

GENOMES to FIELDS

GxE Field Experiment 2016 SOP v.1.1

April 11, 2016

Visit the GxE website for the latest SOP and information updates:

www.genomes2fields.org

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About This Manual

NEW IN 2016:

1. Visit <http://www.genomes2fields.org/for-collaborators/> for project details and links to resources.
2. We are using a new soil lab for basic nutrient and texture analysis. Please send samples to Ward Laboratories in Kearney, NE.
3. Please change weather station batteries and manually clear data before deploying weather stations in the field. Failure to do so can result in loss of data.

Our goal is to collect the most “raw” and meaningful data possible, to be collated in a centralized database and shared with the public. Raw data will give us the most power to analyze and leverage insights from the data. It is a difficult and time consuming task to assimilate all of this information into one place in a consistent format. Therefore, we ask that you pay close attention to the form of data types collected in terms of units, formatting, etc.

Lastly, we would like to thank you, our cooperators, for your monumental efforts and unprecedented collaborative spirit. Without you, the Genomes to Fields GxE Project would not be possible. **Thank you!**

Sincerely,

The GxE Planning Committee

(Carolyn, Darwin, David, Jack, Jane, Jode, David, Liz, Martin, Natalia, Seth, Shawn and Sherry)

GxE Field Experiment 2016 Checklist

Preseason:

- Order weather station components with assistance of Iowa Corn Promotion Board
 - Communicate seed packaging and shipping requirements with GxE Research Coordinator
 - Create CyVerse account and access GxE wiki
 - Join GxE listserv
 - Perform annual maintenance on weather station, clear existing data
- Record the following field information:
- Row spacing and plot dimensions
 - Pedigree of local checks (5 total)
 - Previous crop
 - Tillage method
 - Weather station documents irrigation? (if applicable) [Y/N]
 - Soil taxonomic ID and horizon description (bulk density, texture, CEC loading), if known

At Planting:

- Install weather station in field (ideally one day before planting, if possible)
- Record weather station serial number [m2700s0XXXX] on card inside weather station
- Collect GPS coordinates of field corners, starting at corner of plot 1
- Collect soil sample and send to Ward Laboratories in Kearney, NE
- Activate weather station recording
- Record planting date

In-Season:

- Create and send field map to GxE Research Coordinator. Notify Research Coordinator of any field/planting issues or adjustments to original field map.
 - Check weather station periodically to ensure proper function. Download data monthly, if possible.
- Record the following phenotypic data:
- Flowering dates
 - Plant height
 - Ear height
 - If damaging winds occur, cooperators may choose to record green snap and date of event
 - Stand count
- Record the following field information:
- Pesticides and herbicides: type and amount applied
 - Fertilizer: date, type, and amount applied
 - Irrigation schedule: date and amount applied (if applicable)
 - Fertigation schedule: date and amount applied (if applicable)
 - Notes on field anomalies, phenotyping errors and issues

At Harvest:

- Record the following performance data:
- Root lodging
 - Stalk lodging
 - Plot weight
 - Plot moisture
 - Test weight

Post-Season:

- Update weather station information card in metadata sheet
- Upload final field information, phenotype and performance data to CyVerse
- Download weather station data and upload unedited SWD files to CyVerse

I. **Accessing GxE Wiki and CyVerse Resources**

CyVerse (formerly iPlant Collaborative) has a suite of resources that will be utilized by the Genomes to Fields project, including a wiki for information distribution and the Discovery Environment for data storage as the 2016 growing year progresses. The first step in utilizing these resources is to have an account with CyVerse where one user name and password will allow access to all CyVerse resources.

Creating a CyVerse Account to access GxE Wiki and CyVerse resources

The GxE CyVerse Wiki serves as an online resource for collaborators seeking more information on GxE procedures. <https://pods.iplantcollaborative.org/wiki/display/g2f>

- a. Visit <https://user.iplantcollaborative.org/register> answer all prompts and validate your account.
- b. Once you have an active account, forward your CyVerse account, first and last name to g2f_help@iplantcollaborative.org to set up access to the wiki.
- c. If you have an active CyVerse account, but cannot access the wiki, send an email with CyVerse account, first and last name to g2f_help@iplantcollaborative.org.

II. **Joining the GxE Listserv, GxE@iplantcollaborative.org**

The GxE Planning and Coordinating team periodically uses the listserv to announce important updates and send information to collaborators. To subscribe, update subscription settings, or view complete subscriber list, visit <http://mail.iplantcollaborative.org/mailman/listinfo/gxe> and enter required information. You will receive a confirmation email when your subscription has been approved.

III. Field Layout

- a. The trial is arranged in two reps of approximately 250 plots each. Plots within a replicate are numbered in order from 1-250. On seed packets, R = Rep and P = Plot, unless range/pass coordinates were requested. Arrange the plots in serpentine order by plot order within rep.
- b. Most hybrid trials are arranged in two-row plots, 20' long with 30-72" alleys between plots. Filler should be used as needed to minimize edge effects.
- c. The diagram on the following page represents the ideal setup with plot numbers. Departures from this specific layout are completely acceptable.
- d. Each investigator is asked to choose five locally adapted hybrids to add as checks to each trial to increase connection among trials within a location. These checks will be replicated twice for 10 plots. Empty seed packets are provided for collaborators to fill. Investigators in similar areas are encouraged to choose one or more of the same common checks for connecting sets to provide additional connection among experiments and locations.
- e. Planting density and plot dimensions are determined by individual collaborators.

For additional details on the experimental design and overall project scope, see Appendix D.

24 Row Example														
REP 2	FILLER				500	499	498	497	496	495	494	493	20'	
	481	482	483	484	485	486	487	488	489	490	491	492	20'	
	480	479	478	477	476	475	474	473	472	471	470	469	20'	
	457	458	459	460	461	462	463	464	465	466	467	468	20'	
	456	455	454	453	452	451	450	449	448	447	446	445	20'	
	433	434	435	436	437	438	439	440	441	442	443	444	20'	
	432	431	430	429	428	427	426	425	424	423	422	421	20'	
	409	410	411	412	413	414	415	416	417	418	419	420	20'	
	408	407	406	405	404	403	402	401	400	399	398	397	20'	
	385	386	387	388	389	390	391	392	393	394	395	396	20'	
	384	383	382	381	380	379	378	377	376	375	374	373	20'	
	361	362	363	364	365	366	367	368	369	370	371	372	20'	
	360	359	358	357	356	355	354	353	352	351	350	349	20'	
	337	338	339	340	341	342	343	344	345	346	347	348	20'	
	336	335	334	333	332	331	330	329	328	327	326	325	20'	
	313	314	315	316	317	318	319	320	321	322	323	324	20'	
	312	311	310	309	308	307	306	305	304	303	302	301	20'	
	289	290	291	292	293	294	295	296	297	298	299	300	20'	
	288	287	286	285	284	283	282	281	280	279	278	277	20'	
	265	266	267	268	269	270	271	272	273	274	275	276	20'	
	264	263	262	261	260	259	258	257	256	255	254	253	20'	
	REP 1	241	242	243	244	245	246	247	248	249	250	251	252	20'
		240	239	238	237	236	235	234	233	232	231	230	229	20'
		217	218	219	220	221	222	223	224	225	226	227	228	20'
216		215	214	213	212	211	210	209	208	207	206	205	20'	
193		194	195	196	197	198	199	200	201	202	203	204	20'	
192		191	190	189	188	187	186	185	184	183	182	181	20'	
169		170	171	172	173	174	175	176	177	178	179	180	20'	
168		167	166	165	164	163	162	161	160	159	158	157	20'	
145		146	147	148	149	150	151	152	153	154	155	156	20'	
144		143	142	141	140	139	138	137	136	135	134	133	20'	
121		122	123	124	125	126	127	128	129	130	131	132	20'	
120		119	118	117	116	115	114	113	112	111	110	109	20'	
97		98	99	100	101	102	103	104	105	106	107	108	20'	
96		95	94	93	92	91	90	89	88	87	86	85	20'	
73		74	75	76	77	78	79	80	81	82	83	84	20'	
72		71	70	69	68	67	66	65	64	63	62	61	20'	
49		50	51	52	53	54	55	56	57	58	59	60	20'	
48		47	46	45	44	43	42	41	40	39	38	37	20'	
25		26	27	28	29	30	31	32	33	34	35	36	20'	
24		23	22	21	20	19	18	17	16	15	14	13	20'	
1		2	3	4	5	6	7	8	9	10	11	12	20'	
Row#		1	3	5	7	9	11	13	15	17	19	21	23	

