienced near normal precipitation

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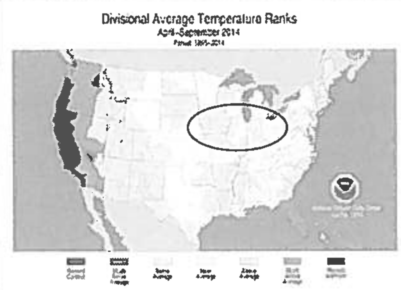
2014 Growing Season Temperature Rank



2014 growing season temperatures were normal to just slightly colder than normal

Ohio was near normal.

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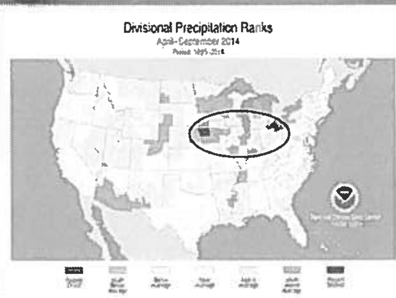
2014 Growing Season Rainfall Rank



2014 growing season rainfall was generally wetter than normal

Ohio was slightly wetter than normal

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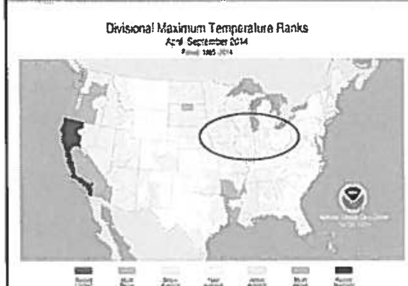
2014 Growing Season Maximum Temperature Rank



2014 growing season maximum extreme temperature ranks were generally below average

Ohio was about normal

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2014 Growing Season Minimum Temperature Rank

2014 growing season minimum extreme temperature ranks were normal

Ohio was near or slightly above normal due to moisture and clouds

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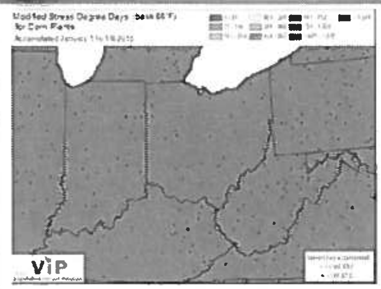
2015 Corn Stress Degree Days



NOAA Midwest Climate Center now generates Corn Stress Degree Days and Departure from normal for entire corn belt.

http://mrcc.isws.illinois.edu/VIP/indexSDD.html

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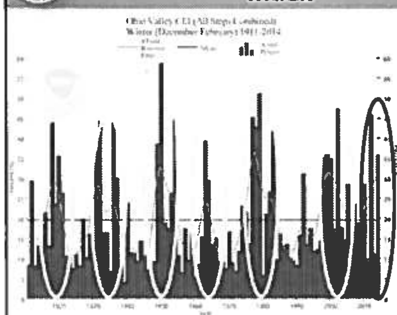
Winter Eastern Corn Belt Extreme Index



Extreme Index is comprised of maximum and minimum temperature ranks, 1-day precipitation ranks, drought ranks and wet and dry days

Extreme Index increasing due to colder weather

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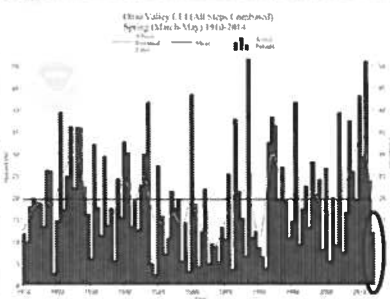
Spring Eastern Corn Belt Extreme Index



After being very high for several years, extreme index dropped in 2013/2014 for spring resulting in good yields.

Index was lowest since 2005.

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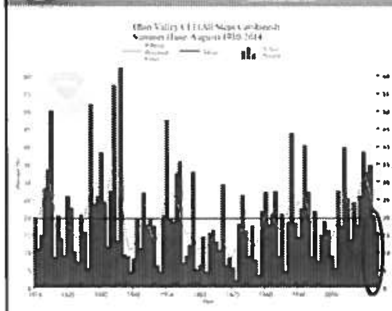
Summer Eastern Corn Belt Extreme Index



After being very high for several years, extreme index dropped in 2013/2014 for summer resulting in good yields.

Index was lowest since 2005.

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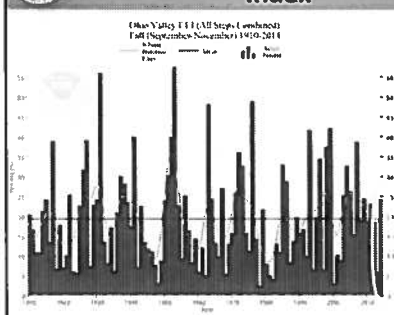
Autumn Eastern Corn Belt Extreme Index



Many recent elevated years due to wet autumns. This includes 2014.

Growing risk to agriculture is harvest season wetting trends.

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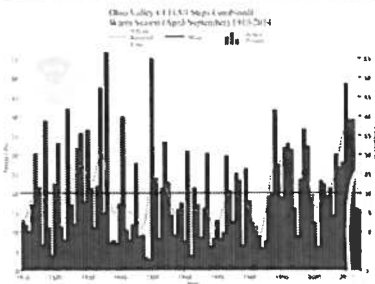
Growing Season Eastern Corn Belt Extreme Index



Growing season risk way down last two years as advertised.

2013
CEI Risk - Corn
-4% +18%

2014
CEI Risk – Corn
-5% +19%

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Early Results Climate Extreme Index (CEI) Versus Corn Crop Yields

- Compared corn crop yields in Ohio to CEI last 43 years.
- When we are above the CEI mean during the growing season (increased risk), corn crop yields averaged 6% below trend line. The CEI averaged 9% above the mean.
- When we are below the CEI mean during the growing season (decreased risk), corn crop yields averaged 3% above trend line. The CEI averaged 7% below trend line.

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Early Results Climate Extreme Index (CEI) Versus Corn Crop Yields

- If we can begin to predict the Climate Extreme Index (CEI) instead of simply above or below normal temperatures and above or below normal precipitation
- then
- We can provide more useful information on whether the changes from normal are meaningful enough to result in RISK to crop yields.

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Experimental Climate Forecast Predictor

- The Climate Forecast Predictor using analogs forecasts the direction of corn crop trend line yields 82% of the time since 1930.

Year	Prediction	Result	Year	Pre	Result
2014	+ 1.3%	+ 18.9%	2006	+0.0	+10.6%
2013	- 5.0%	+ 17.9%	2005	+4.0	+1.0%
2012	- 11.3%	- 36.0%	2004	+0.0	+1.1%
2011	+ 2.9%	+ 4.4%	2003	-8.0	+11.2%
2010	+ 3.6%	+ 8.2%	2002	-13.7	-55.7%
2009	+ 2.0%	+14.9%			
2008	– 5.5%	- 7.4%			
2007	+ 4.3%	+ 4.0%			

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Experimental Climate Forecast Predictor

- The Climate Forecast Predictor using CEI (26) forecasts the direction of corn crop trend line yields 80% of the time since 1930.

Year	Prediction	Result	Year	Pre	Result
2014	+	+ 18.9%	2006	+	+10.6%
2013	+	+ 17.9%	2005	+	+1.0%
2012	-	- 36.0%	2004	+	+1.1%
2011	+	+ 4.4%	2003	+	+11.2%
2010	+	+ 8.2%	2002	+	-55.7%
2009	+	+14.7%			
2008	+	- 7.4%			
2007	+	+ 4.0%			

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Experimental Climate Forecast Predictor

- The Climate Forecast Predictor question is what does it say for Ohio for 2015 corn yields?

Using analogs	Using CEI
-5%	+ side of trend line

Consensus suggests yields within +/- 5% of trend-line. Range is from -55% to +16%. Most clustered between +5% to -10% of trend-line dating back to 1930. More slightly negative than positive.

Confidence is high of lower yields than last 2 yrs.

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Official NOAA Winter Outlook

- Official NOAA winter outlook calls for equal chances for temperatures above, normal or below and slightly drier than normal on precipitation

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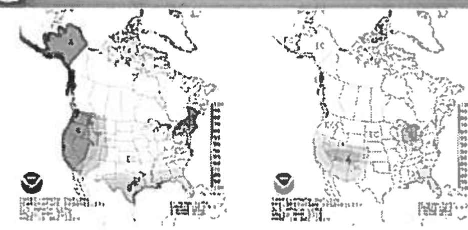
Official NOAA Spring Outlook



- Official NOAA spring outlook calls for equal chances for temperatures above, normal or below normal and slightly drier than normal precipitation

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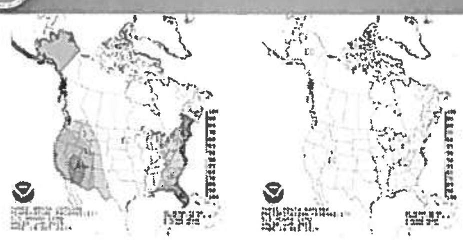
Official NOAA Summer Outlook



- Official NOAA summer outlook for Ohio calls for warmer than normal with equal chances for rainfall.

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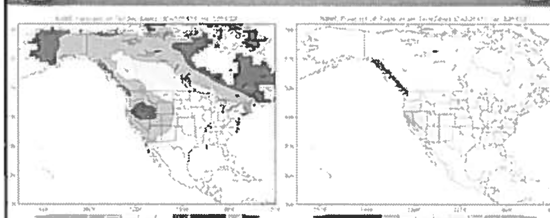
Consensus Winter Climate Models



- Climate model consensus for Ohio's winter is near normal temperatures and precipitation.

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Winter 2015 so far - observed

- So far it has been a little warmer than normal with normal precipitation.

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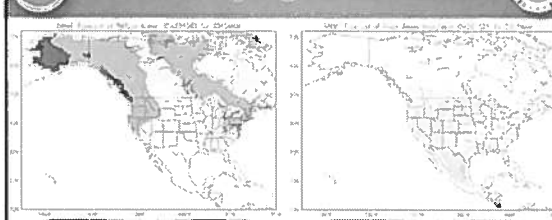
Consensus Spring Climate Models



- Climate model consensus for Ohio's spring is slightly warmer than normal with near normal rainfall.

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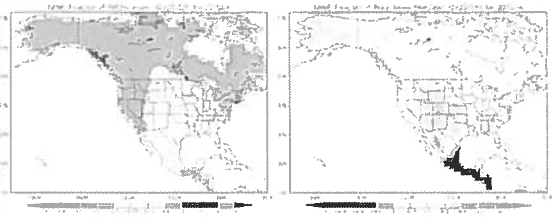
Consensus Summer Climate Models



- Climate model consensus for Ohio's summer is slightly warmer than normal with near normal rainfall.

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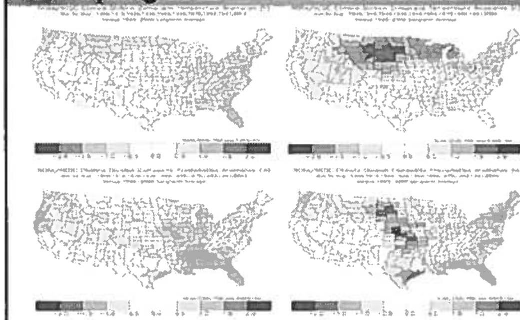
Analogs

Spring 2015 Summer 2015



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Manure Runoff Risk System Development

The Wisconsin runoff risk system is being expanded to the Maumee basin

The hope is NOAA/NWS/OHRFC can generate runoff risk maps for all the Ohio Valley

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Temperature and Precipitation Trends since 1976

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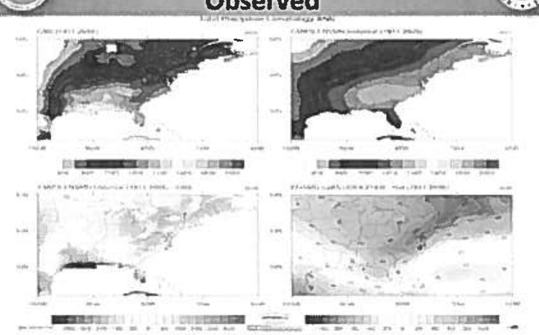
Climate Model Comparison to Observed



http://www.esrl.noaa.gov/psd/ipcc/cmip5/

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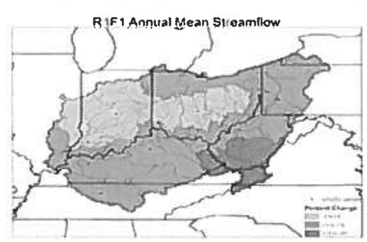
2011-2040 Annual % change Mean



- Insignificant changes to slight wetting across most of the basin compared to 1952-2001

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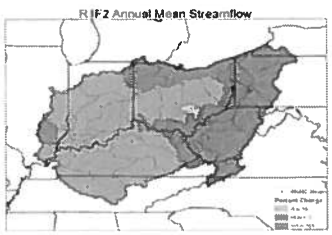
2041-2070 Annual % change Mean



- Some wetting across Ohio Valley with biggest increases in eastern basin compared to 1952-2001

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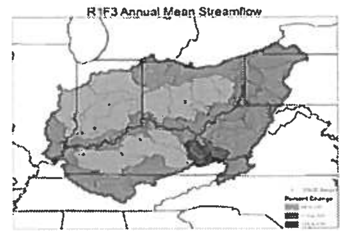
2071-2099 Annual % change Mean



- Wetting continues with biggest increases in mean flow in eastern Ohio Valley compared to 1952-2001

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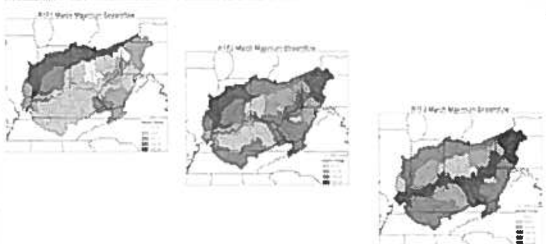
Spring Flood Season - March Monthly % change – Max Flows



- Peak flows gradual increase. Mostly within historical range until after 2040 except northwest

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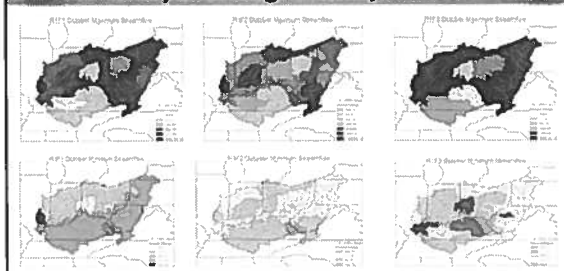
Autumn Dry Season - October Monthly % change – Max/Min Flows



- More variability in low flow season. Mean and maxes increase and mins decrease.

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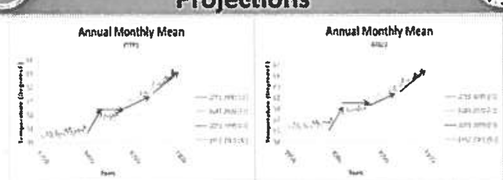
Ohio Valley Temperature Projections



- Pittsburgh (upper Ohio Valley) and Golconda (lower Ohio Valley) show a similar trend about +0.5F per decade then increases about +1F per decade from 2050 to 2099. The faster increase likely leads to increasing evapotranspiration and increasing spread and uncertainty.
- I-64 temperatures shift to I-70 temperatures this century.

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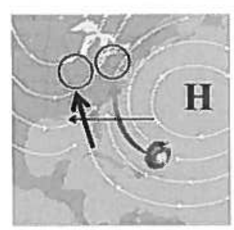
What Influences Ohio Weather

- Climate is always in flux. The changes in ocean temperatures impact the location of the Bermuda high pressure system. Late summer and autumn is very sensitive to its location. This makes late summer and fall in our climate models sensitive to changes!



Source: Penn State University

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Ohio River Basin Climate Change Project

The project took climate change model data of temperatures and precipitation downscaled using IPCC4 CMIP 3 as input into the NOAA/NWS Ohio River Forecast Center (OHRFC) hydrologic river model.

The link is provided here for the CMIP 3 data used.
http://gdo-dcp.ucllnl.org/downscaled_cmip_projections/dcpInterface.html

The USACE IWR used Global Circulation Models (GCMs) for temperatures and rainfall. The approach clustered over 75 ensembles into nine ensemble scenarios that most represented all the GCM runs. The technique was the same technique used by the USACE in the Red River of the North climate change project. The output (Fig. 1) includes three future time periods of 2011-2040, 2041-2070 and 2071-2099 and one retrospective period of 1952-2001.

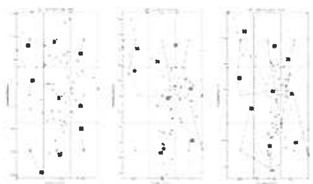


Fig. 1. Nine GCM clustered ensembles for 2011-2040, 2041-2070, 2071-2099

OHRFC used the Community Hydrologic Prediction System (CHPS) along with the Sacramento Soil Moisture Accounting Hydrologic Model (SAC-SMA) to generate the hydrologic response in an unnatural state using a reservoir (RES-J and RES-SNGL) modeling system. The output includes streamflow, temperatures, precipitation and snow water equivalent (in CSV format for easy use). The hydrologic model output is at the bottom end of for each tributary along with the Ohio River and Great Lakes Lake Erie drainage areas. This project did not include the Tennessee River System as that is not part of the OHRFC area of responsibility even though it lies with the USACE LRD area of responsibility.

A comparison of the retrospective period of 1952-2001 to actual historical flows shows how well the climate model inputs with hydrologic outputs of streamflow simulated the past to establish confidence in abilities to simulate the future. Results showed flows were within 2% on the main-stem Ohio River and 5% on tributaries.

The hydrologic model output is retained at the same time-scale as the input climate grids, monthly. The following graphics show the percent changes in annual flow for mean, minimum and maximum flows for the three future periods of 2011-2040 (Fig. 2), 2041-2070 (Fig. 3) and 2071-2099 (Fig. 4) compared to the retrospective period of 1952-2011.

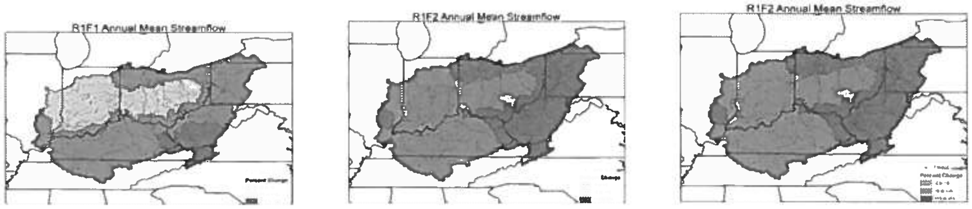


Fig. 2. Annual changes in mean flows (percent) for 2011-2040, 2041-2070, 2071-2099 compared to 1952-2011. Gray(+/-5%), Green (+5 to +15%), Blue (+15 to +25%)

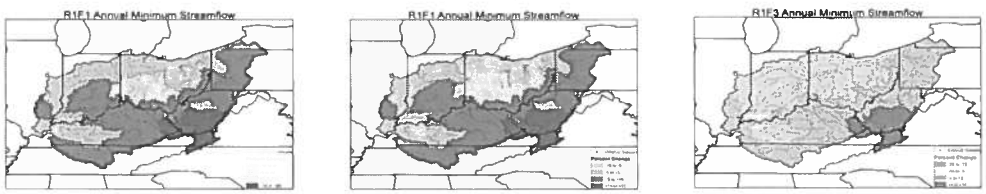


Fig. 3. Annual changes in min flows (percent) for 2011-2040, 2041-2070, 2071-2099 compared to 1952-2011. Yellow (-5 to -15%), Gray(+/-5%), Green (+5 to +15%), Blue (+15 to +25%)

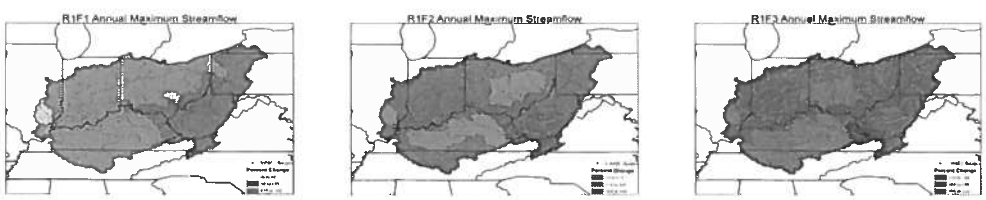


Fig. 4. Annual changes in max flows (percent) for 2011-2040, 2041-2070, 2071-2099 compared to 1952-2011. Gray(+/-5%), Green (5 to 15%), Blue (15 to 25%). Purple (25 to 35%)

Output can also be viewed in terms of actual flow for each basin in the Ohio Valley.

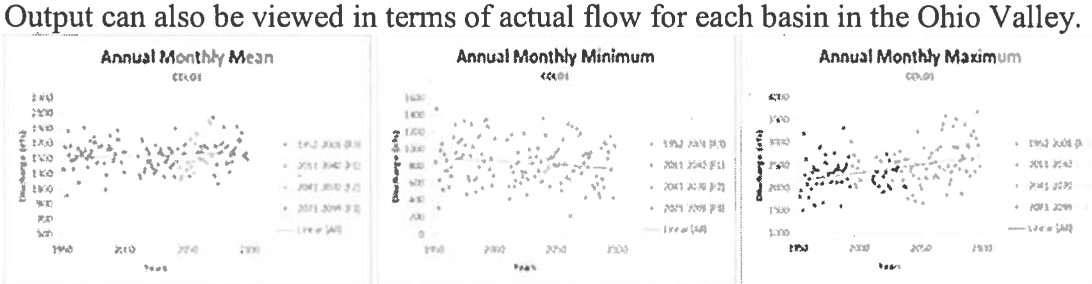
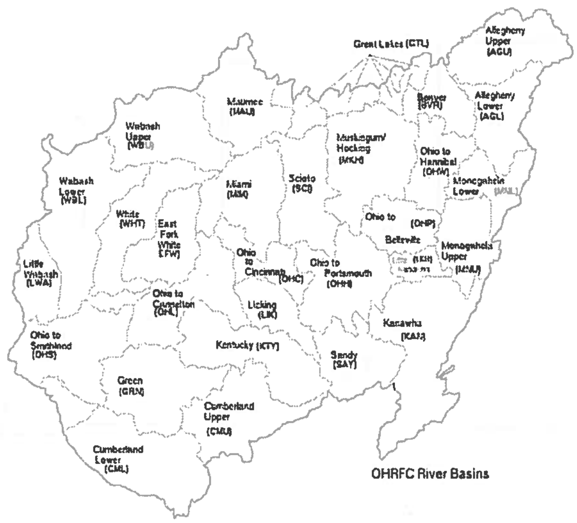


Fig. 5. Annual streamflows for mean, minimum and maximum at Columbus, Ohio

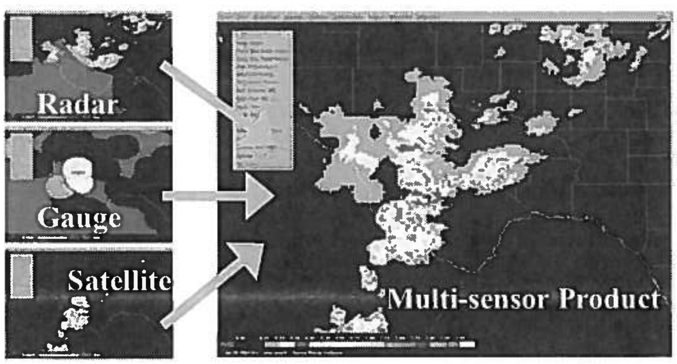
Results show mean, minimum and maximum flows within the historical range through 2040 except autumn. Beyond 2040 increases occur in the mean and maximum flows of between 10 to 40%. Minimum flows decrease beyond 2070. Minimum and maximum flows exceed the historical range especially beyond 2050-2070. Autumn season experiences the greatest changes.

OHRFC
Ohio River Forecast Center

The Ohio River Forecast Center (OHRFC), in cooperation with numerous federal, state, and local government entities, uses the latest science and technology to provide timely and accurate river forecasts in an effort to protect life and property. The OHRFC's area of responsibility stretches from the New York to Illinois to Tennessee to West Virginia and Virginia. It includes the Ohio River. The OHRFC area of responsibility covers more than 200,000 square miles. The OHRFC has responsibility for almost 300 forecast points in the Ohio and Cumberland Valley regions of the United States and operate 6am to 10 pm daily and 24-hours during flooding.

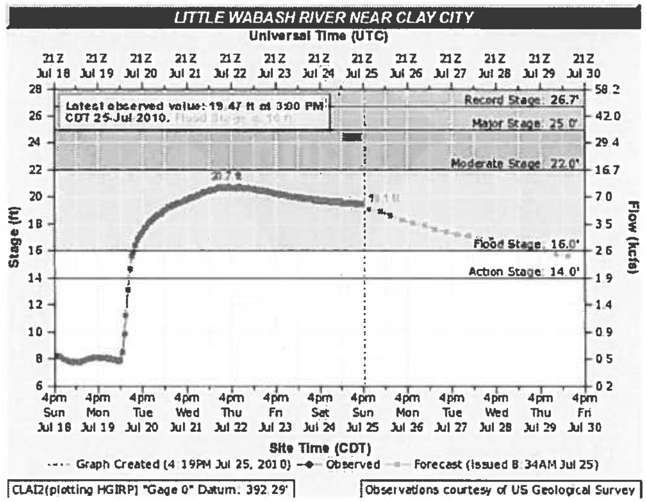


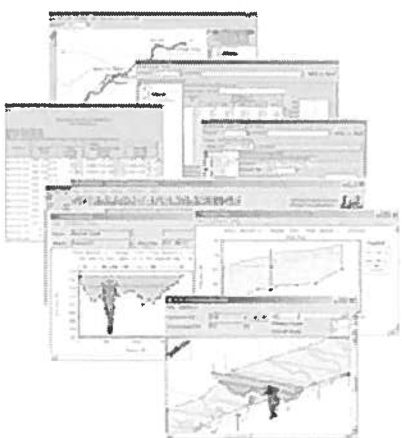
Ohio RFC Area of Responsibility



Hydrometeorological Analysis and Support (HAS) Forecasters monitor rainfall estimates from multiple sources, including radar and satellite. Rainfall estimates from these sources are adjusted based on comparisons to rain gage reports. The final "Best Estimate" of precipitation is input into the river forecasts models. HAS Forecasters also analyze meteorological model data to generate a quantitative precipitation forecast (QPF). QPF is a specific forecast detailing the amount, timing, and location of expected precipitation. Basing their decisions, actions, and forecasts on up-to-date science and technology (along with experience), the HAS Forecasters perform a vital function in the river forecast process.

After obtaining the latest and most accurate rainfall datasets, OHRFC hydrologists begin the process of generating river forecasts for the area. Using river gage data and streamflow measurements and estimates, the hydrologists will look at the combinations of rainfall, runoff, and routed river flows to issue river forecasts. The river forecasts are used as guidance to create public river flood warnings and statements and also help authorities prepare for the impacts associated with the expected river conditions. Forecasts are accessible via the National Weather Service Advanced Hydrologic Prediction Service (AHPS) at: http://water.weather.gov.





OHRFC is migrating to a new operational forecast system which has the capability of infusing cutting-edge hydrologic models and new technologies into the forecast process. This new system, the Community Hydrologic Prediction System (CHPS), builds on better coordination among all water agencies and improves the accuracy and utility of the entire community's water-based forecasts. CHPS will also allow for the rapid transfer of collaborative research into NWS operations. Along with innovation in software, the OHRFC has added a new position to facilitate coordination and outreach with water resource partners and customers.

From time to time, the impacts from river flooding can be extreme. But with accurate and timely forecasts, precautions can be taken to help minimize the damage associated with river flooding. At the OHRFC, our mission is to provide those forecasts. Officials can then determine the best course of action to protect all interests involved during river flood events.

For more information, you can contact the Ohio RFC by sending correspondence to:

1901 South State Route 134
Wilmington, OH 45177

Or you can check us out on the internet at: http://www.weather.gov/ohrfc
To contact our Hydrologist-in-Charge, please e-mail to: Craig.Hunter@noaa.gov

NOAA NWS AHPS Flood Inundation Mapping– A Flood Decision Support Tool

Victor Hom, National Flood Inundation Mapping Services Leader, Hydrologic Services Division, NWS Headquarters

NOAA NWS Advanced Hydrologic Prediction Service (AHPS) delivers flood inundation mapping and forecast warning services, displaying the spatial extent and depth of flooding at river forecast locations. NWS is partnering with other federal, state, and local agencies to expand this capability across the United States.

Floodwaters from the Blanchard River at the Main Street bridge over the Blanchard River in Findlay, Ohio (looking south). Photo taken August 2007 by Mary Terry. Courtesy of Findlay Engineer's Office, reproduced with permission.)

Inundation Mapping as a Flood Decision Support Tool

Before flooding begins: Inundation maps can be used to estimate if locations of interest would be impacted by flood waters. Risk-based decisions could be based on the location of floodwaters and/or the depth of inundation for a given location. Water depth data, when combined with economic loss data, could help users estimate the magnitude of potential damages for a given area. This will help users to prioritize flood fighting efforts and allocate proper resources for effective flood mitigation. For locations where bridges cross the river channel, the maps could be aid logistics and transportation decisions.

For Non-flood situations: Inundation maps in conjunction with FEMA maps can be used to evaluate floodplain scenarios and devise hazard mitigation plans to reduce the future flood impacts.

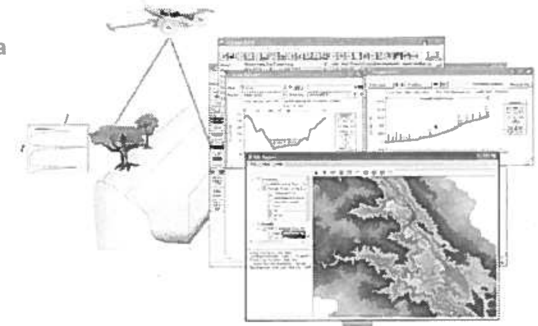
The Process

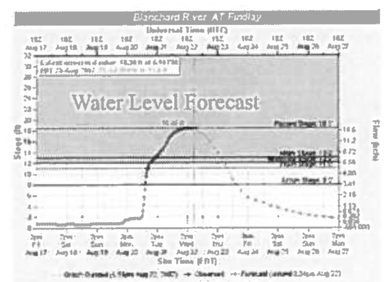
1. High resolution topographic data and hydraulic modeling are necessary to produce inundation maps.

2. A hydraulic model, which requires specialized engineering analytical skills in open channel hydraulics, is more complex to develop than a hydrologic model.

3. Hydraulic analyses, conducted at NWS River Forecast Locations and USGS Gaging Stations, are combined with geospatial analyses to produce a flood map library.

4. The library is linked to AHPS River Forecast Services for real-time flood decision support.





Maps Delivered in User-Friendly Formats

Web Graphics: AHPS provides a graphical interface to visualize the geographic extent of flooding and an estimate of the inundated water depths upstream and\or downstream from the forecast site. The data is accessible 24x7 and viewable via internet. Users can also download the data for viewing in GIS or Google Maps.

Map Library: Each library contains inundation maps for the flood categories (Minor, Moderate, Major) and various flood levels. The depth of inundation for a given flood level is shown on the map according to a color scale with a darker shading for deeper waters.

Informed Decision Makers

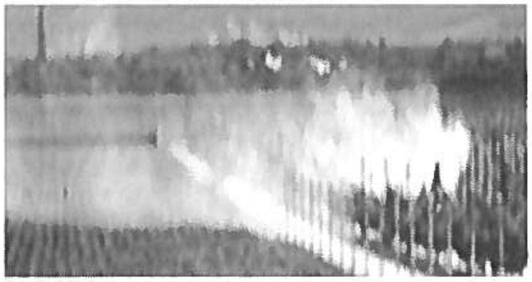
For more info about NWS AHPS Flood Mapping, please contact Victor.Hom@noaa.gov or visit http://water.weather.gov

Core Information

INFORMATION

Cost-effective Strategies to Reduce Spray Drift

Dr. Erdal Ozkan
Prof. and Extension Agricultural Engineer
Food, Agricultural & Biological Engineering Dept.
The Ohio State University



Pesticide applications are required to ensure an adequate and high quality supply of many agricultural crops. Due to concerns for production costs, safety, and the environment, it is important to maximize the pesticide deposit on the target. One of the major problems challenging pesticide applicators is spray drift, which is defined as movement of pesticides by wind from the application site to an off-target site. Spray drift occurs wherever liquid sprays are applied. Although complete elimination of spray drift is impossible, problems can be reduced significantly if the pesticide applicators are aware of major factors which influence drift, and takes precautions to minimize their influence on off-target movement of droplets. Drift distances of droplets that can be tolerated depends on several factors including: crop production type, the sensitivity of the vegetation in the surrounding area, and the type and toxicity level of the pesticide applied. For example, if the target is a row crop that is sprayed from a nozzle centered over each row, then small amounts of droplet displacement by wind can result in large portions of the spray missing the target, causing a much lower efficacy obtained from the pesticide.

Drift is influenced by many factors that usually may be grouped into one of the following categories: 1) Spray characteristics, 2) Equipment and application techniques used, 3) Weather, and 4) Operator care and skill. A general discussion of these factors can be found in an Ohio State University Extension Publication (Reducing Spray Drift; OSUE Bulletin 816) which is available online (http://ohioline.osu.edu/b816/).