50 Row Example																										
REP 2	500	499	498	497	496	495	494	493	492	491	490	489	488	487	486	485	484	483	482	481	480	479	478	477	476	20'
	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	20'
	450	449	448	447	446	445	444	443	442	441	440	439	438	437	436	435	434	433	432	431	430	429	428	427	426	20'
	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	20'
	400	399	398	397	396	395	394	393	392	391	390	389	388	387	386	385	384	383	382	381	380	379	378	377	376	20'
	350	349	348	347	346	345	344	343	342	341	340	339	338	337	336	335	334	333	332	331	330	329	328	327	326	20'
	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	20'
	300	299	298	297	296	295	294	293	292	291	290	289	288	287	286	285	284	283	282	281	280	279	278	277	276	20'
	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	20'
	250	249	248	247	246	245	244	243	242	241	240	239	238	237	236	235	234	233	232	231	230	229	228	227	226	20'
REP 1	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	20'
	200	199	198	197	196	195	194	193	192	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176	20'
	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	20'
	150	149	148	147	146	145	144	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128	127	126	20'
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	20'
	100	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	20'
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	20'
	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	20'
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	20'
	Row#	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49

IV. WatchDog 2700 Weather Station Configuration

- a. **IMPORTANT:** Before installation in the field, manually clear the logger's memory and replace batteries, following prompts through SpecWare software. Failure to clear the logger's memory and replace the batteries will result in loss of data.
- b. Perform any necessary equipment maintenance, e.g. check for corrosion, etc. See Appendix C for a detailed list of maintenance items.
- c. Setup and install your weather station before or at planting. See video, "How to Assemble a WatchDog Weather Station" on the [Wiki Video Library](#), or see the [Complete Watchdog Weather Station Manual](#).

How to install WatchDog 2700 in the field:

- i. Locate weather station at an unshaded edge of GxE field trial. If possible, select an edge that is not completely exposed, such as an ally between corn fields, to improve wind speed accuracy. Ensure solar radiation sensor will not be shaded by canopy.
 - ii. Does the rainfall sensor document irrigation? If no, record irrigation amounts and dates applied in metadata sheet.
 - iii. Install soil probes within GxE trial soil. See Appendix C for specific instructions to install soil probes with PVC pipe protector. Be sure to mark location of cable and weather station to alert passing combines and equipment.
 - iv. For investigators with multiple GxE trial fields, weather stations should be located within ¼ mile of all trial fields. For trials > ¼ mile, or for trials varying water treatments, consider a second, micro weather station to measure soil moisture differences.
- a. Weather stations will record the following information every 30 minutes throughout the growing season:
 - i. Rainfall
 - ii. Temperature
 - iii. Radiation
 - iv. Relative humidity
 - v. Wind speed
 - vi. Soil moisture and temperature
 - b. See Appendix C for more information on installing SpecWare9 software, downloading station data, maintaining your station and troubleshooting issues.

V. Seed Information

- a. Hybrid seed will be sent to most collaborators (excluding Southern locations) in early April. All seed has been chemically treated with Cruiser Extreme 250.

VI. Field Metadata Collection:

Collaborators will record the following metadata in the appropriate location on a Google Sheet for their trial. Google Sheets are accessed via the iPlant Wiki at this link: <https://pods.iplantcollaborative.org/wiki/display/g2f/2016+metadata+collection>

At Planting:

- i. Planting dates [MM/DD/YY]
- ii. Collect soil sample for basic analysis at Ward Laboratories. See Appendix B for detailed instructions.
- iii. Weather station serial number [m2700s0XXXX]
- iv. Latitude/longitude (GPS coordinates) of field location
- v. Row spacing and plot dimensions
- vi. Map of field layout with cardinal direction indicated. Need help figuring out cardinal direction? Visit <http://www.acscdg.com/> Locate your field, draw a line parallel with rows and record Azimuth number.
- vii. Local hybrid checks (5 total)
- viii. Previous crop
- ix. Tillage method
- x. Weather station documents irrigation? (if applicable) [Y/N]
- xi. Notes on planting errors, field anomalies, equipment, etc.

In-Season:

- xii. Pesticides and herbicides: type and amount applied
- xiii. Fertilizer: date, type, and amount applied
- xiv. Irrigation schedule: date and amount applied (if applicable)
- xv. Fertigation schedule: date and amount applied (if applicable)
- xvi. Notes on field anomalies, phenotyping errors and issues

At Harvest:

- xvii. Harvest dates [MM/DD/YY]
- xviii. Notes on field anomalies, whole-field issues, equipment and technical issues, or harvesting issues

VII. Phenotype and Performance Data Collection:

Evaluate hybrids for the following traits. See Appendix A for specific measurement instructions.

In-Season:

- i. Stand Count – may be taken as juveniles and at harvest
- ii. Anthesis [MM/DD/YY]
- iii. Silking [MM/DD/YY]
- iv. Plant Height
- v. Ear Height
- vi. If damaging winds occur, cooperators may choose to record green snap and date of event

At Harvest:

- vii. Stalk Lodging – plant count, NOT percentage
- viii. Root Lodging – plant count, NOT percentage
- ix. Stand count
- x. Plot Weight
- xi. Grain Moisture
- xii. Test Weight

VIII. Uploading Data to CyVerse

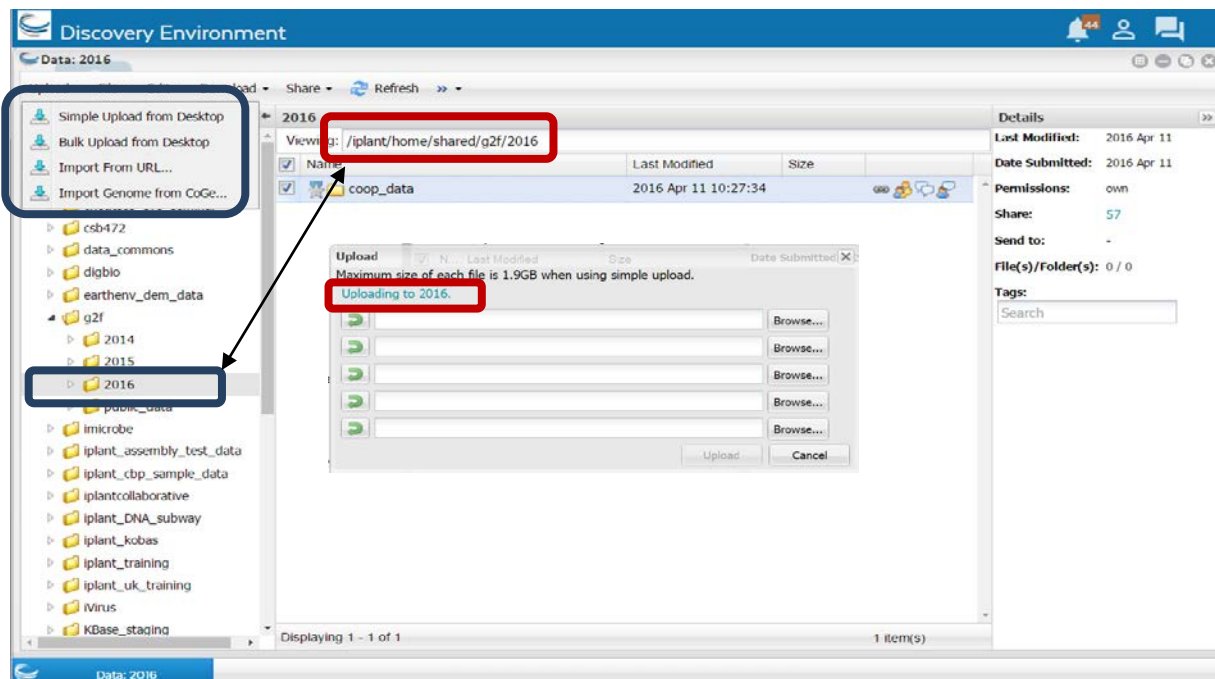
Three methods to upload data for the project are highlighted here.