The factors that significantly influence off-target movement of droplets are: 1) wind velocity and direction, 2) droplet size and density, and 3) distance from the nozzle to the target. Other factors that influence drift include droplet velocity and direction of discharge from the nozzle, volatility of the spray fluid, relative humidity, ambient temperature, and atmospheric turbulence intensity. Effect of these variables on drift distances of spray droplets are discussed in detail in Ohio State University Extension Publication AEX-525, available online (http://ohioline.osu.edu/aex-fact/0525.html). The information presented in this handout is a revised version of AEX-525. The data presented was generated using a computer model called **DRIFTSIM**, developed by Dr. Heping Zhu (USDA-ARS Application Technology Research Unit; Wooster, Ohio). This computer program calculates the effect of various parameters on drift distances of spray droplets. This computer program is available to public online at following web site: http://ohioline.osu.edu/b923/

Although the accuracy of the drift data produced by **DRIFTSIM** has been validated by wind tunnel experiments, one has to be cautious when drawing conclusions from the data presented in this publication. Due to the many variables that influence spray drift, it is extremely difficult to precisely predict drift distances of droplets for field conditions. Some of the variables that affect drift distances, such as wind turbulence, wind velocity and direction can vary considerably after a droplet is released from the nozzle. It is common for terrain and vegetation (size and density) to vary over the path of a drifting droplet and they influence local wind velocity and direction. Therefore, *The drift distance data presented in this publication are only valid for the constant conditions specified. The data presented are useful in comparing the relative effects of several factors on drift distances, but are not intended to precisely model drift distances under variable field conditions.*

Effect of Droplet size, Wind Velocity and Relative Humidity on Spray Drift

Droplet size and wind velocity are the two most influential factors affecting drift. Droplet sizes are measured and described in *microns*. 1 micron is 1/25,000 of an inch. Diameter of a human hair is about 75-100 microns. Droplet velocity also plays some role, but its effect on drift is not as significant as the size of droplets and wind velocity. Relative humidity influences the evaporation rate of a droplet and hence its size, flight time, velocity and drift distance. DRIFTSIM computer model shows all droplets 50 micron diameter and smaller completely evaporated before they reached the target 18 inches below the nozzle under most spraying conditions (wind velocities between 2.0 and 10.0 mph, and relative humidities between 20 and 80%).

Figures 1 and 2 shows drift distances of different sizes of droplets under different wind velocities. This should be noted that the drift distances shown on both Figures are correct only for one set of environmental conditions: Temperature= 75°F; Relative Humidity = 60%. Naturally, when the temperature increases and/or relative humidity decreases, the drift distances of droplets are likely to increase. Although the shape of the curves presented on both Figures may remain similar when the weather conditions (mainly temperature, relative humidity) are different than those mentioned above, to determine the exact drift distances of droplets for a specific set of weather conditions, one should run the DRIFTSIM computer program for that particular set of weather conditions. A large data base on drift distances of droplets under a wide range of droplet sizes, wind velocities, relative humidity and temperature conditions are given in OSU Extension Publication AEX-525. (http://ohioline.osu.edu/aex-fact/0525.html).

The data in Figures 1 and 2 show that the drift distances of small droplets increase rapidly with increased wind velocity, but decrease as initial droplet size increase. Data on both graphs show that drift is far less likely to be a problem when spraying with 200 micron diameter and larger droplets. However, it should be always kept in mind that wind always has the upper hand when spraying. It is common for gusts with velocities two or more times the mean wind velocity to occur while spraying. Under excessive wind conditions no droplet is safe from drifting away, regardless of its size.

Although it is not scientifically correct, it is common to see in popular press that only droplets smaller than 100 micron are considered “drift-prone”. Most nozzles used for applying pesticides produce a large portion of the spray volume in 100 micron diameter droplets and larger. However, it does not take a large volume of a powerful pesticide to create serious drift damage. For example, our measurements of spray droplets from an XR 8002 VS flat-fan nozzle (Spraying Systems Co., Wheaton, IL) with 0.2 gpm flow rate when operated at 40 psi indicated that about 75% of the total spray volume was in droplets 100 micron diameter and larger. However, the remaining 25% of the spray volume in droplets smaller than 100 micron may be more than enough to create significant drift damage, especially if the spraying is done under conditions of high wind speed, high temperature and low relative humidity. So, to reduce the risk of drift damage, one should spray pesticides using the largest size of droplets that are still considered effective, under favorable weather conditions (wind, temperature, relative humidity).

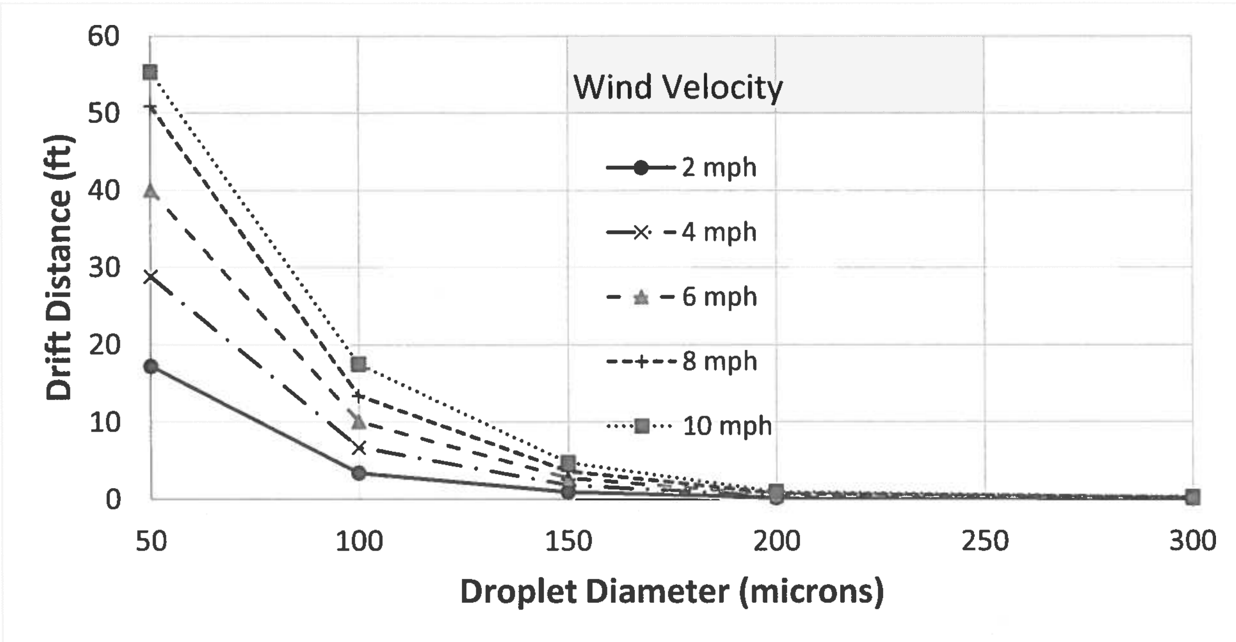


Figure 1: Effect of droplet diameter and wind velocity on drift distances of water droplets directed downward at 65 ft/second toward a target 18 inches below discharge point (Temperature= 75°F; Relative Humidity = 60%).

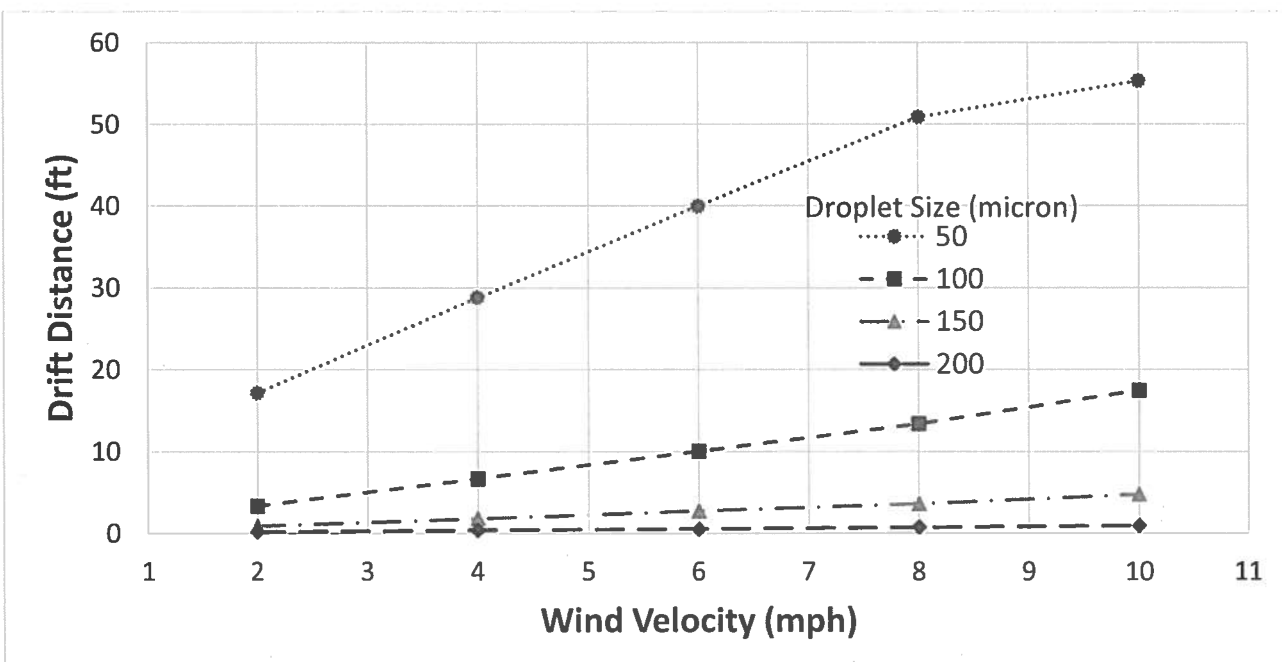


Figure 2: Effect of wind velocity and droplet diameter on drift distances of water droplets directed downward at 65 ft/second toward a target 18 inches below discharge point (Temperature= 75°F; Relative Humidity = 60%).

Effect of Temperature and Relative Humidity on Drift Distances of Droplets

Pesticides are applied over wide ranges of temperatures and relative humidities both influence the evaporation rates of droplets. Since evaporation of liquid from a droplet decreases its mass, it also influences the drift distance of the droplet. However, generally, the effect of temperature and relative humidity is considerably less than the effect of wind velocity and direction. Therefore, to reduce the risk of spray drift to minimum, one should pay more attention to wind speed and direction, more than the temperature and relative humidity. For example, with wind velocity of nearly 6 mph and relative humidity of 50%, 100 micron diameter droplets drifted 10.5 and, 11.6 ft before deposition at temperatures of 50 and 86°F, respectively. Ambient temperatures within the range of 50 and 86°F had very little influence on drift distances of 200 micron diameter and larger water droplets when wind velocity varied from 1.1 to 22.4 mph.

Effect of Boom Height on Drift Distances of Droplets

Agricultural pesticides are applied with a very wide range of nozzle heights above targets. Nozzle height depends on several factors including the sprayer setup, target and operating conditions. In general, the drift distances of droplets increases as the droplet discharge height (or usually referred to as the boom height; the distance between the target and the nozzle) increases. To determine exactly how much the drift distances change as a result of varying the boom height, we used DRIFTSIM computer model, and conducted laboratory experiments to study the effects of nozzle height (0.5-3.0 ft), droplet diameter (50-300 micron) and wind velocity (2.0-10.0 mph) on mean drift distances of water droplets directed downward. Relative humidity and ambient temperature were kept constant at 50% and 70°F, relatively for all simulations. Figure 6 illustrates the effect of discharge height of droplets on the drift distances of 50, 100, 200, and 300 micron diameter water droplets for 10 mph wind velocity, 50% RH and 65°F. The graph shows that increasing discharge height above 0.5 ft had no effect on the drift distance of 50 micron diameter droplets because they completely evaporated before depositing. However, increasing discharge height of 100 micron diameter droplets significantly affects their drift distances. Changes in discharge heights have less effect on mean drift distances as droplet size increases above 200 micron diameter.

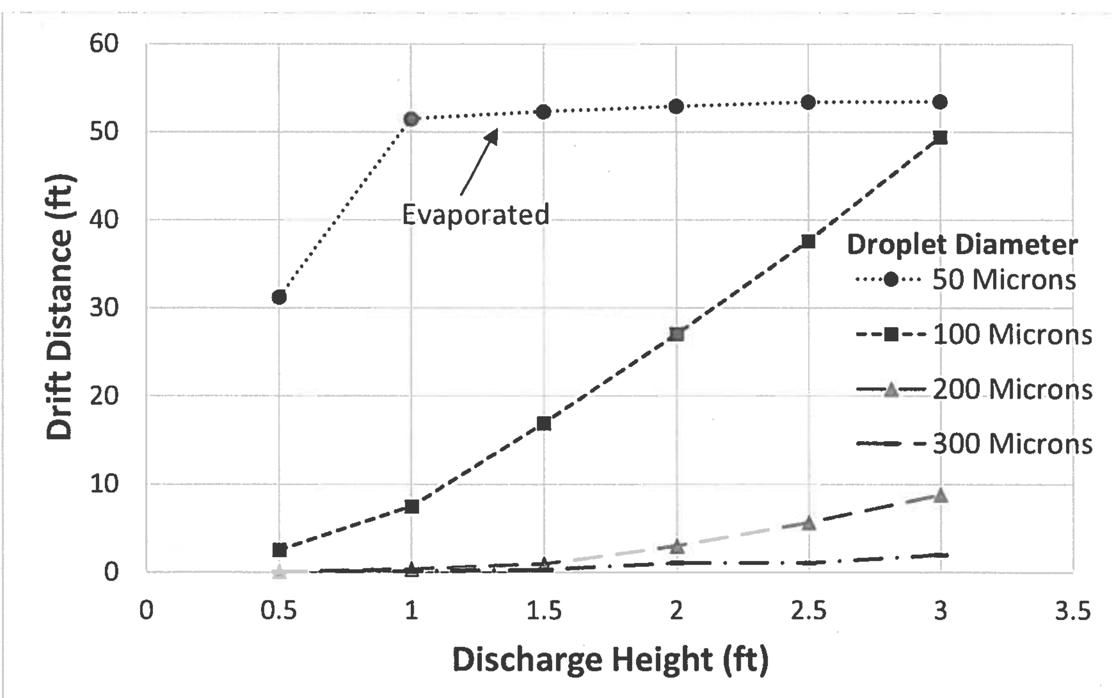


Figure 3. The effect of discharge height of droplets on drift distances of 50, 100, 200, and 300 micron diameter water droplets at 10 mph wind velocity (RH= 50%, T= 65°F.)

When simulations for large size droplets were performed, results indicated that if the discharge height becomes too large, even the large droplets have tendency to drift under high wind velocity conditions. For example, the mean drift distance of 1000 micron diameter droplets was 5 ft for wind velocity and discharge height of 22 mph and 10 ft, respectively. Computer simulation also indicated that the mean drift distances of 1000 and 2000 micron diameter droplets were 57 and 19 ft, respectively, before impaction 13 ft below the point of discharge for 22 mph wind velocity, 50% relative humidity, and 0 mph initial droplet velocity.

Summary: Factors affecting spray drift

The following conclusions are based on the computer simulations of drift distances of water droplets within the range of variables discussed in this publication.

1. Changes in wind velocity, discharge height, ambient temperature and relative humidity had much greater influence on the drift distances of droplets 100 micron diameter or less than on 200 micron diameter and larger droplets. For droplets that did not evaporate before deposition, there was a nearly linear relationship between wind velocity and drift distance.
2. With 100% RH, 10 micron diameter droplets drifted beyond 650 ft when wind velocity exceeded 5.5 mph.
3. Droplets with 50 micron diameter and smaller completely evaporated before reaching 18 inches below the discharge point, regardless of initial velocity, for relative humidities 60% and lower and temperatures between 55 and 85. Also, the mean drift distances of these droplets increased with increased droplet size.
4. Drift distances of 100 micron diameter and larger droplets increased with increased wind velocity and discharge height, but decreased with increased droplet size and discharge velocity.
5. Drift distances of water droplets as large as 200 micron diameter were influenced by initial droplet velocity and height of discharge.
6. The drift potential of 200 micron diameter droplets is considerably less than for 100 micron diameter droplets. Unless some means such as shields or air jets are used, drift reduction techniques should be directed toward reducing the portion of spray volume contained in droplets less than 200 micron diameter for applications where minimizing drift is important. For some applications, such as with high nozzles and slow initial downward velocity and high wind velocity, droplets larger than 200 micron diameter may be needed to satisfactorily reduce drift.

Conclusions:

Spray drift is one of the most serious problems the pesticide applicators have to deal with. It wastes expensive pesticides, may damage non-target crops nearby, and poses a serious health risk to people living in areas where drift is occurring. The three major main reasons to reduce drift are keeping the environment clean, reduce pesticide consumption and cost, and avoid costly litigations. Here are six cost-effective tips on how to minimize spray drift.

1. If you can, keep your nozzles as close to the target as possible while still producing a uniform distribution of spray on the target. This doesn't cost any money as long as it is practical to make it happen.
2. When you're ready to change nozzles, consider selecting a new set of nozzles that will lead to fewer extremely small droplets most likely to drift away. Low-drift nozzles are in the market and do a tremendous job of eliminating extremely small drift-prone droplets from the droplet spectrum.
3. There are chemicals sold in the market that are designed to increase the droplet size when added into the spray mixture. Most of them are some sort of polymer that tends to increase the viscosity and density of the spray mixture which leads to larger droplets. This, however, should be the last defense against drift. First consider the other option such as better targeting of the spray and switching to low-drift nozzles.

4. Air-assisted sprayers significantly reduce spray drift, while allowing you to work with smaller droplets which are advantageous for insect and disease control because small droplets are always provide a more efficient and effective spray coverage if we can get the droplets prevented from drifting away.
5. Use shields that cover partially or fully the distance between the target and the nozzles. There are companies manufacturing and selling such attachments to the boom. Shields prevent small droplets from moving away from the immediate application area. This however may not be practical for sprayers with extremely large booms.
6. If there are any doubts about a spraying job that might result in drift, wait until there is no longer that element of doubt. Always pay attention to wind direction and magnitude. The best investment you can make is to buy one of those wind meters that tell you how high the wind velocity is at any given time. Having a wind meter handy will help you avoid a costly problem associated with spray drift.

More detailed discussion on these tips and other drift reduction strategies are outlined in OSUE Bulletin 816 (http://ohioline.osu.edu/b816/index.html).

Here is a final comment: Spray drift accounts most of the non-compliance cases investigated by the Ohio Department of Agriculture. If you keep in mind the information presented in this publication, and follow the common-sense recommendations we provided above, you will not be one of those people Ohio Department of Agriculture personnel will come to question, or someone's lawyer inviting you to appear in court.

Acknowledgment
Most of the drift distance data presented in this publication was adapted from the following publication:

Zhu, H., D.L. Reichard, R.D. Fox, R.D. Brazee and H.E. Ozkan. 1994. Simulation of drift of discrete sizes of water droplets from field sprayers. Transactions of the ASAE 37(5):1401-1407.

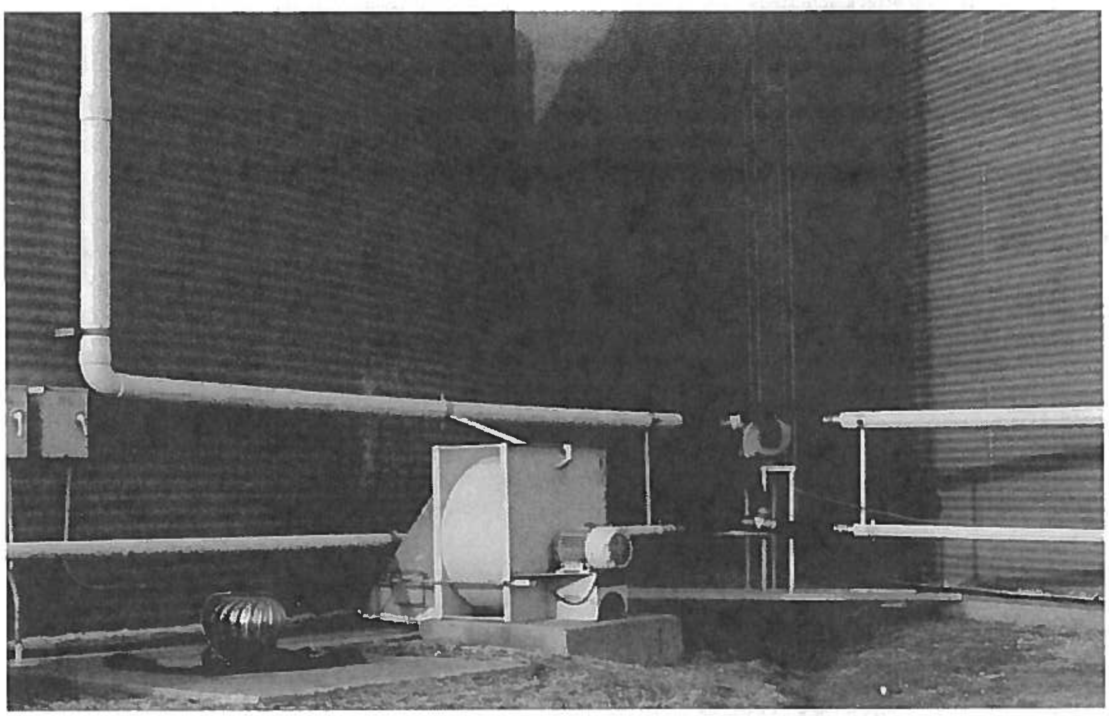
Contact information for Dr. Erdal Ozkan
Email: ozkan.2@osu.edu

Phone: (614)292-3006

Address:
The Ohio State University
590 Woody Hayes Drive
Columbus, OH 43210

Fumigation

CATEGORY 6



Soil Fumigation Additional Training Requirement

Any applicators who are applying soil fumigants are required to complete U.S. EPA approved training. This training is in addition to requirements for the Ohio Private Pesticide Applicator License.

Below is the front page of the web-based training required for licensed Ohio applicators who are planning ot use the following soil fumigants: methyl bromide, chlorpicrin, chloropicrin, and 1,3-dichloropropene, dazomet, and meta sodium and meta potassium.

The website is *www.fumiganttraining.com*
Information about training for other products is available at:
www.epa.gov/pesticides/reregistration/soil_fumigants

Phosphine Gas: Label, Applicator's Manual and Fumigation Management Plan

Curtis E. Young

Van Wert County Extension Educator, OSU Extension

There are only a few materials still on the market that are true fumigants. Of these products, the one that has the greatest potential of being used by an applicator holding a private applicator's license is phosphine gas. Phosphine gas is a Restricted Use Product because of its extreme toxicity primarily by inhalation, but also by absorption. The use of this phosphine gas is strictly prohibited on single and multifamily residential properties and nursing homes, schools (except athletic fields), daycare facilities and hospitals. To purchase and/or use phosphine gas, one must have the new Category 6 on their private applicator's license and acquire re-certification credits for Category 6 to retain that category on their license once every three (3) years. Phosphine gas falls under Category 10c on the commercial pesticide applicator's license.

Typically, phosphine purchased to be used on the farm comes as a solid, Aluminum Phosphide (e.g., Phostoxin, Fumitoxin, and Weevilcide) in the form of a pellet or tablet (5 pellets = 1 tablet). This solid product reacts with moisture (water) to liberate the phosphine gas from the solid. The moisture used to react with the solid primarily comes from the moisture in the air. It is not recommended to bring aluminum phosphide into direct contact with standing water. If this happens, the rate of reaction and the build-up of phosphine gas concentration can result in spontaneous explosion. The moisture in the air is usually more than adequate to move the conversion reaction along at a safe rate and gas concentration. The chemical reaction for this process is aluminum phosphide plus water yields phosphine gas plus aluminum hydroxide powder ($AlP + 3H_2O \rightarrow Al(OH)_3 + PH_3$). The aluminum hydroxide powder or ash is non-toxic.

Beyond the safety issues associated with the use of phosphine gas as a pest management tool is the successful use of phosphine gas to control pest populations. There are several factors that impact the ability of phosphine gas to successfully fumigate a farm bin including: temperature, moisture, condition of the structure to be fumigated, dosage, time, distribution of gas in grain mass, target insect species, life stage of insect, wind, and maybe most significantly, the ability to properly seal the structure to be fumigated. A 39-page Applicator's Manual that is part of the pesticide label for the use of aluminum phosphide, specifically DEGESCH Phostoxin® Tablets and Pellets, can be found on DEGESCH America, Incorporated's website at the following web address: http://www.degeschamerica.com/literature.html.

Sealing of Structure and Aeration

Of critical importance to the success any fumigation is being able to thoroughly seal the structure or area that is to be fumigated to prevent the escape of the gas. After the introduction of the appropriate dosage of the fumigant into the area to be fumigated, one must be able to hold the fumigant in place for the required time at a high enough concentration to satisfactorily kill the majority of the targeted pest. This is one of the greatest reasons why fumigations fail. Many have used phosphine gas in the past without sealing the structure into which the fumigant was introduced. Afterward, it may have superficially appeared that the fumigation was a success. However, the kill of the offending insects may have only been of the most active and exposed stages of the insect (i.e. the adults).

Life stages of primary insect pests (e.g., weevils and grain borers) that are hidden and sealed inside kernels of grain and insects in areas of the grain mass that are not fully exposed to a lethal concentration and/or exposed for too short of a period of time will not be killed. Sealing is a difficult task and requires a lot of time and energy, but without sealing, gas escapes from the area to be fumigated so rapidly, it may never reach a lethal dose.

Why is it a concern if the above occurs?

1. Selecting for Resistance
   It is well documented that exposure of insects to sub-lethal dosages of insecticides leads to the development of resistance to the insecticides. There are already signs of resistance amongst grain infesting insects to phosphine gas.
2. Unsatisfactory Control
   Control may temporarily appear to be successful because of adult knock down, but the infestation may reappear as immature stages complete their development. In the meantime, the grain may have been moved off the farm and into the grain stream. This is simply passing the infestation down the line for someone else to deal with it.
3. Unintended exposure of humans and other animals around the structure being fumigated to an extremely toxic pesticide.

The problem of leakage is exacerbated by structure construction and wind. Some structures are impossible to seal because of construction materials and/or age. Fumigation should never be attempted in these structures. Even small leaks can be problematic out in the country where the wind blows almost constantly.

Ideally, the best set up for fumigation of grain on the farm would be to have a closed-loop recirculation system. This requires retrofitting of older structures or new construction of a system designed to be a closed system.

After the exposure time has passed for a fumigation, then loss of fumigant is desired. Opening a structure to release the fumigant is part of the fumigation process. The gas should be intentionally removed from the material under fumigation to assure that re-entry into the area or structure where the fumigation took place will be safe. A fumigation is not complete until aeration is performed.

Fumigation Management Plans

A relatively new addition to the label and applicator's manual for the use aluminum phosphide is the requirement for the writing of a FUMIGATION MANAGEMENT PLAN (FMP). This document is to be composed prior to any fumigation in which the aluminum phosphide product is used. Each fumigation requires its own FMP. A generic, one-size-fits-all FMP is not permitted. A downloadable, model FMP can be found on the DEGESCH America, Incorporated's website at the following address: http://www.degeschamerica.com/literature.html.

A checklist guide for a Fumigation Management Plan

A. Preliminary Planning & Preparation
B. Personnel
C. Monitoring
D. Notification
E. Sealing Procedures
F. Application Procedures & Fumigation Period
G. Post-Application Operations

Application Procedures

The applicator's manual for the use of aluminum phosphide lays out the entire process for fumigating multiple types of structures and vehicles. The first statements under the section title for application procedures are, "A FMP must be written PRIOR to all applications. A FMP must be devised to cover application, exposure period, aeration and disposal of the fumigant, so as to keep to a minimum any human exposure to phosphine and to help assure adequate control of the insect pests." These statements are immediately followed by the application procedures for fumigating an on-farm, grain-storage bin. This emphasizes the fact that a FMP needs to be produced for all fumigations including the on-farm, grain-storage bin fumigation.

Temperature and Moisture

These two factors should be considered together for one influences the other and both impact the characteristics of the fumigation. Air of different temperatures has varying moisture saturation levels. The relationship between air temperature and moisture holding capacity is a direction relationship where the warmer the air temperature, the greater the amount of moisture it can hold and the colder the air temperature, the lesser the amount of moisture it can hold. Since moisture (water) is required to liberate phosphine gas from the solid aluminum phosphide, the more moisture that is available, the more rapidly the gas can be released from the solid.

One should keep in mind that the temperature of the commodity (grain) to be fumigated can be very different than the ambient surrounding air temperature. Grain is an excellent insulator, thus once grain is chilled, it can hold that temperature for a long period of time even after the ambient air temperature has risen. Since low temperature and moisture result in slow liberation of phosphine from the solid aluminum phosphide, there is a danger that unreacted product could remain within the grain mass for an extended period of time. As a result, unreacted product could begin reacting when the grain rewarms during the spring or when the grain is being moved. This could endanger the lives of those working around the grain in the bin as it is being emptied, in transport vehicles, and/or at the receiving site where the grain is being unloaded.

Once the phosphine gas is liberated from the solid, temperature also influences how rapidly the gas will be distributed throughout the grain mass being fumigated. The relationship once again is a direct relationship where the colder the temperature, the slower the gas will be distributed, and the converse, the warmer the temperature, the faster the distribution.

Temperature also influences insect activity. Insects decrease their activity as temperatures decline. As their activity level declines, they respire less. As they respire less, they will take less fumigant into their systems. Thus, low temperatures will have a negative impact on the success of the fumigation.

Temperature influences several aspects of the fumigation process. Since most things in the fumigation tend to occur more slowly as the temperature declines, the minimum exposure time for a fumigation to occur increases. At the coldest allowable temperature range for fumigating with phosphine gas, a fumigation will minimally require 8 (pellets) to 10 (tablets) days to complete. And a final word on temperature, according to the user's manual for phosphine gas, fumigations should not be attempted below 40ºF. There are too many negative impacts on fumigation success at that temperature and below.

Target Pests and Target Commodities

Phosphine gas is registered for use against numerous species of insects which infest stored commodities and the control of select burrowing mammals. Phosphine gas has been found to be effective against the following insects in all stages of their lives: almond moth, Angoumois grain moth, bean weevil, bees, cadelle, cereal leaf beetle, cigarette beetle, confused flour beetle, dermestid beetle, dried fruit beetle, dried fruit moth, European grain moth, flat grain beetle, fruit flies, granary weevil, greater wax moth, hairy fungus beetle, Hessian fly, Indian meal moth, Khapra beetle, lesser grain borer, maize weevil, pea weevil, Mediterranean flour moth, pink bollworm, raisin moth, red flour beetle, rice weevil, rusty grain beetle, saw-toothed grain beetle, spider beetles, tobacco moth, yellow mealworm, and Africanized bees & honeybees infested with tracheal mites. Unfortunately, there have been some reports of potential development of resistance in a few of the above listed insects. Vertebrate pests for which phosphine gas is registered include: woodchucks, yellowbelly marmots (rockchucks), prairie dogs (except Utah prairie dogs, Cynomys parvidens), Norway rats, roof rats, mice, ground squirrels, moles, voles, pocket gophers, and chipmunks. However, the use of phosphine gas for woodchuck (groundhog) management in Ohio is prohibited.

In the farm grain bin, the primary target for fumigation are the insect pests that attack sound grain and develop in the interior of the grain such as grain borers and weevils. Fumigation in these cases is recommended as a rescue treatment. For many of the other insect pests listed above, other actions are recommended before fumigation such as moving, cleaning and treating the grain with a standard insecticide.

Phosphine gas is registered to treat raw agricultural commodities, animal feed, animal feed ingredients, processed foods, and non-food commodities. Detailed lists of the products that can be treated with phosphine gas are found in the user's manual. On the farm, the primary targets of fumigation are typically wheat, corn and soybeans.

Dosage Rates

The Applicator's Manual lists the maximum allowable dosages for fumigation with aluminum phosphide tablets and pellets. It is important not to exceed these dosages because of the increased hazards associated with too high of concentrations of phosphine gas in confined areas (i.e. potential spontaneous explosions and excessive corrosion of certain metals). The following is directly from Section 8 of the Applicator's Manual:

Max. Allowable Dosages
for PHOSTOXIN® Fumigation

Product	per 1000 cu.ft.*	per 1000 bu.*
Pellets	725	900
Tablets	145	180

*NOTE: Maximum Dosage for dates, nuts & dried fruits is 200 pellets/40 tablets/1000 cu.ft. OR 250 pellets/50 tablets per 1000 bu.

- **Maximum allowable dosage rate for Rodent Burrows is 10-20 pellets per burrow OR 2-4 tablets per burrow.**
- **Maximum allowable dosage rate for commodity in small containers – 1-2 pellets per 10 cu.ft.**

As tempting as it may seem, adding higher dosages of aluminum phosphide to a fumigation typically does not significantly shorten necessary exposure times to shorten how long a structure needs to remain sealed and inaccessible. The Applicator's Manual lists multiple dosage ranges for numerous types of fumigations. For on-farm, grain-storage bins, the dosage ranges are as follows:

	Dosage Range	
Fumigation	Pellets	Tablets
Farm Bins	450-900/1000 bu.	90-180/1000 bu.
(Butler Type)	350-725/1000 cu.ft.	70-145/1000 cu.ft.

When fumigating an on-farm, grain-storage bin, one needs to calculate the dosage of tablets or pellets to be applied based on type of structure, volume of the area within the structure in which the fumigant is permitted to circulate, sealing properties of the structure, content type, expected weather conditions, commodity temperature, moisture content of the commodity, and the planned duration of the fumigation. Once the dosage has been calculated, the fumigant may be scattered over the surface or probed into the grain using a rigid PVC pipe about 5-7' in length and having a diameter of 1 1/4". The dosage should be divided such that 20-50 tablets or 100-250 pellets be used per probe and distributed uniformly over the surface. Volume of the structure can be reduced by covering the surface of the grain with a plastic tarpaulin and being certain to seal the edges of the tarpaulin to the walls of the bin. A portion of the dosage should be reserved to place under the bottom of the bin if the bottom of the bin is open to application (i.e. aeration floor or aeration duct). Place no more than 25% of the total dose at the bottom. Before introducing pellets or tablets into aeration ducts or floors, be sure there is no standing water present. Mixing aluminum phosphide and standing water may result in violent, rapid reaction and fire.

Protective Clothing

Basic worker protection clothing is required for handling phosphine with the addition of dry cotton gloves if the aluminum phosphide product or ash residue is to be touched.