a. Discovery Environment

- i. Log into [Discovery Environment \(DE\)](#).
- ii. Navigate to /iplant/home/shared/g2f

✓ If you cannot see it or cannot enter the directory, please reach out for assistance g2f_help@iplantcollaborative.org

- iii. Navigate to the appropriate folder (named for the trial ID, e.g. deh1).
- iv. From the upload dropdown menu, choose one of the 3 options shown in the [blue rectangle](#).
- v. Ensure the file path is correct before uploading ([red oval](#)). If not, cancel and start over.



b. iDrop [beta]

A GUI application based file access to the Discovery Environment.

[RENCI source forge](#)

c. iRODS

A command-line application compatible with Linux, Mac, and Windows computers.

Download iRODS: http://wiki.irods.org/index.php/windows#Windows_i-commands

Using iCommands: <https://pods.iplantcollaborative.org/wiki/display/DS/Using+iCommands>

Appendix A: Phenotyping Handbook

Trait Summary					
Trait	Abbrv.	Unit	Timing	Description/Procedure	Measurement Notes
Green Snap (optional)	GSP	count and date of causal event [MM/DD/YY]	before flowering	Number of plants broken between ground level and top ear node before flowering	Optional, cooperators may record this if an event causes substantial green snap.
Anthesis	DMF	date [MM/DD/YY]	at flowering	Days between planting and 50% of plants of a plot exhibit anther exertion on more than half of the main tassel spike.	
Silking	DFF	date [MM/DD/YY]	at flowering	Days between planting and 50% of plants of a plot show silk emergence.	
Ear Height	EHT	centimeter [cm]	plant maturity	Placing measuring stick on ground next to the root crown, "ear height" is measured at the primary ear bearing node.	One plant is considered sufficient since these are hybrids and are not segregating for traits.
Plant Height	PHT	centimeter [cm]	plant maturity	Measure the distance between the base of a plant and the ligule of the flag leaf.	One plant is considered sufficient since these are hybrids and are not segregating for traits.
Root Lodging	RLD	count	before harvest	Number of plants that show root lodging per plot, i.e., those stems that lean substantially to one side ($\geq 15\%$ from vertical). Count includes "goosenecked" plants that have "straightened up" after becoming lodged earlier in the season.	Emphasis is on the number of plants, not the %, which does not tell us much. Accurate stand counts and lodging counts are essential and will be used to calculate a % lodging in later analyses.
Stalk Lodging	SLD	count	before harvest	Number of plants broken between ground level and top ear node at harvest	Emphasis is on the number of plants, not the %, which does not tell you very much.
Stand Count	STC	count	before/at harvest	Number of plants per plot at harvest.	Main consideration is how many plants were in the plot at harvest time. Counting can occur earlier but if a plot damage occurs before harvest they will need to be recounted.
Plot Weight	PWT	lbs	at harvest	Shelled grain weight per plot	
Grain Moisture	GMT	percent [%]	at harvest	Water content in grain at harvest.	
Test Weight	TWT	lbs/bu	at harvest	Shelled grain weight per bushel	

Anthesis (DMF)

Description/Procedure:

Taken as [MM/DD/YY] to 50 percent of a plot exhibiting anther exertion on greater than half of main tassel spike. Day of anthesis recording is shown in *Picture 1*, whereas the day after is shown *Picture 2*.

Timing: At Flowering

n = 1 date per plot

Unit: [MM/DD/YY]



Picture 1



Picture 2

Image Credit:

- 2004, 2006; Purdue University, RL Nielsen
- <http://www.mississippi-crops.com/2013/06/26/identifying-corn-reproductive-growth-stages-and-management-implications/>

Silking (DFF)

Description/Procedure:

Taken as [MM/DD/YY] to 50 percent of plot exhibiting silk emergence (*Picture 1*). Following day is shown in *Picture 2*.

Timing: At Flowering

n = 1 date per plot

Unit: [MM/DD/YY]



Picture 1



Picture 2

Ear Height (EHT)

Description/Procedure:

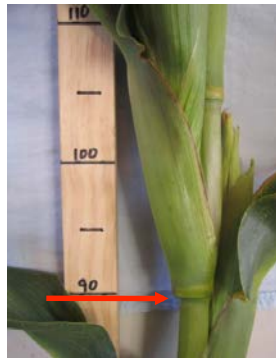
Placing measuring stick on ground next to the root crown, “ear height” is measured at the primary ear bearing node. See *Picture 1*.

Timing: At plant maturity

n = 1 representative plant per plot

Unit: centimeter [cm]

Notes: One plant is considered sufficient since these are inbreds and hybrids and are not segregating for traits.



Picture 1



Plant Height (PHT)

Description/Procedure:

Placing measuring stick on ground next to the root crown, “plant height” is measured at the ligule of the flag leaf. See *Picture 1*.

See *Picture 1*

Timing: At plant maturity

n = 1 representative plant per plot

Unit: centimeter [cm]

Notes: One plant is considered sufficient since these are inbreds and hybrids and are not segregating for traits. Please record date measured.



Picture 1



Stand Count (STC)

Description/Procedure:

Number of plants per plot at harvest.

Timing: At Harvest

n = 1 count per plot

Unit: count

Notes: Main consideration is how many plants were in the plot at harvest time. Accurate stand counts and lodging counts are essential and will be used to calculate a % lodging in later analyses.

Counting can occur earlier but if a plot damage occurs before harvest they will need to be recounted.

Stalk Lodging (SLD)

Green Snap (GSP) (optional)

Stalk Lodging

Description/Procedure:

Number of plants broken between the ground level and the top ear node (picture 1).

Timing: Before Harvest

n = 1 count per plot

Unit: number of plants with SLD

Notes: Emphasis is on the number of plants, not the %, which does not tell us much. Accurate stand counts and lodging counts are essential and will be used to calculate a % lodging in later analyses.



Picture 1

Green Snap (optional)

Description/Procedure:

Number of plants broken between the ground level and the top ear node **before flowering** (picture 2).

Timing: Before flowering

n = 1 count per plot

Unit: number of plants with GSP and date of triggering event [MM/DD/YY]

Notes: Collaborators may choose to take counts of green snap following a weather event occurring before flowering that causes substantial numbers of stalks to snap. Please also record date of event.

Emphasis is on the number of plants, not the %, which does not tell us much. Accurate stand counts and lodging counts are essential and will be used to calculate a % lodging in later analyses.



Picture 2

Photo 1 credit: Gordon Johnson, UDel Extension

Photo 2 credit: UGA Cooperative Extension

Root Lodging (RLD)

Description/Procedure:

Number of plants that show root lodging per plot, i.e., those stems that lean substantially to one side ($\geq 15\%$ from vertical) (picture 2). Count includes “goosenecked” plants that have “straightened up” after becoming lodged earlier in the season (Picture 1).