Respiratory Protection

Respiratory protection equipment is required when working with fumigants such as phosphine. Minimal respiratory protection equipment is required under very limited conditions. In most instances, Self-Contained Breathing Apparatus (SCBA) will be necessary. **SCBA respiratory protection is required when concentration levels of phosphine are unknown.**

A NIOSH/MSHA approved full-face gas mask equipped with phosphine canister(s) may be used at levels up to 15 ppm or following manufacturers' use conditions instructions for escape. Above 15 ppm or in situations where the phosphine concentration is unknown, a NIOSH/MSHA approved, SCBA must be worn. Facial hair and/or shape of one's face may prevent proper fit of the respiratory protection and disqualify a person from working with fumigants.

If aluminum phosphide is to be applied from within the structure to be fumigated, an approved full-face gas mask with phosphine canister(s) or SCBA or its equivalent must be available at the site of application in case it is needed. Respiratory protection must also be available for applications from outside the area to be fumigated such as addition of tablets or pellets to automatic dispensing devices, outdoor applications, etc.

Gas Detection Equipment

There are a number of devices on the market for the measurement of phosphine gas at both industrial hygiene and fumigation levels. Glass detection tubes used in conjunction with the appropriate hand-operated air sampling pumps are widely used. These devices are portable, simple to use, do not require extensive training and are relatively rapid, inexpensive and accurate. Electronic devices are also available for both low level and high phosphine gas readings. Such devices must be used in full compliance with manufacturers' recommendations.

Placarding of Fumigated Area

All entrances to the fumigated structure must be placarded. Placards must be made of substantial material that can be expected to withstand adverse weather conditions and must bear the wording as follows:

1. The signal words DANGER/PELIGRO and the SKULL AND CROSSBONES symbol in red.
2. The statement "Structure and/or commodity under fumigation, DO NOT ENTER/NO ENTRE".
3. The statement, "This sign may only be removed by a certified applicator or a person with documented training after the structure and/or commodity is completely aerated (contains 0.3 ppm or less of phosphine gas). If incompletely aerated commodity is transferred to a new storage structure, the new structure must also be placarded if it contains more than 0.3 ppm. Workers exposure during this transfer must not exceed allowable limits.
4. The date the fumigation begins.
5. Name and EPA registration number of fumigant used.
6. Name, address and telephone number of the Fumigation Company and/or applicator.
7. A 24-hour emergency response telephone number.

All entrances to a fumigated area must be placarded. Where possible, place placards in advance of the fumigation to keep unauthorized persons away. Do not remove placards until the treated commodity or area is aerated down to 0.3 ppm hydrogen phosphide or less. To determine whether aeration is complete, each fumigated structure must be monitored and shown to contain 0.3 ppm or less phosphine gas in the air space around and, if feasible, in the mass of the commodity.

Once the all clear has been established, placards need to be removed. Leaving old fumigation placards on bins and other structures for long periods of time beyond the fumigation time may lead to persons becoming immune to the alert and not paying attention to the placards in the future. A fumigation is not complete until the placards are removed.

Safety

Working around grain bins is a dangerous job. One should never work alone. The more safety measures that are taken the better off all will be. Bin stairs are ideal. Grain entrapment is also a major concern. Have lock-out equipment so no one can accidentally turn on grain augers while people are inside of bins. Entrapment in flowing grain occurs in a matter of seconds.

References

- Carol Jones, James Hardin, and Edmond Bonjour, Oklahoma Cooperative Extension Service, Design of Closed-loop Fumigation Systems for Grain Storage Structures.
- http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-7486/BAE-1111web.pdf

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COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

Preliminary On Farm Research Reports

Fulton County - 2014

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Special Thanks to this year's On Farm Research Team: Nate & Trish Andre, Aaron Bernath, Tom Boger, Ken Clark, Mary Jo Hassen, Tommy Herr, Emily Herring, Bob Huskins, John King, Ian Kuntz, Lawrence Onweller, Larry Richer, Brian Rufenacht, Jason Rufenacht, Les and Jerry Seiler, Dick Snyder, Tim Spiess, Tim Stutzman, Keith Truckor, and Chris Weaver.

1. Corn Seeding Rate - 1

Eric Richer, Ohio State University Extension Educator, Fulton County

Objective

To determine effects of corn seeding rate on grain yield for two seed varieties.

Background

Crop Year: 2014
Location: Fayette, OH
County: Fulton
Soil Type: Blount/Glynwood loam
Drainage: Systematic
Previous Crop: Soybeans

Tillage: No-till
Soil Test: pH 6.0, P 22 ppm*, K 115 ppm
Planting Date: May 5, 2014
Nitrogen: 200 lbs at split at plant and sidedress
Harvest Date: October 10, 2014
Rainfall April-Sept: 10.94”
*Reported as Bray P1

Methods

This trial was designed with four treatments replicated four times in a randomized complete block design. Treatment plots were field length (at least 1,000 feet) by 15 feet wide. A 12-row Kinze 3600 planter was used to plant the plot. Pioneer 0604 was used in 6 rows and Pioneer 0636 was used in the other 6 rows. All treatments received the same starter fertilizer, herbicide and sidedress nitrogen. Stand counts were taken prior to harvest by obtaining 8 counts per treatment and calculating the simple average. Plots were harvested with commercial combine. Yields and moistures were measured by using a calibrated Ag Leader yield monitor. Yields were shrunk to 15% moisture. Precipitation data was downloaded from weather.com.

Treatments for both varieties:

1. 28,000 seeds per acre
2. 33,000 spa
3. 38,000 spa
4. 43,000 spa

Results

Table 1. Corn Yield (bu/ac) Response to Seeding Rate - Pioneer 0604

Treatment	Harvest Stand	Moisture	Dry Yield
28,000 seeds/ac	**27,100 plants/acre**	**20.9%**	**150.6 a**
33,000 spa	32,800 ppa	20.5%	148.8 a
38,000 spa	36,700 ppa	20.3%	148.0 a
43,000 spa	40,000 ppa	20.2%	145.7 a

LSD 8.54 (p<.05), CV 3.6 – No significant difference among treatments

Table 2. Corn Yield (bu/ac) Response to Seeding Rate - Pioneer 0636

Treatment	Harvest Stand	Moisture	Dry Yield
28,000 seeds/ac	**27,100 plants/acre**	**22.9%**	**169.7 a**
33,000 spa	32,800 ppa	22.1%	164.3 ab
38,000 spa	36,700 ppa	22.0%	163.7 ab
43,000 spa	40,000 ppa	22.1%	160.6 b

LSD 7.03 (p<.05), CV 2.67 – Yes Significant

Summary

Pioneer 0604

Seeding rate (x1,000)	Yield Bu/acre	Gross Revenue per acre	Seed Cost per acre	Net Revenue per acre
28	150.6	$602.40	$96.04	$506.36
33	148.8	$595.20	$113.19	$482.01
38	148.0	$592.00	$130.34	$461.66
43	145.7	$582.80	$147.49	$435.31

Pioneer 0636

Seeding rate (x1,000)	Yield Bu/acre	Gross Revenue per acre	Seed Cost per acre	Net Revenue per acre
28	169.7	$678.80	$96.04	$582.76
33	164.3	$657.20	$113.19	$544.01
38	163.7	$654.80	$130.34	$524.46
43	160.6	$642.40	$147.49	$494.91

Economics: Gross income= yield x $4.00/bu; Seed cost= $3.43 per 1,000 seeds x seeding rate; Net revenue= Gross revenue – seed cost.

Discussion:
There was no statistical significance among any of the treatments for Pioneer 0604. However, there was a significant statistical difference between the top and bottom treatments in the trial involving Pioneer 0636. Based on one year of data, a planted population of 28,000 seeds per acre resulted in the greatest returns per acre for both varieties. It should be noted that this field location received lower than average seasonal rainfall, which could have affected "normal" results. Further data, in the form of multi-year replications will add to the validity of these results.

Acknowledgement

The author expresses appreciation to on farm collaborator Les Seiler for his help in planting and harvesting this plot.

2. Corn Seeding Rate – 2

Eric Richer, Ohio State University Extension Educator, Fulton County

Objective

To determine effects of corn seeding rate on grain yield and profit.

Background

Crop Year: 2014
Location: Delta, OH
County: Fulton
Soil Type: Granby-Tedrow
Drainage: Systematic-40 ft laterals
Previous Crop: Soybeans

Tillage: Conservation
Soil Test: pH 6.2, P 92 ppm*, K 164 ppm
Planting Date: May 6, 2014
Nitrogen: 200 lbs at split at plant and sidedress
Harvest Date: October 25, 2014
Rainfall April-Sept: 14.64"
*Reported as Bray P1

Methods

This trial was designed with three treatments replicated four times in a randomized complete block design. Treatment plots were field length (at least 1,000 feet) by 20 feet wide. An 8-row White 6100 planter was used to plant the plot. Pioneer 0636 was the seed variety planted in all plots. All treatments received the same starter fertilizer, herbicide and sidedress nitrogen. Stand counts were taken prior to harvest by obtaining 8 counts per treatment and calculating the simple average. Plots were harvested with commercial combine. Yield was measured by using a calibrated Ag Leader yield monitor. Yields were shrunk to 15% moisture. Precipitation data was downloaded from weather.com.

Treatments:

1. 28,400 seeds per acre
2. 33,400 spa
3. 38,800 spa

Results

Table 1. Corn Yield (bu/ac) Response to Seeding Rate

Treatment	Harvest Stand	Dry Yield
28,400 seeds/ac	**28,100 plants/acre**	**179.9 a**
33,400 spa	32,600 ppa	166.5 b
38,800 spa	35,900 ppa	162.6 b

LSD 11.98 (p<.05), CV 4.1 – Yes significant difference among treatments

Summary

Seeding rate (x1,000)	Yield Bu/acre	Gross Revenue per acre	Seed Cost per acre	Net Revenue per acre
28.4	179.9	$719.60	$97.41	$622.19
33.4	166.5	$666.00	$114.56	$551.44
38.8	162.6	$650.40	$133.08	$517.32

Economics: Gross income= yield x $4.00/bu; Seed cost= $3.43 per 1,000 seeds x seeding rate; Net revenue= Gross revenue – seed cost.

Discussion:
The results of this plot show a statistically significant difference of at least +13.4 bushel per acre in treatment 1 (28,400 seeds per acre) over treatments 2 and 3. Based on one year of data, a planted population of 28,400 seeds per acre resulted in the greatest returns per acre. Further data, in the form of multi-year replications will add to the validity of these results. Conducting site specific seeding rate trials is the best way for a producer to optimize seeding rates.

Acknowledgement

The author expresses appreciation to on farm collaborator Dick Snyder for his help in planting and harvesting this plot. Thanks to student worker Emily Herring and Tim Barney for assisting with data collection and data processing, respectively.

THE OHIO STATE UNIVERSITY

For more information, contact:
Eric Richer
OSU Extension –Fulton County
8770 State Route 108
Wauseon, Ohio 43567
Richer.5@osu.edu

3. Corn Nitrogen Rates (100-250 lbs/ac)

Eric Richer, Ohio State University Extension Educator, Fulton County

Objective

To determine the effects of total nitrogen rate on corn grain yield.

Background

Crop Year: 2014
Location: Metamora, OH
County: Fulton
Soil Type: Hoytville loam
Drainage: systematic
Previous Crop: soybeans
Tillage: conventional

Soil Test: pH 6.2, P 30 ppm*, K 157 ppm
Planting Date: May 6, 2014
Starter: liquid 20 lbs N, 68 lbs P
Seeding Rate: 34,000 seeds/ac
Harvest Date: October 30, 2014
Rainfall April-Sept: 18.7"
*Reported in Bray P1

Methods

This trial included four treatments replicated four times in a randomized complete block design. Treatments were 100, 150, 200 and 250 total units of nitrogen per acre with credits given for starter nitrogen. Additionally, one plot strip had 0 units of in season nitrogen applied, but this treatment was replicated. Plots were approximately 1,200 feet long by 12 rows (30 feet) wide. Corn variety was Dekalb 52-04. Plant population stands and Normalized Digital Video Image (NDVI) readings were taken with Greenseeker handheld sensors approximately four weeks after nitrogen was applied. Approximately 1-2 weeks after black layer, stalk nitrate samples were to sent to A&L Labs to evaluate nitrate nitrogen remaining in the plant at harvest. Plot centers were harvested with an 8 row head on a JD 9660 combine. Yield and moisture data was collected with a calibrated yield monitor and shrunk to 15% moisture. Weather data was obtained from weather.com.

Results

Table 1. Corn Yield (bu/ac) Response to Total Nitrogen Rate

Treatment	Harvest Stand	Avg NDVI Reading	Stalk Nitrate (ppm)	Dry Yield (bu/ac)
0 lbs/ac*	33.0	.73	20	117.9 c
100 lbs/ac	33.4	.66	160	200.6 b
150 lbs/ac	32.6	.72	660	212.8 a
200 lbs/ac	33.3	.66	380	216.5 a
250 lbs/ac	33.5	.68	1350	216.8 a

LSD 7.23 (p<.05), CV 2.13 – Yes significant difference btween treatments
*0 rate was not replicated.

Summary

Total Nitrogen Rate, lbs/ac	Yield	Gross Revenue per acre	Nitrogen Cost per Acre	Net Return per acre
0	117.9	$472	$--	$472
100	200.6	$802	$41	$761
150	212.8	$851	$61.50	$790
200	216.5	$866	$82	$784
250	216.8	$867	$102.50	$765

Economics: Gross income= yield x $4.00/bu;
Nitrogen cost= $0.41 per lb (source: OFR collaborator).

Discussion:
There was a statistically significant difference in yield in those treatments where at least 150 units of total nitrogen were applied to corn. Based on one year of data, the 150 lbs total N rate achieved greatest returns per acre. Further data in the form of multi-year replications will add to the validity of these results.

Acknowledgement
The author expresses appreciation to on farm collaborator Keith Truckor for the planting and harvesting of this plot. Thanks to student worker Emily Herring for assistance with data collection.

THE OHIO STATE UNIVERSITY

For more information, contact:
Eric Richer
OSU Extension –Fulton County
8770 State Route 108
Wauseon, Ohio 43567
Richer.5@osu.edu

4. Corn Nitrogen Rates (150-225 lbs/ac)

Eric Richer, Ohio State University Extension Educator, Fulton County

Objective

To determine the effects of total nitrogen rate on corn grain yield.

Background

Crop Year: 2014
Location: Wauseon, OH
County: Fulton
Soil Type: Hoytville loam
Drainage: systematic
Previous Crop: soybeans
Tillage: conventional

Soil Test: pH 7.5, P 48 ppm*, K 203 ppm
Planting Date: May 8, 2014
Starter: dry 20 lbs N, 39 lbs P, 45 lbs K, 12 lbs S
Seeding Rate: 32,000 spa (30,700 harvest stand)
Harvest Date: October 23, 2014
Rainfall April-Sept: 14.64"
*Reported as Bray P1

Methods

This trial included four treatments replicated three times in a randomized complete block design. Treatments were made on May 31, 2014 and were at rates of 150, 175, 200 and 225 total units of nitrogen per acre with credits given for starter nitrogen. A pre-side dressed nitrogen test (PSNT) revealed that this field had 17 ppm of nitrate-nitrogen available at sidedress. Plots were approximately 2,500 feet long by 12 rows (30 feet) wide. Corn variety was Becks 6175. Normalized Digital Video Image (NDVI) readings were taken with Greenseeker handheld sensors approximately four weeks after nitrogen was applied, mainly to begin to understand how to better use NDVI scores. Approximately 1-2 weeks after the corn reached black layer (physiological maturity), stalk nitrate samples were sent to A&L Labs to evaluate nitrate nitrogen remaining in the plant at harvest. Plot centers were harvested with an 8 row head on a JD 9660 combine. Yield and moisture data was collected with a calibrated yield monitor and shrunk to 15% moisture. Weather data was obtained from weather.com.

Results

Table 1. Corn Yield (bu/ac) Response to Total Nitrogen

Treatment	Avg NDVI Reading	Stalk Nitrate	Dry Yield (bu/ac)
150 lbs/ac	.65	360 ppm	200.3 b
175 lbs/ac	.66	1,850 ppm	205.7 ab
200 lbs/ac	.65	1,410 ppm	211.0 a
225 lbs/ac	.67	490 ppm	213.0 a

LSD 7.3 (p<.05), CV 1.76 – Yes significant difference btween treatments

Summary

Total Nitrogen Rate, lbs/ac	Yield	Gross Revenue per acre	Nitrogen Cost per Acre	Net Return per acre
150	200.3	$801	$46	$755
175	205.7	$823	$69	$754
200	211.0	$844	$92	$752
225	213.0	$852	$115	$737

Economics: Gross income= yield x $4.00/bu;
Nitrogen cost= $0.46 per lb (source: 2014 Ohio State University AEDE Corn Budget).

Discussion:
There was a statistically significant difference in yield in those treatments where at least 175 units of total nitrogen were applied to corn. Based on one year of data, the 100 lbs total N rate had a slight economic advantage to those treatments where more nitrogen was applied. Stalk nitrate tests indicated an atypical nitrate nitrogen residual, but could have been affected by amount of time to ship and process samples. Additionally, more experience is needed to correlate NDVI readings with "N" rich strips, nitrogen response and yield response. Further data in the form of multi-year replications will add to the validity of these results.

Acknowledgement

The author expresses appreciation to on farm collaborator Larry Richer for the planting and harvesting of this plot.

THE OHIO STATE UNIVERSITY

For more information, contact:
Eric Richer
OSU Extension –Fulton County
8770 State Route 108
Wauseon, Ohio 43567
Richer.5@osu.edu

5. Corn Nitrogen Rates on Two Corn Varieties

Eric Richer, Ohio State University Extension Educator, Fulton County

Objective

To determine the effects of nitrogen rates on two corn varieties and their grain yield.

Background

Crop Year: 2014
Location: Fayette, OH
County: Fulton
Soil Type: Blount/Glynwood loam
Drainage: Systematic
Previous Crop: Soybeans

Tillage: No-till
Soil Test: pH 6.0, P 22 ppm*, K 115 ppm
Planting Date: May 6, 2014
Seeding rate: 33,000 seeds per acre
Harvest Date: October 10, 2014
Rainfall April-Sept: 10.94"

Methods

Four corn nitrogen rates were replicated three times in a randomized complete block design. Field length treatments were planted with a 12 row foot Kinze 3600 planter. Six rows were planted to Pioneer 0604 and 6 rows were planted to Pioneer 0636. Starter rates of nitrogen were fixed and starter nitrogen credit was subtracted from the total nitrogen rate. The remainder of the total was applied at in season and V4 stage corn as anhydrous ammonia. Total nitrogen treatment rates were 100, 150, 200 and 250 lbs of N per acre. All treatments received the same tillage and herbicide applications. All treatments were harvested with a commercial, 6 row combine. Yields and moistures were obtained by using a calibrated Ag Leader monitor. Dry yields were shrunk to 15% moisture. Precipitation data was obtained from Weather.com.

Results

Total Nitrogen Rate, lbs/ac	Variety	Harvest Moisture %	Dry Yield Bu/acre	
100	P 0604	20.3%	152.7	A
150	P 0604	20.4%	154.5	A
200	P 0604	20.7%	158.0	A
250	P 0604	20.5%	158.0	A
100	P 0636	22.1%	160.2	B
150	P 0636	21.7%	165.2	AB
200	P 0636	22.4%	174.5	A
250	P 0636	22.2%	171.7	AB

LSD 7.8 (p<..05)
CV 2.50

LSD 14. (p<..05)
CV 4.32

Summary

Total Nitrogen Rate, lbs/ac	Variety	Yield	Gross Revenue per acre	Nitrogen Cost per Acre	Net Return per acre
100	P 0604	152.7	$611	$46	$565
150	P 0604	154.5	$618	$69	$549
200	P 0604	158.0	$632	$92	$540
250	P 0604	158.0	$632	$115	$517
100	P 0636	160.2	$641	$46	$595
150	P 0636	165.2	$661	$69	$592
200	P 0636	174.5	$698	$92	$606
250	P 0636	171.7	$687	$115	$572

Economics: Gross income= yield x $4.00/bu;
Nitrogen cost= $0.46 per lb (source: 2014 Ohio State University AEDE Corn Budget).

Discussion:
There was no statistically significant difference in the trial with variety P0604. However, there was a statistically significant difference in yield in the trial with variety P0636; the 200 lb/ac rate outyielded all other rates and the 100 lb/ac rate showed a significantly lower yield as compared to the best rate. Based on one year of data, the P 0604 variety achieved greatest returns per acre when only 100 total units of nitrogen were applied and the P 0636 variety achieved greatest returns per acre when 200 total units of nitrogen were applied during the growing season. It should be noted that rainfall in this plot was significantly below normal and could have impacted results. Further data in the form of multi-year replications will add to the validity of these results.

Acknowledgement

The author expresses appreciation to on farm collaborators Seiler Farms for the planting and harvesting of this plot. Thanks to student worker Emily Herring for assistance with data collection.

THE OHIO STATE UNIVERSITY

For more information, contact:
Eric Richer
OSU Extension –Fulton County
8770 State Route 108
Wauseon, Ohio 43567
Richer.5@osu.edu

6. Product Efficacy on Asiatic Garden Beetles in Field Corn

Eric A. Richer, Ohio State University Extension Educator, Fulton County
Andy Michel, Associate Professor, Ohio State University, Department of Entomology

Objective

To evaluate soil insecticide product efficacy on Asiatic Garden Beetles in field corn by measuring grain yield.

Background

	Farm A	Farm B	Farm C
Crop Year:	2014	2014	2014
Location:	Wauseon, OH	Delta, OH	Swanton, OH
County:	Fulton	Fulton	Fulton
Soil Type:	Tedrow/Gilford	Tedrow/Granby	Tedrow/Granby
Drainage:	Undrained	Systematic	Systematic
Previous Crop:	Soybeans	Soybeans	Soybeans
Tillage:	No-till	No-till	No-till
Soil Test:	pH 6.8, P 143 ppm, K 151 ppm	pH 6.5, P 51 ppm, K 190 ppm	pH 5.9, P 110 ppm, K 197 ppm
Planting Date:	May 19, 2014	May 14, 2014	May 8, 2014
Seeding Rate:	34,000	33,000	33,000
Harvest Date:	Nov 3, 2014	Oct 23, 2014	Sept 30, 2014
Rainfall (Apr-Sept):	10.94"	14.64"	16.28"

Methods

This study was designed with three treatments replicated four times in a randomized complete block design. Furthermore, the trial was replicated on three different Fulton County, Ohio farms in 2014. Treatment plots were roughly 15 feet wide by field length (1,000 feet minimum). In treatment 1 (untreated check), no soil insecticide was applied at planting. In treatment 2, soil insecticides Lorsban or Empower, both dry, were t-banded over the furrow at planting at a rate of 9 lbs/acre. In treatment, 3, 10 ounces/acre of Capture LFR was applied in furrow at planting.

All plots were planted with a White 6100 planter using Pioneer 0636AMX at a rate of 33,000-34,000 seeds per acre depending on producer preference. Asiatic Garden Beetle larva pressure was evaluated weekly from late May through June. Plots were harvested with a Case 2388 combine. Yield measurements were taken with a scale wagon (farm A) or Ag Leader Integra monitor (farms B &C) and shrunk to 15% moisture.

Treatments

1) Untreated, no soil applied insecticide at plant
2) Empower at 9 lbs/acre (dry *bifenthrin)* in farm A and Lorsban (*chloropyrifos)* in farms B & C.
3) Capture LFR at 10 oz/acre

Results

Table 1. Corn Yield (bu/ac) Response to Soil Applied Insecticide at plant Farm A

Treatment	AGB pressure	Moisture	Dry Yield
Untreated check	**Low**	**19.6%**	**121.0 a**
Empower at 9 lbs/ac	Low	20.3%	120.3 a
Capture LFR at 10 oz/ac	Low	19.9%	117.8 a

LSD 9.61 (p<.05), CV 4.64 – No significant difference between treatments

Table 2. Corn Yield (bu/ac) Response to Soil Applied Insecticide at plant Farm B

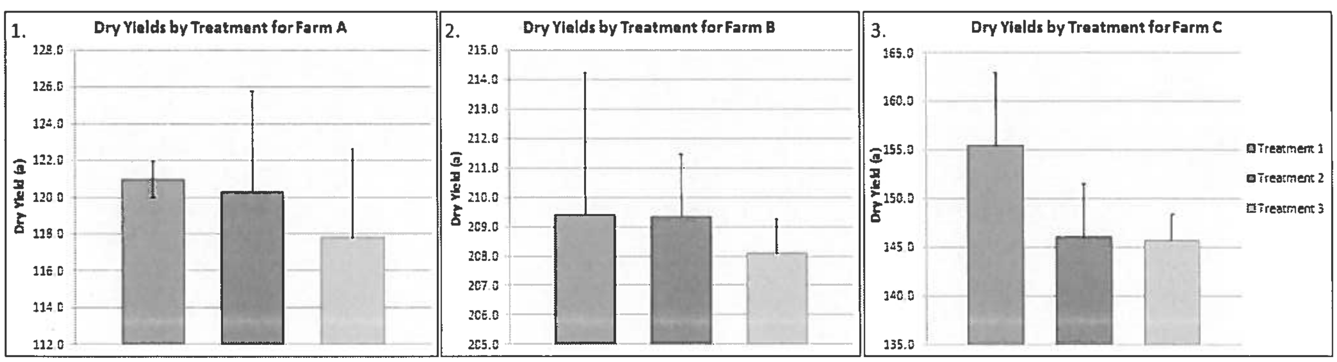
Treatment	AGB pressure	Moisture	Dry Yield
Untreated check	**Very high**	**26.1%**	**209.4 a**
Lorsban at 9 lbs/ac	Very high	26.2%	209.3 a
Capture LFR at 10 oz/ac	Very high	26.1%	208.1 a

LSD 7.14 (p<.05), CV 1.97 – No significant difference between treatments

Table 3. Corn Yield (bu/ac) Response to Soil Applied Insecticide at plant Farm C

Treatment	AGB pressure	Moisture	Dry Yield
Untreated check	**Low to moderate**	**26.9%**	**155.5 a**
Lorsban at 9 lb/ac	Low to moderate	27.8%	146.1 a
Capture LFR at 10 oz/ac	Low to moderate	27.1%	145.7 a

LSD 26.09 (p<.05), CV 7.72 – No significant difference between treatments



Figures 1, 2 and 3. Dry yields for each treatment illustrated for Farm A, Farm B, and Farm C ± standard errors and there are no significant differences between any treatment and any farm.

Summary

There was no statistically significant difference in grain yield among all trials across all farms. Further data in the form of multi-year replications will add to the validity of these results.

Acknowledgement

The authors express appreciation to on farm collaborators Clark Farms and Snyder Farms. Thanks also to FMC for insecticide contribution for this plot.

7. Effect of Row Width on Corn Silage Yield and Quality

Eric Richer, Ohio State University Extension Educator, Fulton County

Objective

To evaluate corn row width on corn silage yield and quality.

Background

Crop Year: 2014
Location: Archbold, OH
County: Fulton
Soil Type: Latty/Fulton clay
Drainage: systematic with 40' laterals
Previous Crop: Soybeans
Tillage: conventional

Soil Test: pH 6.6, P 120 ppm*, K 456 ppm
Planting Date: May 6, 2014
Nitrogen: 156 lbs N & 10 lbs S with pre-emerge
Seeding Rate: 42,000 in 15"; 36,000 in 30"
Harvest Date: September 10, 2014
Rainfall April-Sept: 15.66"
*Bray P1 Extractant

Methods

This study was designed with two treatments replicated three times in an alternating strip plot. Harvested plots were field length (>2,000 ft) and the width of a 15 foot chopper head. Treatments were planted on May 6, 2014 at 42,000 seeds/acre in narrow (15") corn and 36,000 seeds/acre in standard (30") corn with a John Deere 1770 planter. Narrow row treatments were "double planted" 15" off center at a half rate of 21,000 seeds/ac. Seed used was Rupp T09-22 in all treatments.

Plots were harvested with a commercial John Deere 6810 forage harvester with a 15 foot Kemper rotary head. Each harvested treatment was weighed on certified scales and had samples sent in to Agri-King, Inc for nutrient analysis. Yields and nutrient analyses were shrunk to 100% dry matter. Data were analyzed using a simple ANOVA statistics procedure.

Treatments
1. Narrow row corn planted in 15" rows at 42,000 seeds/ac
2. Standard row corn planted in 30" rows at 36,000 seeds/ac

Results

Table 1. Silage Yield and Quality Based on Row Width

Row width	15"	30"
Seeding rate	42,000/ac	36,000/ac
Harvest stand	40,600/ac	35,500/ac
Dry Yield	**7.62 T/ac A**	**8.29 T/ac A**
Crude Protein (dry basis)	8.04%	7.61%
Net Energy for Gain (dry basis)	.40	.38
Net Energy for Lactation (dry basis)	.74	.72

LSD 4.17 (p > .05); CV 5.55; Not Significant

Summary

There were no significant differences observed in forage yield or forage quality between the narrow row corn and the 30" corn. If the cost of seed corn is $3.44 per 1,000 seeds ($275/bag), an additional $20.64 in silage value must be achieved and equipment modifications considered in order to offset the cost of this practice. Data contained in this report is from one year at one location and thus, further data in the form of multi-year replications are needed to validate these results.

Acknowledgement

The author expresses appreciation to Rufenacht Farms for their cooperation and aid in planting, harvesting and weighing of this trial.

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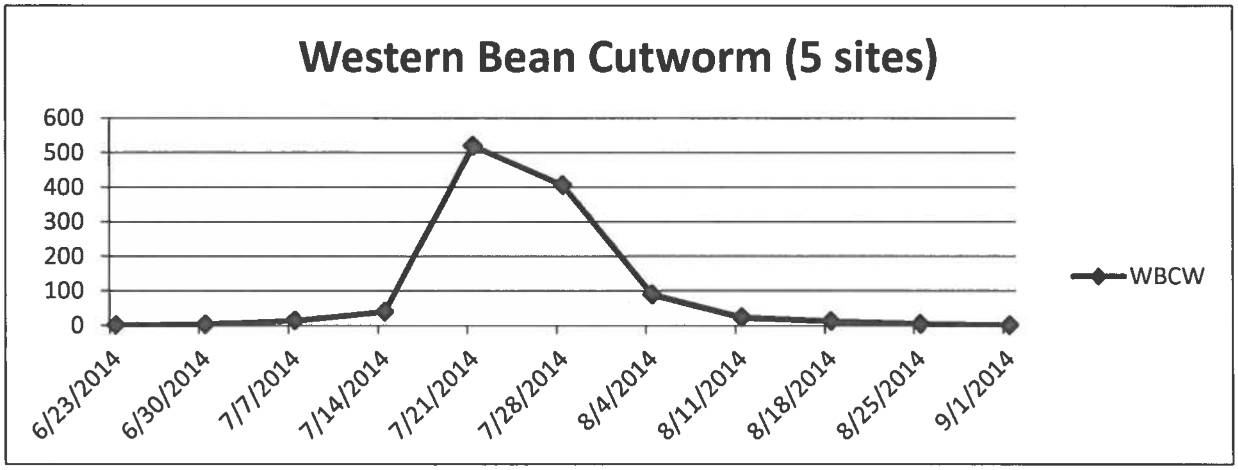
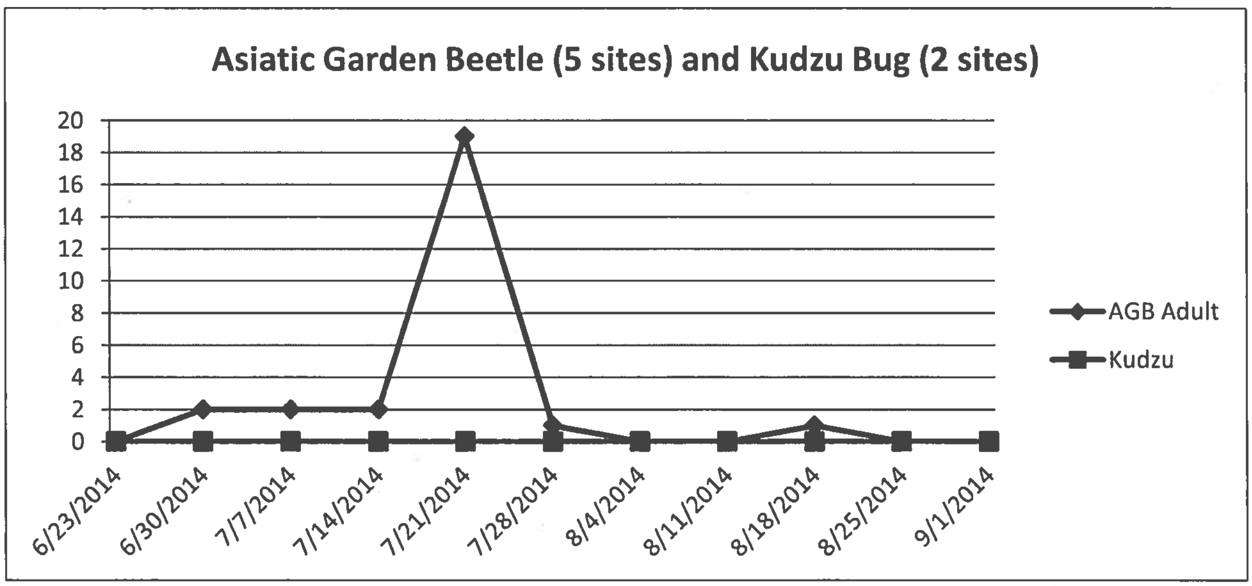
For more information, contact:
Eric Richer
OSU Extension –Fulton County
8770 State Route 108
Wauseon, Ohio 43567
Richer.5@osu.edu

8. Insect Monitoring – Fulton County – 2014 Season

Eric Richer, Ohio State University Extension Educator, Fulton County





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For more information, contact:
Eric Richer
OSU Extension –Fulton County
8770 State Route 108
Wauseon, Ohio 43567
Richer.5@osu.edu

9. Soybean Seeding Rate

Eric Richer, Ohio State University Extension Educator, Fulton County

Objective

To determine the effects of soybean seeding rate on grain yield.