Timing: Before Harvest

n = 1 count per plot

Unit: number of plants with RLD

Notes: Emphasis is on the number of plants, not the %, which does not tell us much. Accurate stand counts and lodging counts are essential and will be used to calculate a % lodging in later analyses.



Picture 1



Picture 2

Plot Weight (PWT) Test Weight (TWT)

Plot Weight

Description/Procedure:

Shelled grain weight per plot

Timing: At Harvest

n = 1 weight per plot

Unit: lbs

Test Weight

Description/Procedure:

Shelled grain weight per bushel

Timing: At Harvest

n = 1 weight per plot

Unit: lbs/bu

Grain Moisture (GMT)

Description/Procedure: Water content in grain at harvest.

Timing: At Harvest

n = 1 measure per plot

Unit: percent [%]

Appendix B: Soil Sampling Handbook

a. Soil Sampling Instructions for GxE 2016

1. Each sample should be made up of a minimum of 10 cores to ensure accurate representation of the field, ideally 20 or more cores. Cores should be taken to a depth of **30cm**.
2. For uniform fields: When gathering soil cores to make a composite sample, collect cores in a uniform pattern over the whole trial area.
3. For fields with known clines/variants: Sample in order to get an accurate representation of the majority of the field. If significant differences exist in areas of the field, sample areas separately and submit multiple, clearly labeled samples.
4. Thoroughly mix the cores before placing approximately 2 cups in the sample bag. This can be a sample bag, or a regular Ziploc bag.
5. Label the bag with PI name and trial ID. Complete a [sample submittal form](#).
6. Secure samples for shipping** and send to

Ward Laboratories, Inc.
4007 Cherry Ave, PO Box 788
Kearney, Nebraska 68848-0788
(308) 234-2418 Fax (308) 234-1940
www.wardlab.com

****SOIL SAMPLES FROM REGULATED/FOREIGN AREAS (TX, GA, NC, SC, ON):** All samples need to be shipped in sturdy, leak proof containers which preclude spillage or pest escape in transit and while awaiting processing. Sealed tubes, vials or cans placed in sealed coolers or sturdy boxes are acceptable shipping containers. All regulated or foreign soil must be shipped via Fedex, see account # below. All samples need to have a copy of the Soil Permit inside and affixed to the outside. For foreign soils, a copy of PPQ Form 550 goes on the outside of the box. This requirement applies to samples from TX, GA, NC, SC and Ontario.

SHIPPING INFORMATION: Use UW Madison Agronomy Fedex Account: 173635532



Laboratories, Inc.

4007 Cherry Ave, PO Box 788
 Kearney, Nebraska 68848-0788
 (308) 234-2418 Fax (308) 234-1940
 www.wardlab.com

Soil Sample Information

Submitted By
PI Name:
Institution:
Address:
Phone/Email:

Sample Information	
Date	

For Lab Use	Results For	Field	Sample ID	Depth	Test

Comments:

Chain of Custody			
Relinquished By	Date / Time	Received By	Date / Time

United States Department of Agriculture
 Animal and Plant Health Inspection Service
 4700 River Road
 Riverdale, MD 20737

**Permit to Receive Soil
 Regulated by 7 CFR 330**

This permit was generated electronically via the ePermits system.

PERMITTEE NAME:	Mr. Nick Ward	PERMIT NUMBER:	P330-14-00384
COMPANY:		APPLICATION NUMBER:	P525-150121-003
RECEIVING ADDRESS:	4007 Cherry Ave Kearney, NE 68847	DATE ISSUED:	11/28/2014
MAILING ADDRESS:	4007 Cherry Ave PO Box 788 Kearney, NE 68848		
PHONE:	(308) 234-2418	DATE AMENDED:	12/07/2015
FAX:	(308) 234-1940	EXPIRES:	12/07/2018

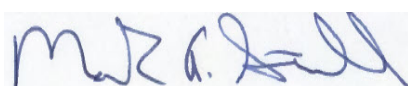
PORTS OF ARRIVAL/PLANT INSPECTION STATIONS: AK, Anchorage; AL, Huntsville; AL, Mobile; AZ, Douglas; AZ, Lukeville; AZ, Naco; AZ, Nogales; AZ, Phoenix; AZ, San Luis; AZ, Tucson; CA, Calexico; CA, El Segundo; CA, Fresno; CA, Long Beach; CA, Oakland; CA, Ontario; CA, Otay Mesa; CA, Port Hueneme; CA, Sacramento; CA, San Diego; CA, San Francisco; CA, San Jose; CA, San Ysidro; CA, Tecate; CO, Denver; CT, Hartford; CT, New Haven; DE, Dover; DE, Wilmington; FL, Ft. Lauderdale; FL, Ft. Myers; FL, Ft. Pierce; FL, Jacksonville; FL, Key West; FL, Miami (For Cargo and Courier Packages Only); FL, Orlando; FL, Pensacola; FL, Port Canaveral; FL, Port Everglades; FL, Sanford; FL, Tampa; FL, West Palm Beach; GA, Atlanta; GA, Savannah; GU, Agana; HI, Hilo; HI, Honolulu; HI, Kahului; HI, Kailua-Kona; HI, Lihue; ID, Eastport; IL, Chicago; IN, Indianapolis; KY, Louisville; MA, South Boston; MD, Baltimore; MD, Beltsville; ME, Bangor; ME, Calais; ME, Houlton; ME, Portland; MI, Detroit; MI, Port Huron; MI, Romulus; MI, Sault Saint Marie; MN, Duluth; MN, Grand Portage; MN, International Falls; MN, Minneapolis; MO, Kansas City; MO, St. Louis; MP, Commonwealth of the Northern Mariana Islands; MS, Gulfport; MS, Port Bienville; MT, Raymond; MT, Roosville; MT, Sweetgrass; NC, Raleigh; NC, Wilmington; ND, Dunseith; ND, Pembina; ND, Portal; NJ, Linden; NJ, Newark; NM, Albuquerque; NM, Columbus; NM, SantaTeresa; NV, Las Vegas; NY, Albany; NY, Alexandria Bay; NY, Brooklyn; NY, Buffalo; NY, Champlain, Rouses Point; NY, Jamaica; NY, Jamaica; NY, Newburgh; OH, Ashtabula; OH, Cincinnati; OH, Cleveland; OH, Columbus; OH, Toledo; OH, Wilmington; OK, Oklahoma City; OR, Portland; PA, Allentown; PA, Harrisburg; PA, Philadelphia; PA, Pittsburgh; PA, Scranton; PR, Aguadilla; PR, Carolina; PR, Fajardo; PR, Mayaguez; PR, Ponce; RI, Warwick/Providence; SC, Charleston; TN, Memphis; TN, Nashville; TX, Austin; TX, Brownsville; TX, Corpus Christi; TX, Dallas; TX, Del Rio; TX, Eagle Pass; TX, El Paso; TX, Fabens; TX, Falcon; TX, Fort Hancock; TX, Galveston; TX, Hidalgo; TX, Humble; TX, Laredo; TX, Los Indios; TX, Pharr; TX, Port Arthur; TX, Presidio; TX, Progreso; TX, Rio Grande City; TX, Roma; TX, San Antonio; TX, Victoria; UT, Salt Lake City; VA, Dulles; VA, Norfolk; VI, St. Croix; VI, St. Thomas; VT, Berlin; WA, Blaine; WA, Oroville; WA, Port Angeles; WA, SeaTac; WA, Sumas; WI, Green Bay; WI, Milwaukee

HAND CARRY: No

Under the conditions specified, this permit authorizes the following:
Quantity of Soil per Shipment and Treatment
 3 lbs or less: Sterilization will interfere with intended use - Your facility MUST be inspected and approved to receive this soil