Background

	Farm A	Farm B	Farm C
Crop Year:	2014	2014	2014
Location:	Delta, OH	Wauseon, OH	Fayette, OH
County:	Fulton	Fulton	Fulton
Soil Type:	Rimer/Mermill	Hoytville	Colwood/Dixboro
Drainage:	Systematic	Systematic	Systematic
Previous Crop:	Corn	Corn	Corn
Tillage:	No-till	Minimum	No-till
Soil Test:		pH 7.3, P 26 ppm*, K 151 ppm	pH 6.8, P 58 ppm*, K 173 ppm
Planting Date:	May 31, 2014	May 27, 2014	May 30, 2014
Seeding Rate:	140k-200k	115k-190k	110k-210k
Variety:	Pioneer 93Y05	Becks 319	Pioneer 32T25
Harvest Date:	October 25, 2014	October 30, 2014	November 3, 2015
Rainfall (Apr-Sept):	14.64"	14.64"	10.94"

*Bray P1 Extractant

Methods

This trial was designed with four treatments replicated three times in a randomized complete block design. Furthermore, the trial was replicated on three different farms in Fulton County, Ohio. Treatment plots were planted wide enough that a commercial combine could be used to harvest plot centers. Fertility and pesticide programs within each farm trial. Row spacing for all three farms was 15". Stand counts were taken prior to harvest by obtaining 8 counts per treatment and calculating the simple average. Yields and moistures were measured by using calibrated yield monitors and shrinking the dry yields to 13% moisture. Precipitation data was obtained from weather.com.

Results

Table 1. Soybean Yield (bu/ac) Response to Seeding Rate - Farm A

Treatment	Harvest Stand	Moisture	Dry Yield
140,000 seeds/ac*	106,000 plants/acre	14.1%	57.7 c
160,000 spa	116,000 ppa	14.5%	63.7 b
175,000 spa	131,000 ppa	14.2%	66.6 a
200,000 spa	164,000 ppa	14.4%	66.8 a

LSD 3.07 (p<.05), CV 2.41 – Yes significant difference between treatments

*Only two replications were available for harvest.

Table 2. Soybean Yield (bu/ac) Response to Seeding Rate - Farm B

Treatment	Harvest Stand	Moisture	Dry Yield
115,000 seeds/ac	93,000 plants/acre	14.0%	49.6 b
140,000 spa	121,000 ppa	13.8%	50.0 a
165,000 spa	133,000 ppa	14.5%	50.1 a
190,000 spa	146,000 ppa	13.6%	51.1 a

LSD 5.97 (p<.05), CV 5.96 – Yes significant difference between treatments

Table 3. Soybean Yield (bu/ac) Response to Seeding Rate - Farm C

Treatment	Harvest Stand	Moisture	Dry Yield
110,000 seeds/ac	84,400 plants/acre	12.2%	46.5 c
135,000 spa	109,000 ppa	12.3%	49.6 bc
160,000 spa	124,000 ppa	12.3%	46.8 c
185,000 spa	130,000 ppa	12.2%	53.3 b
210,000 spa	153,000 ppa	12.2%	56.2 a

LSD 5.04 (p<.05), CV 5.31 – Yes significant difference between treatments

Summary

Farm A

Seeding rate (x1,000)	Yield Bu/acre	Gross Revenue per acre	Seed Cost per acre	Net Revenue per acre
140	57.7	$577.00	$57.40	$519.60
160	63.7	$637.00	$65.60	$571.40
175	66.6	$666.00	$71.75	$594.25
200	66.8	$668.00	$82.00	$586.00

Farm B

Seeding rate (x1,000)	Yield Bu/acre	Gross Revenue per acre	Seed Cost per acre	Net Revenue per acre
115	49.6	$496.00	$47.15	$448.85
140	50.0	$500.00	$57.40	$442.60
165	50.1	$501.00	$67.65	$433.35
190	51.1	$511.00	$77.90	$433.10

Farm C

Seeding rate (x1,000)	Yield Bu/acre	Gross Revenue per acre	Seed Cost per acre	Net Revenue per acre
110	46.5	$465.00	$45.10	$419.90
135	49.6	$496.00	$55.35	$440.65
160	46.8	$468.00	$65.60	$402.40
185	53.3	$533.00	$75.85	$457.15
210	56.2	$562.00	$86.10	$475.90

Economics: Gross income= yield x $10.00/bu; Seed cost= $0.41 per 1,000 seeds x seeding rate; Net revenue= Gross revenue – seed cost.

Discussion:

In farm A, where planted populations were less than 175,000 seeds per acre, significantly lower yields were realized. Furthermore, a planted population of 175,000 seeds per acre resulted in the greatest returns per acre.

In farm B, where seeding rates were less than 140,000 seeds per acre, significantly lower yields were realized. However, a planted population of 115,000 seeds per acre resulted in the greatest returns per acre due to the minimal yield increases from increased planting population.

In farm C, the treatment planted at 210,000 seeds per acre yielded the greatest and resulted in the greatest returns per acre. This farm location received much less July and August rains that either farm A or B.

Further data in the form of multi-year replications will add to the validity of these results.

Acknowledgement

The author expresses appreciation to Richard Snyder, Larry Richer and Les Seiler for the planting and harvesting of these plots and to the Ohio Soybean Council for providing funding for this research.

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For more information, contact:
Eric Richer
OSU Extension –Fulton County
8770 State Route 108
Wauseon, Ohio 43567
Richer.5@osu.edu

10. Soybean Seeding Rate and the Effects of Water Molds

Eric Richer, Ohio State University Extension Educator, Fulton County

Objective

To determine the effects of seeding rate on soybean yield when the crop is affected by water molds (*P. sojae* and *Pythim spp.)*

Background

Crop Year: 2014
Location: Archbold, OH
County: Fulton
Soil Type: Fulton silty clay loam
Drainage: Undrained
Previous Crop: corn

Tillage: minimum
Soil Test: pH 6.7, P 73 ppm*, K 284 ppm
Planting Date: May 8, 2014
Fertility: VRT applied in corn year
Harvest Date: September 20, 2014
Rainfall (May-Sept): 15:66"
*Bray P1 Extractant

Methods

Five soybean populations were replicated four times in a randomized complete block design. Treatments were planted with a 40 foot John Deere 1790 air seeder. All treatments received the same tillage and herbicide applications. Seed used was Rupp 7251. Stand counts were taken at V3, R1, and leaf drop by obtaining 8 counts per treatment and calculating the simple average. Plot centers were harvested with a commercial combine equipped with a 35 foot grain header. Yields and moistures were obtained by using a calibrated GreenStar 2630 monitor. Yields were shrunk to 13% moisture. Precipitation data was obtained from Weather.com and recorded weekly.

Results

Seeding Rate 5/8/2014	Stand Count- V3 6/11/2014	Stand Count- R1 7/9/2014	Stand Count 9/18/2014	% Total Stand Loss	% Moisture	Yield Bu/acre	
107	80.1	73.8	73.8	-31%	13.6%	51.2	B
131	106	97.3	88.9	-32%	13.4%	52.9	B
154	127	118	113	-27%	13.3%	55.5	A
175	157	139	136	-22%	13.6%	54.2	Ab
200	160	149	126	-37%	13.8%	55.7	A

LSD = 2.49 (p<.05); CV 3.00; Yes significant difference, see above.

Seeding rates and stand counts reported to 3 significant figures, in thousands per acre

Week of:	Rainfall	Week of:	Rainfall	Week of:	Rainfall	Week of:	Rainfall
May 5	.31"	June 9	.64"	July 14	0"	Aug. 18	1.47" *
May 12	1.5"	June 16	1.8"	July 21	0"	Aug. 25	.03"
May 19	.27"	June 23	1.09"	July 28	.15"	Sept. 1	1.18"
May 26	.09"	June 30	0.05	Aug. 4	.24"	Sept. 8	3.18" *
June 2	1.17"	July 7	.43"	Aug. 11	1.99" *	Sept. 15	.51"

*= single day rain event; weather.com

Summary

Seeding rate (x1,000)	Yield Bu/acre	Gross Revenue per acre	Seed Cost per acre	Net Revenue per acre
107	51.2	$512.00	$43.87	$468.13
131	52.9	$529.00	$53.71	$475.29
154	55.5	$555.00	$63.14	$491.86
175	54.2	$542.00	$71.75	$470.25
200	55.7	$557.00	$82.00	$475.00

Economics: Gross income= yield x $10.00/bu; Seed cost= $0.41 per 1,000 seeds x seeding rate; Net revenue= Gross revenue – seed cost.

Discussion:
Loss in population averaged 30% across treatments due to positive identification of *P. sojae* and *Pythium spp.* during the growing season. *Pythium* and *P. sojae* were positively identified in the field on June 11th and likely were present earlier. *P. sojae* continued to reduce stand throughout the growing season.

Treatments where harvest stands fell below 100,000 plants per acre resulted in significantly lower yields than treatments with a harvested population above 100,000 plants per acre. Based on one year of data, a planted population of 154,000 seeds/acre or a harvest stand of 113,000 plants/acre resulted in the greatest returns per acre when significant stand losses occurred. Further data in the form of multi-year replications will add to the validity of these results.

Acknowledgement

The author expresses appreciation to on farm collaborators Rufenacht Farms for the planting and harvesting of this plot. Thanks also to Rupp Seed Co for their cooperation and support in this trial. Thanks to student workers Emily Herring and John Schoenhals for assistance with data collection and processing. Additionally, Ohio Soybean Council provided funding for this research.

For more information, contact:
Eric Richer
OSU Extension –Fulton County
Richer.5@osu.edu

11. Late Season Foliar Treatments on Soybean Yield and Profit

Eric A. Richer, Ohio State University Extension Educator, Fulton County

Objective

To evaluate the effect of foliar fungicide, insecticide or combination treatments on soybean yield and profitability.

Background

Crop Year: 2014
Location: Delta, OH
County: Fulton County
Soil Type: Hoytville clay loam
Drainage: 25' Systematic, perpendicular
Previous Crop: Corn
Tillage: Conventional

Planting Date: May 8, 2014
Fertilizer: applied according to Tri-State's in corn
Seeding Rate: 185,000 seeds/acre, 15" rows
Herbicide: Authority pre-emerge, glyphosate post
Harvest Date: October 16, 2014
July-August Rainfall: 2.59"

Methods

This study included four treatments arranged in a randomized complete block design with three replications. Treatment plots were planted 100 feet wide by 2,500 feet long (field length). Treatments were planted with a 1790 JD Planter after light spring tillage. Seed used was Pioneer 35T66 in all treatments. Harvest (yield) measurements were made by harvesting the center 70' within each treatment using a JD 9660 commercial combine. Yield measurements were taken with an Insight Ag Leader monitor and shrunk to 13% moisture.

Treatments
1) 6 oz/ac Aproach fungicide at R2 growth stage
2) 6 oz/ac Aproach fungicide plus 6 oz/ac Asana insecticide at R2
3) 6 oz/ac Aproach fungicide plus 1 pt/100 gal Non-Ionic Surfactant (NIS) at R2
4) Untreated check (no fungicide, insecticide or surfactant application)

Results

Table 1. Mean Yield (bu/ac) in Response to Foliar Fungicide & Insecticide applications on soybean

Treatment	Yield (bu/ac)	**Gross Revenue/Ac	***Cost per acre	Net Revenue/Ac
Aproach fungicide*	**60.5 a**	**$605**	**$22**	**$583**
Aproach fungicide plus Asana insecticide	60.6 a	$606	$29	$577
Aproach fungicide plus NIS	60.2 a	$602	$22.50	$579.50
Untreated check	57.0 b	$570	-	$570

LSD 1.79; CV 1.5; P value ≤ 0.05
Yes, significant difference between untreated check and treatments.
*Only two replications of this treatment were available for harvest.
** Based on $10.00/bu marketing price
***Based on $15/ac fungicide, $4/ac insecticide, $.50/ac NIS and $7/ac custom application

Summary

The research was found to show a statistically significant difference in grain yield among the untreated check and all treatments of at least +3.2 bushels per acre. While there was no statistical difference among the top three treatments, an economic analysis shows a slight advantage to the fungicide treatment this year. Pesticide application should be made based on economic thresholds established from research. Further data in the form of multi-year replications will add to the validity of these results.

Acknowledgement

The author expresses appreciation to L & L Farms as the cooperating farmer. Thanks also to DuPont Pioneer for product used in the plot and the Ohio Soybean Council for providing funding to conduct this research.

For more information, contact:
Eric Richer
OSU Extension – Fulton County
8770 State Route 108
Wauseon, OH 43567
Richer.5@osu.edu

12. The Effects of Phosphorus, Potassium or the Combination on Soybean Yield and Profit

Eric Richer, Ohio State University Extension Educator, Fulton County

Objective

To determine the effects of simple applications of phosphorus, potassium or the combination on soybean yield.

Background

Crop Year: 2014
Location: Metamora, OH
County: Fulton
Soil Type: Hoytville
Drainage: systematic
Previous Crop: corn

Tillage: no-till
Soil Test: pH 6.5, P 10 ppm*, K 116 ppm
Planting Date: May 8, 2014
Seeding Rate: 165,000 seeds/ac
Harvest Date: October 30, 2014
*Reported as Bray P1

Methods

This research trial included four treatments replicated four times in a randomized complete block design. Plots were approximately 1,200 feet long by 50 feet wide. Soybean variety was Asgrow 3034. Fertilizer treatments were broadcast in spring prior to planting with a 50 foot spreader using RTK autosteer technology. Soybeans were then planted with the same seeding rate and pesticide treatments across all treatments. Plot centers were harvested with a 35foot header on a JD 9660 combine. Yield and moisture data was collected with a calibrated yield monitor and shrunk to 13% moisture. Weather data was obtained from weather.com.

Treatments:

1. No broadcast fertilizer
2. 75 lbs/ac Mono-Ammonium Phosphate (MAP) 11-52-0
3. 150 lbs/ac Potash 0-0-60
4. 75 lbs/ac MAP and 150 lbs/ac Potash

Results

Table 1. Soybean Yield (bu/ac) Response to Phosphorus and Potassium

Treatment	Moisture	Dry Yield	Gross Revenue	Fertilizer Cost	Net Return/ac
1. No fertilizer	12.7%	59.5 b	$595	$---	$595
2. 75 lbs/ac MAP	12.6%	62.0 a	$620	$30.30	$590
3. 150 lbs/ac Potash	12.8%	59.4 b	$595	$40.65	$554
4. 75 lbs/ac MAP & 150 lbs/ac Potash	12.8%	59.0 b	$590	$62.40	$528

LSD 2.55 (p<.05), CV 2.66 – Yes significant difference between treatments

Economics: Gross income= yield x $4.00/bu;
MAP costs = $.32/lb (source: OFR collaborator)
Potash costs = $.23/lb (source: OFR collaborator)
Combined fertilizer = $.25/lb (source: OFR collaborator)
Application cost = $6.15/ac (source: 2014 OSUE Custom Farm Rental Rates)

Discussion:
The only treatment that showed a statistically significant difference in yield was treatment 2 (75 lbs/ac MAP), showing at least a +2.5 bushel per acre advantage over all other treatments. Based on one year of data, treatment 1 (no fertilizer) achieved the greatest net returns per acre. Further data in the form of multi-year replications will add to the validity of these results.

Acknowledgement

The author expresses appreciation to on farm collaborator Keith Truckor for the planting and harvesting of this plot. Thanks for Crop Production Services (Morenci) for applying the fertilizer treatments. Thanks to student worker Emily Herring for assistance with data collection. This projected was supported by the Ohio Soybean Association Research and Education Fund.

THE OHIO STATE UNIVERSITY

For more information, contact:
Eric Richer
OSU Extension –Fulton County
8770 State Route 108
Wauseon, Ohio 43567
Richer.5@osu.edu

13. Timing of Cover Crop Rye Termination in No-Till Soybeans

Eric Richer, Ohio State University Extension Educator, Fulton County

Objective

To determine of effects of cover crop rye termination on no-till soybean grain yield.

Background

Crop Year:	2014	Soil Test:	6.1 pH, P 32 ppm, K 127 ppm
Location:	Fayette, OH	Planting Date:	May 28, 2014
County:	Fulton	Fertility:	applied with corn
Soil Type:	Fulton-Shinrock	Seeding Rate:	150,000 seeds per acre
Drainage:	Random	Variety:	Pioneer 93Y22
Previous Crop:	Wheat	Harvest Date:	November 2, 2014
Tillage:	No-till	Rain (Apr-Sept):	10.94"

Methods

This trial was designed with three treatments replicated four times in a randomized, complete block design. As more and more producers are utilizing cover crops in their agronomic crop rotation, more questions regarding the timing of cover crop termination arise. Treatment plots were field length (over 2,000 feet) by 60 feet wide (sprayer width). All plots received the same fertilizer, seed and insecticide/fungicide treatments during the growing season in addition to 1 pint per acre of 2-4, D applied in the fall of 2013. Plots were sprayed with the treatments below using the labeled rates and 35 foot centers were harvested with a commercial combine. Yield and moisture measurements were made with a calibrated Ag Leader monitor. Yields were shrunk to 13% moisture. Precipitation data was downloaded from weather.com.