SPECIAL INSTRUCTIONS TO INSPECTORS
 See permit conditions below

Permit Number P330-14-00384

THIS PERMIT HAS BEEN APPROVED ELECTRONICALLY BY THE FOLLOWING PPQ HEADQUARTER OFFICIAL VIA EPERMITS.  Mark A. Stull	DATE 12/07/2015
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INSTRUCTIONS TO DHS CBP INSPECTORS FOR IMPORTED SOIL SHIPMENTS ROUTED TO RECEIVING FACILITY:

For hand carry of soil, an official of CBP Agricultural Programs and Trade Liaison (APTL) would have been notified to document and facilitate the entry of the soil (See hand carry conditions below if stipulated). Otherwise:

1. Validate the permit in ePermits using the CBP search feature by logging on to: <https://epermits.aphis.usda.gov/epermits>
2. Confirm that the shipment is being routed directly to a USDA APHIS PPQ Inspected Facility authorized to receive soil by logging on to: <https://web01.aphis.usda.gov/PPQ/AuthSoilLabs.nsf/web?openform>
3. Confirm that the imported shipment has a valid USDA PPQ Form 550 Black/White label.
4. Confirm that the carrier of the shipment imported under this USDA PPQ 525 permit is commercially bonded.
5. For questions or concerns, contact the USDA APHIS PPQ Permit Unit in Riverdale, MD, at 866-524-5421 and ask to speak with a compliance officer.

PERMIT GUIDANCE

Receipt or use of foreign isolates or samples from countries under sanctions requires specific permission from the U.S. Department of Treasury (see <http://www.treasury.gov/resource-center/sanctions/Programs/Pages/Programs.aspx> for current country/regional listings) for current country listings.

This permit does not authorize importation, interstate movement, possession, and/or use of strains of genetically engineered regulated organisms (created by the use of recombinant DNA technology).

If an animal pathogen is identified in your shipment, to ensure appropriate safeguarding, please refer to http://www.aphis.usda.gov/import_export/animals/animal_import/animal_imports_anproducts.shtml.

If a human pathogen is identified, please see the CDC Etiologic Agent Import Permit Program at <http://www.cdc.gov/od/eaipp/>

This permit does not fulfill the requirements of other federal or state regulatory authorities. As appropriate, please contact the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the U.S. Food and Drug Administration, the Centers for Disease Control and Prevention, the APHIS Veterinary Services unit, or your State's Department of Agriculture to ensure proper permitting.

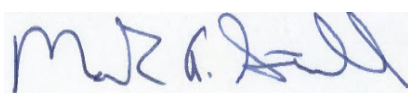
If you are considering renewal of this permit, an application should be submitted at least 90 days prior to the expiration date of this permit to ensure continued coverage. Permits requiring containment facilities may take a longer period of time to process.

This permit authorizes the importation of soil from all foreign sources (except countries with sanctions or embargoes by U.S. State Department) only for chemical/ physical analysis in a controlled laboratory environment at the named facility on the permit.

PERMIT CONDITIONS

1. This permit is issued only for the named permit holder at the address(s) identified on this permit. This permit cannot be transferred or assigned.
2. The permit holder verifies United States residency by initialing and accepting these permit conditions. If you are not a United States resident, it is unlawful for you to initial or accept these permit conditions because a USDA 525 soil Permit can only be issued to United States residents.

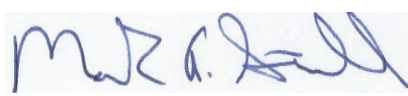
Permit Number P330-14-00384

<p>THIS PERMIT HAS BEEN APPROVED ELECTRONICALLY BY THE FOLLOWING PPQ HEADQUARTER OFFICIAL VIA EPERMITS.</p>  <p>Mark A. Stull</p>	<p>DATE</p> <p>12/07/2015</p>
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3. The permit holder is solely responsible for ensuring compliance with all statutory requirements and specifically listed permit conditions. Failure to comply with the terms and conditions of this permit is cause for the following: (a) cancellation of this permit, (b) cancellation of other permits issued to the permit holder, (c) seizure and/or destruction of regulated organisms, (d) denial of future permit applications by this permit holder, (e) liability for civil penalties, and (f) criminal prosecution under provisions in the Plant Protection Act.
4. Any alteration, forgery, unauthorized use of this permit and/or associated Federal Forms are subject to civil and criminal penalties including fines and imprisonment.
5. This permit must not be used for the movement or use of plant pathogens listed in the Public Health Security and Bioterrorism Preparedness and Response Act of 2002. If any organism listed as a Select Agent is identified from materials associated with this research, the permit holder is required to notify APHIS, Agricultural Select Agent Program (ASAP) within one business day by phone at 301-851-3300, and within seven (7) days submit APHIS/CDC Form 4 (Report of Identification of a Select Agent or Toxin in a Clinical or Diagnostic Laboratory) to APHIS, ASAP; 4700 River Rd, Unit 2, Riverdale, MD 20737 (see instructions at: http://www.aphis.usda.gov/programs/ag_selectagent/index.shtml). Failure to comply with this requirement is a violation of the Agricultural Bioterrorism Protection Act of 2002.
6. If a regulated organism is received in this shipment, the permit holder must take all prudent measures to contain the organism(s) and notify the permit unit within one business day by calling 866-524-5421 or by e-mail to pest.permits@aphis.usda.gov. The permit holder must immediately notify the permit unit of the destruction of regulated organisms received under this permit, as above. Similarly, the permit holder must immediately notify the permit unit if facilities are destroyed or decommissioned for any reason.
7. You as the permit holder are responsible for maintaining a valid permit for as long as the soil is in your possession. APHIS does not issue extensions or renewals of existing permits; the permit holder must submit a new permit application at least three months prior to the expiration of this permit, and obtain a new permit to continue uninterrupted authorization for the soil approved under this permit.
8. If an accidental release into the environment occurs, notification must be made within one business day to APHIS, PPQ, 4700 River Rd., unit 133; Riverdale, MD 20737; 866-524-5421. A written report of the incident must be submitted identifying: (a) the name of the permit holder (responsible person), (b) the permit number, (c) the country or State of origin of the soil, (d) the nature of the release, and (e) measures already taken to contain, reduce or limit the effects of the accidentally released soil. Any plans prepared to contain, reduce or limit the effects of the accidentally released soil may be submitted as developed.
9. Without prior notice and during reasonable hours, authorized PPQ and/or State regulatory officials shall be allowed to inspect the conditions associated with the regulated soil authorized under this permit.
10. The permit holder must maintain an official permanent work assignment at the address identified on this permit. If the permit holder ceases assignment/affiliation at the address identified on this permit, or personnel circumstances change in any way, then a compliance officer must be notified at the PPQ permit unit immediately (that is, within one business day) by either (a) email to pest.permits@aphis.usda.gov, (b) fax to 301-734-4300 or 8700/5392, or (c) conventional mail to USDA PPQ Permit Unit, 4700 River Road, Riverdale, MD 20737. Should the permit holder depart from the organization/facility, the permit holder must either (a) request cancellation of this permit and comply with all permit-specific termination conditions, (b) apply for and receive a permit to move the soil to a new facility, or (c) relinquish control of the regulated soil to a qualified individual who obtained a permit for the continued use of this regulated soil prior to this permit holder's departure.
11. A copy of this permit must accompany all shipments authorized under this permit.
12. CBP-AI and PPQ have the authority to order and approve treatment, re-exportation or destruction of a shipment, a portion of a shipment or any other material associated with the shipment (i.e. pallets, packaging, and means of conveyance). If an official of CBP-AI or PPQ determines that the shipment requires treatment as a condition of entry, is contaminated with a quarantine plant pest or pests, is commingled with prohibited plant material or the required documentation is incomplete or missing, then that official may order and approve treatment, re-exportation or destruction of a shipment, a portion of a shipment or any other material associated with the shipment (i.e. pallets, packaging, means of conveyance).