Treatments:
1. Cover crop rye terminated in early April with 2-4,D, glyphosate and Envive
2. Cover crop rye terminated 7 days preplant with 2-4, D, glyphosate and Envive
3. Cover crop rye terminated at planting with glyphosate and Envive only.

Results

Table 1. Soybean Yield Response to Timing of CC Rye Termination

Treatment		Moisture %	Yield (lbs/A)
Termination in early April		13.7	45.7 A
Termination 7 days preplant		13.7	46.4 A
Termination at planting		13.7	46.8 A
C.V. = 4.95	**LSD (0.05)**		**3.97**

Summary

There was no statistically significant difference in these treatments. Additionally data like difference in weed suppression or organic matter content could be evaluated to see the benefits of this research in the future. Further data in the form of multi-year replications will add to the validity of these results.

Acknowledgement

The author expresses appreciation to on farm collaborators Les and Jerry Seiler for planting, spraying and harvesting this plot. Thanks to student worker Emily Herring for helping with data collection. This research plot was supported by the Ohio Soybean Council.

THE OHIO STATE UNIVERSITY

For more information, contact:
Eric Richer
OSU Extension –Fulton County
8770 State Route 108
Wauseon, Ohio 43567
Richer.5@osu.edu

14. Wide Row Wheat

Eric A. Richer, Ohio State University Extension Educator, Fulton County
Laura Lindsey, Assistant Professor, Ohio State University, Horticulture & Crop Sciences

Objective

To evaluate the effect of row width and population on wheat grain yield.

Background

	Farm A	Farm B	Farm C
Crop Year:	2014	2014	2014
Location:	Wauseon, OH	Wauseon, OH	Pettisville, OH
County:	Fulton	Fulton	Fulton
Soil Type:	Nappanee	Tedrow/Blount	Blount-Pewamo
Drainage:	Systematic	Random	Random
Previous Crop:	Soybeans	Soybeans	Soybeans
Tillage:	No-till	No-till	No-till
Soil Test:	pH 6.0, P 45 ppm, K 162 ppm	pH 6.7, P 197 ppm, K 98 ppm	pH 6.6, P 63 ppm, K 230 ppm
Planting Date:	Oct. 14, 2013	Oct. 2, 2013	Oct. 12, 2013
Seeding Rate/Row Spacing:	Varies	Varies	Varies
Harvest Date:	July 15, 2014	July 9, 2014	July 14, 2014

Methods

Three commercial, on farm wheat research plots (3 site years) were established in the fall of 2013 in Fulton County, OH using an eleven-row 15" White 5100 planter. Variety was Rupp 972 in Farm A and C, and variety was Pioneer 34R25 in Farm B. Trials were identical, randomized complete block design with four replications of treatments. Plots were 30 feet wide by a minimum of 1,000 feet long.

The standard practice of 7.5-inch row width at 2.0 million seeds/ac was compared to 15-inch row spacing at 1.0 and 1.5 million seeds/ac. Spring stand, number of heads per square foot, moisture and yield were recorded. Centers of the plots were harvested with commercial combines and yields and moistures were measured with calibrated yield monitors. Grain yield was adjusted to 13.5% moisture. Data were analyzed using the ANOVA procedure. Factors were considered statistically significant at $\alpha = 0.05$.

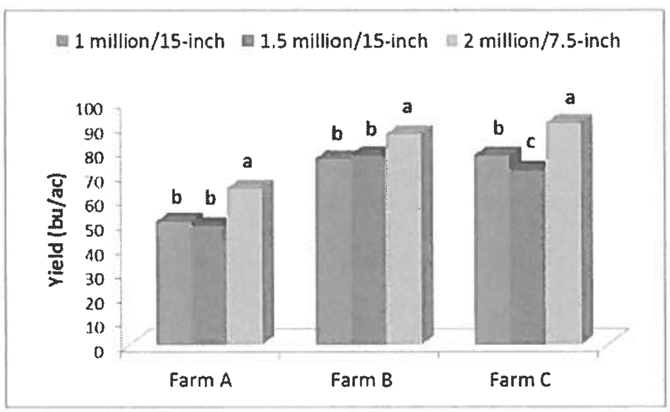
Treatments

1) Drilled, 7.5" row wheat at 2.0 million seeds per acre
2) Planted 15" row wheat at 1.5 million seeds per acre
3) Planted 15" row wheat at 1.0 million seeds per acre

Results

	Row Width inch	Seed Rate seeds/ac	Spring Stand seeds/ac	Head Count number/sq ft	Grain Moisture %	Yield bu/ac	
FARM A	7.5	2.0 mill	1.3 mill	100	15	72.6	a
	15	1.5 mill	1.1 mill	73	15	54.8	b
	15	1.0 mill	0.68 mill	67	15	55.3	b
FARM B	7.5	2.0 mill	1.3 mill	96.3	14	90.5	a
	15	1.5 mill	0.93 mill	58.5	15	82.9	b
	15	1.0 mill	0.78 mill	62.7	15	81.0	b
FARM C	7.5	2.0 mill	1.3 mill	102.4	16	105.8	a
	15	1.5 mill	1.2 mill	81	16	83.6	c
	15	1.0 mill	0.81 mill	75.2	16	90.6	b

Effect of Row Spacing and Seeding Rate



Summary

In all three on farm trials, the standard practice of 7.5-inch row width at 2.0 million seeds/ac produced more heads and yielded greater than wheat grown in 15-inch row width at 1.0 and 1.5 million seeds/ac (Fig. 3). At 15-inch row width, 1.0 million seeds per acre yielded the same as 1.5 million seeds/ac at two farms and 1.0 million seeds/ac out-yielded 1.5 million seeds/ac at one farm. In our on-farm research, wide-row wheat is less profitable than the standard practice. However, wide row wheat may offer seed cost savings and the opportunity to interseed soybeans in northern Ohio where double cropping soybeans is difficult. Additionally, wide-row wheat can be planted without the use of a drill. If wide-row wheat is being planted, we recommend a seeing rate of 1.0 million seeds/ac.

Acknowledgement

The authors express appreciation to on farm collaborators Ken Clark and Larry Richer.

15. Comparison of Dairy Manure and UAN as Nitrogen Sources at Side-dress for Corn Yield

Glen Arnold, Ohio State University Extension, Field Specialist-Manure Nutrient Management Systems
Eric Richer, County Educator, OSU Extension, Fulton County

Objective

To compare corn yield response to nitrogen applied at side-dress as incorporated dairy manure and incorporated UAN 28%.

Background

Crop Year:	2014	Soil Test:	pH 7.7
Cooperator:	Nate Andre		P 65 ppm (130 lb/ac)
County:	Fulton		K 207 ppm (414 lb/ac)
Nearest Town:	Lyons, OH		PSNT 26 ppm Nitrate N
Drainage:	Undrained		Organic Mater 2.9%
Soil Type:	Ottokee-Mermill	Planting Date:	May 20, 2014
Tillage:	Conventional	Row Width:	30 inch twins
Previous Crop:	Soybeans	Harvest Date:	November 7, 2014
Variety:	G07V88	Rainfall (Apr-Sept):	14.02"

Methods

A randomized block design with two treatments and four replications was used. Plots were 12 rows (30 feet) wide and 1150 feet long. Liquid dairy manure from a dairy manure storage pond was applied via incorporation using a 6,200 gallon Jamesway tanker equipped with a Dietrich toolbar. The Dietrich toolbar incorporated the dairy manure at a depth of five inches using shanks with five inch sweeps.

The commercial fertilizer treatments were sidedressed with 30 gal of UAN on the same day as the manure application. In addition, all treatments received 15 gal of UAN applied as 2x2 in starter. All treatments also received 20 gal of UAN applied with pre-emerge herbicide.

The dairy manure and 28% UAN were applied on the same day while corn was in the V2 stage. Field conditions were firm at the time of application.

The 28% UAN application rate was 90 units of nitrogen per acre. All dairy manure replications received 9,000 gallons per acre. Manure samples indicated 3.38 pounds of available nitrogen per 1,000 gallons. Dairy manure treatments received 30.4 pounds of nitrogen, 50.8 lb/ac P_2O_5 and 66.8 lb/ac K_2O per acre.

Dairy Manure Analysis

Nutrient	lbs. per 1,000 Gallons
Nitrogen (available the 1st year)	3.38
Phosphorus as P_2O_5	5.64
Potassium as K_2O	7.42

Weather conditions during the time of manure application were sunny with an ambient air temperature of 74 degrees. The plot received well below average rainfall for the growing season.

Table 1 Treatment Summary

Treatment	Description
Treatment 1 (T1)	30 gal/ac UAN 28%, 90#/ac of N
Treatment 2 (T2)	9,000 gal/ac incorporated liquid dairy manure, 30#/ac of N

Results and Discussion

Table 2 Yield Summary

Treatments	Yield (bu/ac)
28% UAN (T1)	142.9
Incorporated manure (T2)	143.0

LSD (0.05)

The results of this plot indicated no significant difference between the treatments (LSD (0.05) = 26.42, C.V=8.21). The dairy manure analysis showed less than half the available nitrogen expected from previous tests so it's possible the dairy manure treatments received more than the 30 pounds per acre of sidedress being reported.

The 28% UAN cost $0.52 per pound of $78 per acre plus the cost of application. The manure was available from the nearby dairy farm at no cost. The manure application cost, using the Minnesota Manure Distribution Cost Analyzer spreadsheet was calculated at $20 per 1,000 gallons or $.02 per gallon. The cost of applying 9,000 gallons per acre as side-dress nitrogen was $180 per acre.

Acknowledgement

The authors would like to thank on farm collaborator Nate Andre for planting and harvesting this plot and Chris Weaver/Oakshade Dairy for the dairy manure.

The authors would also like to thank the Ohio Environmental Education Fund and the Ohio Dairy Research Fund for their financial support.

For more information, contact:
Glen Arnold
Field Specialist, Manure Nutrient Management Systems
Ohio State University Extension, Hancock County
7868 County Road 140, Suite B
Findlay, Ohio 45840
419-422-3851
arnold.2@osu.edu

The Ohio State University
College of Food, Agricultural, and Environmental Sciences

16. Comparison of Swine Manure and Anhydrous Ammonia as Nitrogen Sources at Side-dress for Corn Yield

Glen Arnold, Ohio State University Extension, Field Specialist-Manure Nutrient Mgmt Systems
Eric Richer, County Educator, OSU Extension, Fulton County

Objective

To compare corn yield response to nitrogen applied at side-dress as incorporated swine finishing manure and incorporated Anhydrous Ammonia.

Background

Crop Year:	2014	Soil Test:	pH 6.5
Cooperator:	Aaron Bernath		P 130 ppm (260 lb/ac)
County:	Fulton		K 263 ppm (526 lb/ac)
Nearest Town:	Wauseon, OH		PSNT 46 ppm Nitrate N
Drainage:	Tile-40 feet spacing		Organic Mater 1.7%
Soil Type:	Lamson fine sandy loam	Planting Date:	May 19, 2014
Tillage:	Conventional	Row Width:	30 inch
Previous Crop:	Wheat	Harvest Date:	October 30, 2014
Variety:	Golden Harvest G07V88	Rainfall (Apr-Sept):	14.64"

Methods

A randomized block design with two treatments and four replications was used. Plots were 12 rows (30 feet) wide and 1175 feet long. Liquid swine manure from a finisher building was applied via incorporation using a 6,200 gallon Jamesway tanker equipped with a Dietrich toolbar. The Dietrich toolbar incorporated the swine manure at a depth of five inches using shanks with five inch sweeps.

The swine manure and 110 Units of Anhydrous Ammonia were applied on the same day while corn was in the V2 stage. Field conditions were firm at the time of application.

All swine manure replications received 6,000 gallons per acre. Manure samples indicated 29.1 pounds of available nitrogen per 1,000 gallons. Swine manure treatments received 174.6 pounds of nitrogen, 107,4 lb/ac P_2O_5 and 196.2 lb/ac K_2O per acre.

Swine Finishing Manure Analysis

Nutrient	lbs. per 1,000 Gallons
Nitrogen (available the 1st year)	29.1
Phosphorus as P_2O_5	17.9
Potassium as K_2O	32.7

Weather conditions during the time of manure application were sunny with an ambient air temperature of 74 degrees. The plot received above average rainfall for the growing season.

Table 1 Treatment Summary

Treatment	Description
Treatment 1 (T1)	Anhydrous Ammonia, 110#/ac of N
Treatment 2 (T2)	6,000 gal/ac incorporated liquid swine manure, 175#/ac of N

Results and Discussion

Table 2 Yield Summary

Treatments	Yield (bu/ac)
Anhydrous Ammonia (T1)	198.5
Incorporated manure (T2)	198.8
	LSD (0.05)

The results of this plot indicated no significant difference between the treatments (LSD (0.05) = 6.41, C.V=1.44).

The Anhydrous Ammonia cost $0.52 per pound of $57.20 per acre plus the cost of application. The manure was available from the farmer's swine finisher building at no cost. The manure application cost, using the Minnesota Manure Distribution Cost Analyzer spreadsheet was calculated at $20 per 1,000 gallons or $.02 per gallon. The cost of applying 6,000 gallons per acre as side-dress nitrogen was $120 per acre.

Acknowledgement

The authors would like to thank McClure Farms for the use of manure application equipment and Bernath Farms for the swine finishing manure.

The authors would also like to thank the Ohio Pork Producers and the Ohio Environmental Education Fund for their financial support.

For more information, contact:
Glen Arnold
Field Specialist, Manure Nutrient Management Systems
Ohio State University Extension, Hancock County
7868 County Road 140, Suite B
Findlay, Ohio 45840
419-422-3851
arnold.2@osu.edu

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

17. Comparison of Swine Manure and UAN as Nitrogen Sources at Side-dress for Corn Yield

Glen Arnold, Ohio State University Extension, Field Specialist-Manure Nutrient Mgmt Systems
Eric Richer, County Educator, OSU Extension, Fulton County

Objective

To compare corn yield response to nitrogen applied at side-dress as incorporated swine finishing manure and incorporated UAN 28%.

Background

Crop Year:	2014	Soil Test:	pH 6.3
Cooperator:	John King		P 30 ppm (60 lb/ac)
County:	Fulton		K 187 ppm (374 lb/ac)
Nearest Town:	Pettisville, OH		PSNT 26 ppm Nitrate N
Drainage:	Tile-40 feet spacing		Organic Mater 2.5%
Soil Type:	Gilford-Dixboro	Planting Date:	May 6, 2014
Tillage:	Conventional	Row Width:	30 inch
Previous Crop:	Soybeans	Harvest Date:	November 7, 2014
Variety:	Rupp J03-31	Rainfall (Apr-Sept):	15.66"

Methods

A randomized block design with two treatments and four replications was used. Plots were 12 rows (30 feet) wide and 975 feet long. Liquid swine manure from a finisher building was applied via incorporation using a 6,200 gallon Jamesway tanker equipped with a Dietrich toolbar. The Dietrich toolbar incorporated the swine manure at a depth of five inches using shanks with five inch sweeps.

The swine manure and 110 units of N in the form of 28% UAN were applied on the same day while corn was in the V3 stage. Field conditions were firm at the time of application.

The swine manure replications received 4,200 gallons per acre. Manure samples indicated 29.1 pounds of available nitrogen per 1,000 gallons. Swine manure treatments received 122 pounds of nitrogen, 75 lb/ac P_2O_5 and 137 lb/ac K_2O per acre.

Swine Finishing Manure Analysis

Nutrient	lbs. per 1,000 Gallons
Nitrogen (available the 1st year)	29.1
Phosphorus as P_2O_5	17.9
Potassium as K_2O	32.7

Weather conditions during the time of manure application were sunny with an ambient air temperature of 75 degrees. The plot received above average rainfall for the growing season.

Table 1 Treatment Summary

Treatment	Description
Treatment 1 (T1)	49 gal/ac UAN 28%, 147#/ac of N
Treatment 2 (T2)	4,200 gal/ac incorporated liquid swine manure, 122#/ac of N

Results and Discussion

Table 2 Yield Summary

Treatments	Yield (bu/ac)
28% UAN (T1)	226.5
Incorporated manure (T2)	223.6
	LSD (0.05)

The results of this plot indicated no significant difference between the treatments (LSD (0.05) = 5.43, C.V=1.07).

The 28% UAN cost $0.52 per pound of $76.44 per acre plus the cost of application. The manure was available from a swine finisher building at no cost. The manure application cost, using the Minnesota Manure Distribution Cost Analyzer spreadsheet was calculated at $20 per 1,000 gallons or $.02 per gallon. The cost of applying 4,200 gallons per acre as side-dress nitrogen was $84 per acre.

Acknowledgement

The authors would like to thank on farm collaborator John King and Rupp Seeds, Inc for planting, sidedressing and harvesting this plot. Thanks to Bernath Farms for furnishing the swine finishing manure and McClure Farms for the use of manure application equipment.

The authors would also like to thank the Ohio Pork Producers and the Ohio Environmental Education Fund for their financial support.

For more information, contact:
Glen Arnold
Field Specialist, Manure Nutrient Management Systems
Ohio State University Extension, Hancock County
7868 County Road 140, Suite B
Findlay, Ohio 45840
419-422-3851
arnold.2@osu.edu

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