Permit Number P330-14-00384

<p>THIS PERMIT HAS BEEN APPROVED ELECTRONICALLY BY THE FOLLOWING PPQ HEADQUARTER OFFICIAL VIA EPERMITS.</p>  <p>Mark A. Stull</p>	<p>DATE</p> <p>12/07/2015</p>
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13. All solid wood packing material (SWPM) accompanying the shipment must be in compliance with ISPM 15 treatment regulations and IPPC stamp requirements and enforcement. Noncompliant shipments will be treated, re-exported or destroyed at the consignee's expense.
14. All costs and arrangements for safeguarding and transportation of the cargo are the responsibility of the importer, broker or other parties associated with the shipment.
15. All operations must be consistent with information submitted in association with the above listed APHIS-PPQ inspected facility and subject to the conditions below.
16. Soil must be shipped in a securely closed, watertight container (primary container, test tube, vial, etc.) which must be enclosed in a second, durable watertight container (secondary container).
17. The shipment must be free from foreign matter or debris, plants and plant parts including noxious weeds and infestations by other macroorganisms such as insects, Cyst nematodes, mollusks and acari. Authorized material found to be commingled with unauthorized material will be subject to the same action (i.e. re-export, destruction) as unauthorized material.
18. The imported article can be released without treatment at the port of entry to the permittee's address listed on the permit or label or to an authorized user only if the final destination is an approved facility listed at <https://web01.aphis.usda.gov/PPQ/AuthSoilLabs.nsf/web?openform>.
19. The soil must not be used in field research or release into the environment before sterilization.

The soil must not be used for isolation or culture of organisms, or for extracting and concentrating organisms from the soil.

The soil must not be used as a growing medium.


20. Further distribution of soil is not allowed without prior approval from Federal officials [State Plant Health Director or designee] (or from Federal officials with State concurrence): Access the website at <http://www.aphis.usda.gov/ppq/sphd/> for a list of State Plant Health Offices. Access the website at <http://nationalplantboard.org/member/index.html> for a list of State Plant Regulatory Officials.
21. While in storage, all soil must be kept locked (e.g. in freezer, cabinet) in the approved lab with access limited to authorized personnel or they will be in a restricted access building that requires a key card entry and access is restricted to authorized personnel only; or it must be in locked room restricted to authorized personnel only.
22. The soil must be handled as quarantined material until sterilized. This will include keeping the soil enclosed in containers when not in use and labeling all containers and/or storage areas: "Quarantine Soil- Sterilize Before Disposal"
23. All packing material, media, substrate, and shipping containers must be sterilized or destroyed as approved and prescribed by the permit conditions after removing the soil.
24. All unconsumed soil, containers and effluent must be autoclaved, incinerated or properly sterilized by the permittee at the conclusion of the project as approved and prescribed by the permit conditions.
25. Any water residues (effluent) from the processing of soil samples must be treated by an approved sterilization procedure such as hydroclave or autoclave.
26. All soil residues must be dry-heated, incinerated or autoclaved.

Dry Heat Treatment: use one of the following schedules:

- 110- 120.5 degrees C (230-249 F) for 16 hours
- 121-154 degrees C (250-309 F) for 2 hours
- 154.4 - 192.5 degrees C (310-379 F) for 30 minutes
- 193-220 degrees C (380-429 F) for 4 minutes
- 221-232 degrees C (430-450) for 2 minutes

Time starts when the entire sample reaches the required temperature, and a suitable temperature probe must be used for verification.

Permit Number P330-14-00384

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Autoclave soil and other material using the following conditions:

- a. Soil must be autoclaved at 121 degrees Centigrade (250 degrees Fahrenheit) for a minimum of 30 minutes at 15 psi.
- b. Autoclave tape or other indicators must be placed on each bag or sharps container prior to treatment. The autoclave tape or other indicator on each container must be checked to verify color change before disposal.
- c. The autoclave log must be completed by each user for each autoclave cycle. All parameters must be noted as listed on the log for each autoclave load.
- d. If the autoclave does not attain the minimum time and/or temperature or the autoclave tape does not change color, a notation must be made in the comment section of the autoclave log. The load must then be re-autoclaved after placing new tape on the material. If minimum time and temperature is not attained on the second cycle, users must contact the person responsible for maintaining the unit to initiate repairs. Waste must then be treated at an alternate autoclave facility that is approved by USDA.
- e. Thermometers on the autoclave must be calibrated annually, and a written record must be maintained. This must be done by an authorized autoclave service company during routine servicing.
- f. Every 6 months, you should use a commercially available test indicator kit that uses bacterial spores *Bacillus stearothermophilus* that are rendered unviable at 250 degrees F or 121 degrees C. For the test, ampules of *B. stearothermophilus* are autoclaved along with a load of waste. Upon completion of the cycle, the ampules are incubated for 48 hours and then observed for any sign of growth, which indicates insufficient sterilization. If any growth is observed, you must have the autoclave serviced and retested.

Incineration:

With the exception of metal and glass containers, all regulated and associated material must be reduced completely to ash at the end of the incineration cycle.

27. Equipment and supplies used to conduct operations or that have contacted the soil must be decontaminated using one of the following methods:

- (a) Material can be soaked in a fresh bleach solution of 10 percent (1:10) for at least 30 minutes. (1:10 is a convention that means 1 in 10 or 1 part 9 parts = 10 parts total, which is a 10 percent solution)
- (b) Material can be soaked in 70 percent ethanol
- (c) Flamed with ethanol
- (d) Treated with quaternary ammonium compounds.

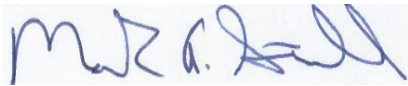
Note also that autoclaving, hydroclave, incineration, and dry heat sterilization are also acceptable sterilization/decontamination methods.

28. Upon issuance of this permit (i.e., a signed PPQ 525), you will need to request the PPQ Form 550 Black/White labels at least 5 days in advance. If you applied online using ePermits, you may request the labels using the My Shipments/Labels feature. Otherwise, send your request to BlackWhiteGreenYellowlabelrequest@aphis.usda.gov. All email requests must come from the permit holder or appointee, if requested by the appointee the permit holder must be Ccd on all requests. Specify the approved port as listed on the permit and the total number of labels needed in multiples of four. You may request additional labels the same way. We will send you the labels by email as a pdf.

A label must be attached with clear tape to the exterior of each package being imported under this permit. The labels will include detailed shipping instructions. You are responsible for instructing your shipper to carefully follow these instructions. You are responsible for each import shipping label issued under this permit. All labels must be printed in color. Failure to do so may result in refused entry or destruction of your package.

Enclose the following supplemental information in each shipment:
- Permittee Name

Permit Number P330-14-00384

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- Permit number
- Label number

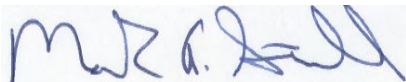
Underlying packaging/wrapping must carry the address, billing, and any other information required to direct the shipment to its final destination (i.e., the permit holder's address; N.B., USDA APHIS does not defray any additional shipping costs incurred for transiting the shipment through an inspection station as the initial US destination).

29. Underlying packaging/wrapping must carry the address, billing, and any other information required to direct the shipment to its final destination (i.e., the permit holder's address; Please note: USDA APHIS does not defray any additional shipping costs incurred for transiting the shipment through an inspection station as the initial US destination).

END OF PERMIT CONDITIONS

Permit Number P330-14-00384

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Mark A. Stull

DATE

12/07/2015

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Appendix C: Additional Weather Station Resources

For weather station troubleshooting, contact:

Wendy Sayre

Spectrum Technologies Research/Education Sales Consultant

331-212-6718 (direct)

630-207-5975 (cell)

wsayre@specmeters.com

a. Annual Watchdog 2700 Maintenance

- i. Check that all sensors are reading correctly on LCD screen. Calibrate as necessary.
- ii. Check battery level and for battery corrosion. Replace if needed.
 1. If batteries are replaced, check communication again.
- iii. Check for environmental inhibitors or damage:
 1. Waste in rain gauge
 2. Damaged sensor wires
 3. Damaged external parts
- iv. Check that the station is firmly mounted and grounded.
- v. Inspect fasteners and ensure all are tight.
- vi. Check that the anemometer spins freely. The cups should slip down 1/16 inch.
- vii. Check for moisture damage & corrosion. Inspect circuit board if there are signs of water damage or corrosion.
- viii. Confirm that the weather station is communicating as intended

GPRS Modem:

 - Check for physical or chemical damage to solar panel
 - Remove any waste blocking solar panel cells
 - Check that antenna is receiving good satellite signal, reposition outside of box if necessary by running wire through gland
 - Check for moisture damage to GPRS unit

Wireless Radio-to-Radio:

 - Check for physical obstructions blocking signals, reposition radio(s) if necessary
 - Check for physical or chemical damage to radio units
 - Check for moisture damage to radio units

Wireless Radio-to-LAN

 - Check for physical obstructions blocking signals, reposition radio if necessary
 - Check for physical or chemical damage to radio unit
 - Check for moisture damage to radio unit

c. Check LAN receiver unit connection Transferring SWD files / data

To transfer files, i.e., to consolidate data from multiple locations and computers, you can download your WatchDog Weather Station data in a few ways including:

- Using SpecWare software (first select months/time period then generate a report and/or a graph) then (a) export a text file, save the file (give a name) and email (b) copy a report or graph to the clipboard and paste in an email
- The most straightforward method would be to email the files for each station from its respective computer C-drive.
 1. Open your C-Drive on your computer (you do not need to open SpecWare software)
 2. Open your SpecWare FOLDER (by double clicking your mouse)
 3. Select your station and open this folder (to see files)
 4. Select one or multiple files to send, copy and insert these into an email (as
 5. attachments)
 - The first file is the INDEX file (optional to send if not using SpecWare)
 - The other files are the data files by month (send these)
 6. Later, to view emailed data files (SWD format), open in either Excel (opens automatically if double click file) or in SpecWare software (to view, graph, generate reports) ---- save this file with a new file name so as not to overwrite your original data file.

d. Additional Links to Resources:

1. Software Setup: [SpecWare9 Quick Start Guide](#)
2. [Complete Watchdog Weather Station Manual](#)
3. [Additional Spectrum Technology manuals](#)



Soil Moisture Sensor Placement and Cable Protector

Make a candy cane! Well, not really but the cable protector for each looks like a large candy cane. Each cable protector is constructed from two components: a 36" PVC shaft and a 180° rain head. The rain head friction fits over the shaft, no permanent fastening is required.

The preferred installation method is to use a soil core sampler (if one is not available, see "Alternative Method") With the instructions below, the sensor will be end up in loosely compacted soil with the midpoint of the sensor being about 30cm below soil surface. There is a link at the bottom of this page to a Spectrum Technologies installation video. Please review it before installing the sensor and cable protector.

Materials Description

Each **blue** PVC shaft has 3 grooves labeled A, B, C. The painted section will end up in the ground.

C = 33.5cm, which is the depth of the soil core

B = 30cm, which demarcates the mid-point of sensor once placed in the soil (unused)

A = 26.5cm, which you will align to the soil surface when the placing sensor

Soil Core Depth

Method of Installation:

1. Transfer a mark of 33.5cm to the soil core sampler using groove **C** as a guide.
2. Core the soil in the desired location (near a tripod leg if convenient) to the depth of the mark from step 1.
3. Remove and crumble the core soil into the cored hole so when it's *lightly* compacted groove **A** aligns with the soil surface – you should expect to have some of the core soil left over.
4. Place the sensor into the blue end of the shaft with the remaining lead pushed through the rain head.
5. Push the sensor gently into the soil so groove **A** aligns with the soil surface.
DO NOT PUSH HARD! The sensor is breakable!! If it is too hard, remove the soil core and try again, compacting the soil less.
6. Tamp the remaining dirt from the soil core around the outside of the shaft to divert surface water and support the shaft.
7. Plug the sensor lead into the soil moisture input on the weather station.

Sensor mid-point

Soil surface

Alternative Method:

1. If you do not have a soil core sampler, use a small shovel to dig a hole to the depth of **C**.
2. Place the sensor in the shaft and align groove **A** with the soil surface
3. Ensure full soil contact with the sensor by *lightly* compacting soil around the sensor
4. Back fill and tamp excess soil around the shaft

End of Season:

1. Remove the sensor in the fall by digging it out with a shovel, **DO NOT** pull on the sensor cable

Installation video:
<http://goo.gl/gpHY0w>





Soil Temperature Sensor Placement and Cable Protector

Make a candy cane! Well, not really but the cable protector for each looks like a large candy cane. Each cable protector is constructed from two components: a 36" PVC shaft and a 180° rain head. The rain head friction fits over the shaft, no permanent fastening required.

The soil temperature cable protector is top heavy, and may not remain vertical if the soils were to become water logged or if there are persistent winds. It will have to be supported; so selecting a good location for placement that would enable support is critical. When placing the sensor (" Method of Installation" instructions below), make sure the shaft will be near one of the weather station tripod legs.

!!! Caution !!!

When placing the shaft, ensure it does not pinch, crimp or mangle the sensor cable.

Materials Description

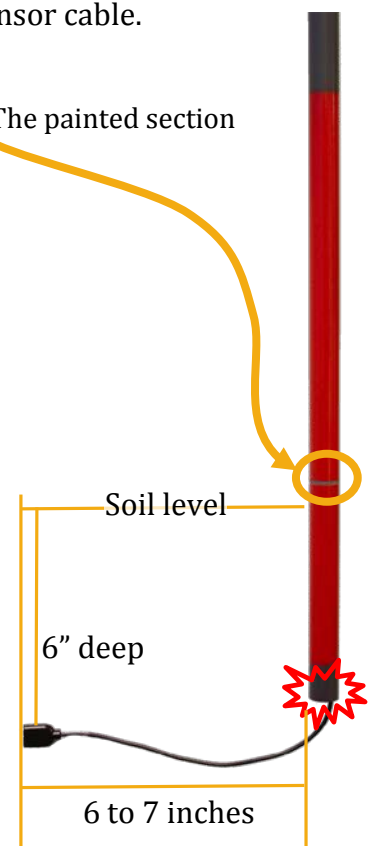
Each red PVC shaft has 1 groove that indicates the depth of sensor placement at 6" The painted section will be in the ground.

Method of Installation:

1. Dig a small trench 6" deep, roughly 8" long
2. Place the sensor horizontally in the trench about 6" from the vertical shaft
3. Lightly tamp the soil around the sensor to ensure complete soil contact
4. Feed the sensor cable through the shaft, then rain head
5. Place the shaft vertically in the soil
6. Tamp the soil around the shaft to provide vertical support.
(The pipe [not the sensor] can be deeper than 6" in the soil)
7. Use the cable tie to fasten the shaft to the tripod leg, stick or rod with a cable tie.
8. Plug the sensor lead into the soil temperature input on the weather station

End of Season:

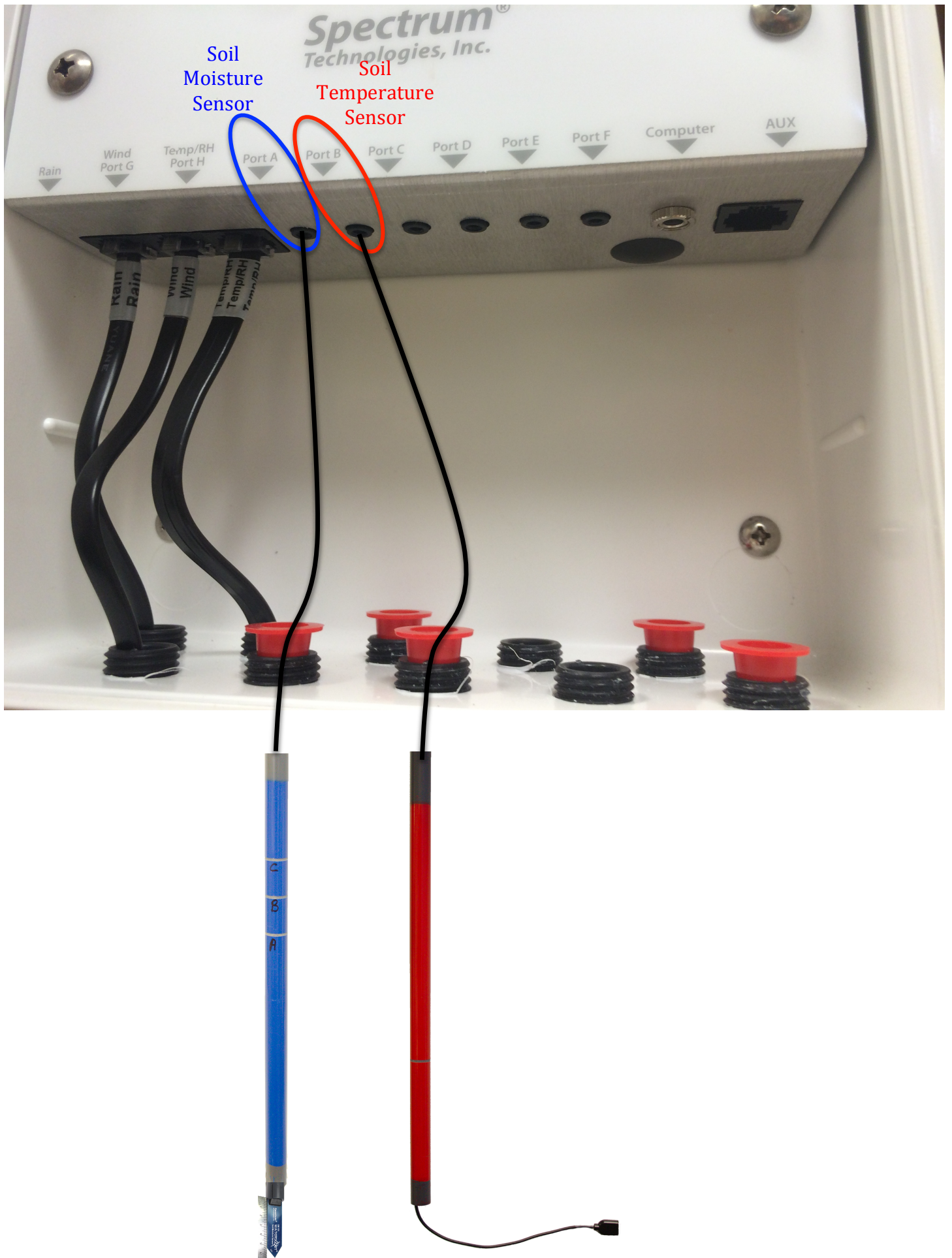
1. Remove the sensor in the fall by digging it out with a shovel, **DO NOT** pull on the sensor cable



Do you have questions
or need assistance?

Send an email to
g2f_help@iplantcollaborative.org

or call
Darwin @ 515-294-8209



Appendix D: Additional Experiment Details

Hybrid Experiment Design Details

There will be 500 hybrids assigned to each location. Whole-experiment common hybrids (50) and local and regional common hybrids (10-20) are replicated twice for 120-140 total entries. Remaining hybrids are divided among four sub-experiments, summarized below.

1. **Ex-PVP Factorial (“Design 2”) Experiment:** Planned ex-PVP diallels integrated with genomic prediction based on ex-PVP-derived progeny. Three sets of materials selected for appropriate maturity will be planted in 28 locations. Led by Jode Edwards (USDA ARS), Elizabeth Lee (Guelph), and Martin Bohn (U. Illinois Urbana-Champaign).
2. **Stiff Stalk GxE:** Founder lines, public early releases, and ex-PVP lines, which represent a span of selection pressure, crossed by inbred line 3IIH6. The Stiff Stalk Set will be planted in 17 locations. Led by Natalia de Leon and Shawn Kaeppler (UW-Madison).
3. **Near-Isogenic Lines Experiment:** Teosintes introgressions; B73/Mo17 near-isogenic lines (NILs). The NILs experiment will be planted in 17 locations. Led by Sherry Flint-Garcia (USDA-ARS) and Candice Hirsch (U. Minn.).
4. **Germplasm Enhancement of Maize (GEM):** A highly diverse set of materials containing un-adapted, exotic germplasm to enhance genetic diversity and trait performance, and to minimize risks to production. The GEM lines are crossed with inbred line LH195 and will be planted in 17 locations.
5. **Common Hybrid Checks:** A set of 50 common check hybrids and five local checks will be planted in all locations. Two smaller sets of regional common hybrids (15 early and 5 late) will be planted in locations based on maturity. Hybrid checks were selected for diversity and continuity with 2014-2015 trials.

Locations

Trial ID	Lead PI	City	State	Plots	Attributes
ARH1	Beth Hood	Jonesboro	AR	500	
ARH2	Beth Hood	Marianna	AR	500	
DEH1	Randy Wisser	Georgetown	DE	500	
GAH1	Joe Knoll	Tifton	GA	500	
GAH2	Jason Wallace	Watkinsville	GA	210	
IAH1	Jode Edwards	Crawfordsville	IA	750	
IAH2	Jode Edwards	Carroll	IA	860	
IAH3	Jode Edwards	Keystone	IA	830	
IAH4	Jode Edwards	Ames	IA	860	
ILH1	Martin Bohn	Urbana	IL	500	
ILH2	Steve Moose	Urbana	IL	220	nitrogen use efficiency
INH1	Mitch Tuinstra	West Lafayette	IN	500	

KSH1	Ignacio Ciampitti	Manhattan	KS	680	
KSH2	Sanzhen Liu	Garden City	KS	440	irrigated
KSH3	Sanzhen Liu	Garden City	KS	440	dryland
KSH4	Sanzhen Liu	Garden City	KS	440	low density
MIH1	Kurt Thelen	East Lansing	MI	500	
MNH1	Candice Hirsch	Waseca	MN	500	
MOH1	Sherry Flint-Garcia	Columbia	MO	730	
NCH1	Jim Holland	Kinston	NC	500	
NEH1	Oscar Rodriguez	Mead	NE	500	irrigated
NEH4	Oscar Rodriguez	Mead	NE	480	dryland
NEH5	Pat Schnable	Mead	NE	440	low density
NYH1	Rebecca Nelson	Aurora	NY	500	disease
NYH2	Ed Buckler	Aurora	NY	500	
NYH3	Ed Buckler	Aurora	NY	490	
OHH1	Peter Thomison	South Charleston	OH	500	
ONH1	Elizabeth Lee	Waterloo	ON	490	
ONH2	David Hooker	Ridgetown	ON	500	
SCH1	Rajan Sekhon	Clemson	SC	500	
TXH1	Seth Murray	College Station	TX	500	
TXH2	Wenwei Xu	Lubbock	TX	500	
WIH1	Natalia de Leon	West Madison	WI	680	
WIH2	Natalia de Leon	Arlington	WI	880	

Seed Distribution - Hybrids

Collaborators will receive a single box of seed containing all seed for their trial organized in plot order. Ten empty seed packets are provided for collaborators to fill with a locally adapted hybrid.

Pictured below: An example envelope for local hybrid checks. Collaborators should select 5 hybrid checks, replicated twice, for inclusion in the hybrid trial.

