Retrofitting Old Equipment with New Technology on a Budget

Practical Farmers of Iowa
January 17-18, 2020
Jim Poyzer
jim@outfarming.com

What's here?

- Show low cost technology available
  - Things I've built
  - What others are doing
  - Free stuff you should consider
- Resources for you

16 Things I've Built

- It started with a one row test stand to check the performance of my Precision ™ corn finger meters.
- A planter monitor to show skips and doubles, population, speed.
- An advanced planter monitor that keeps data.
- An app to record field info with pictures and text with locations flagged on a field map.
- An app to locate soil sample spots.
- Exporting / importing soil sample info into SMS ™ mapping software. Migrating to free QGIS mapping software.
- A spreadsheet for deciding what nutrients and micronutrients are needed using an Open Office spreadsheet (free).

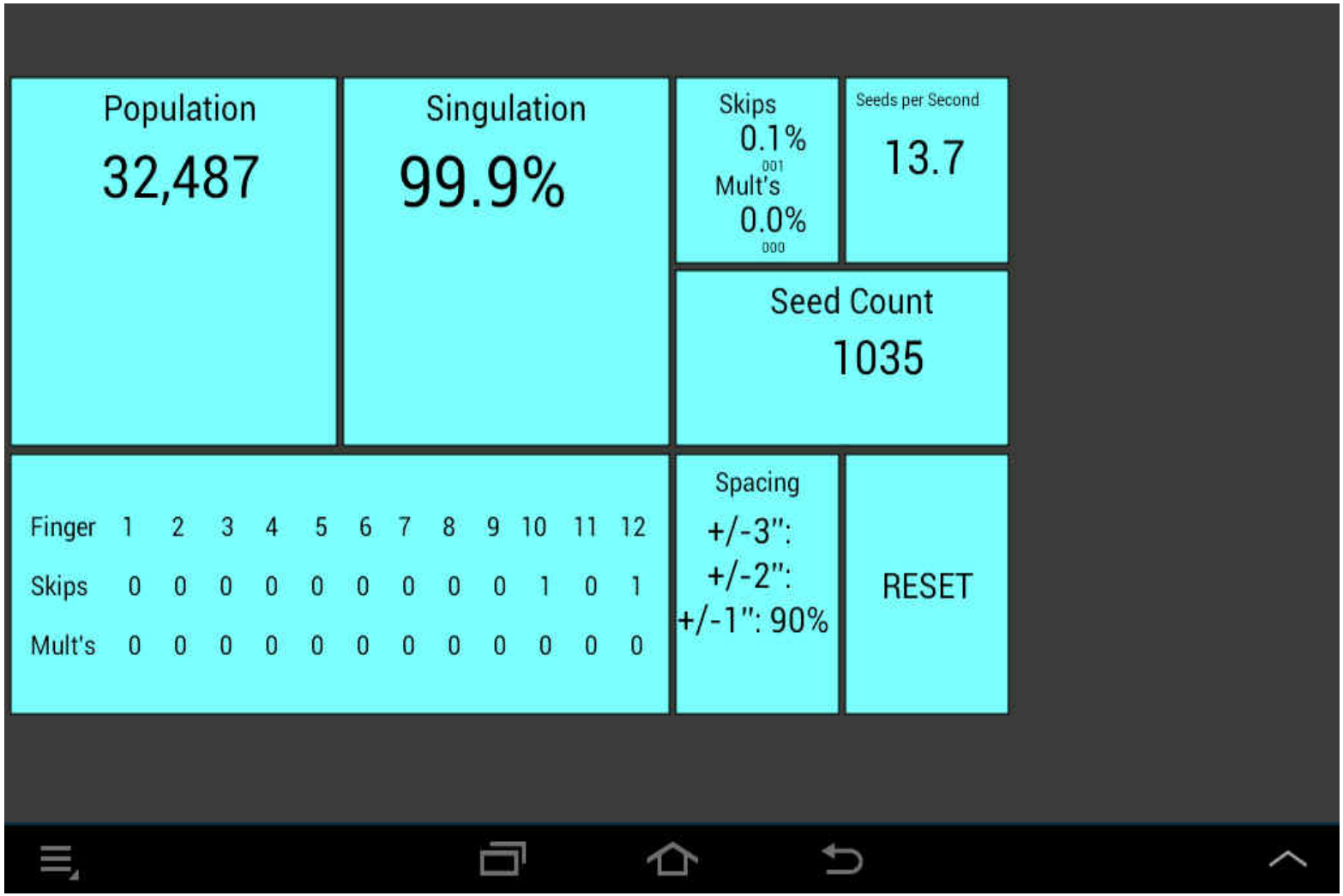
- I added a Duo-Rate device to my planter to vary population – and added the ability to do it with a prescription map.
- Liquid flow monitoring with flow meters and an app.
- Radar replacement for my old Raven sprayer controller.
- RTK for my Ag Leader autosteer.
- Capturing soil and air temps, moisture with solar powered remote sensors.
- Seed counter for accurate yield calculations. Put my app on the Internet.
- Internet of Things: Building random sensors and controllers. Controlling Christmas tree lights from my website.
- Remote on/off switch. Built for testing liquid flow on my planter.
- 3D printing replacement parts, cases, tablet holders.

Seed meter test stand

- Bought one row unit from Colfax
- Added legs,a gear motor & sprocket
- Regular seed tube & sensor
- Arduino Uno R3, prototyping board. Design is on my website.

Findings:
- Great way to find problems
- Test seed sizes for best settings
- Buy medium round seeds

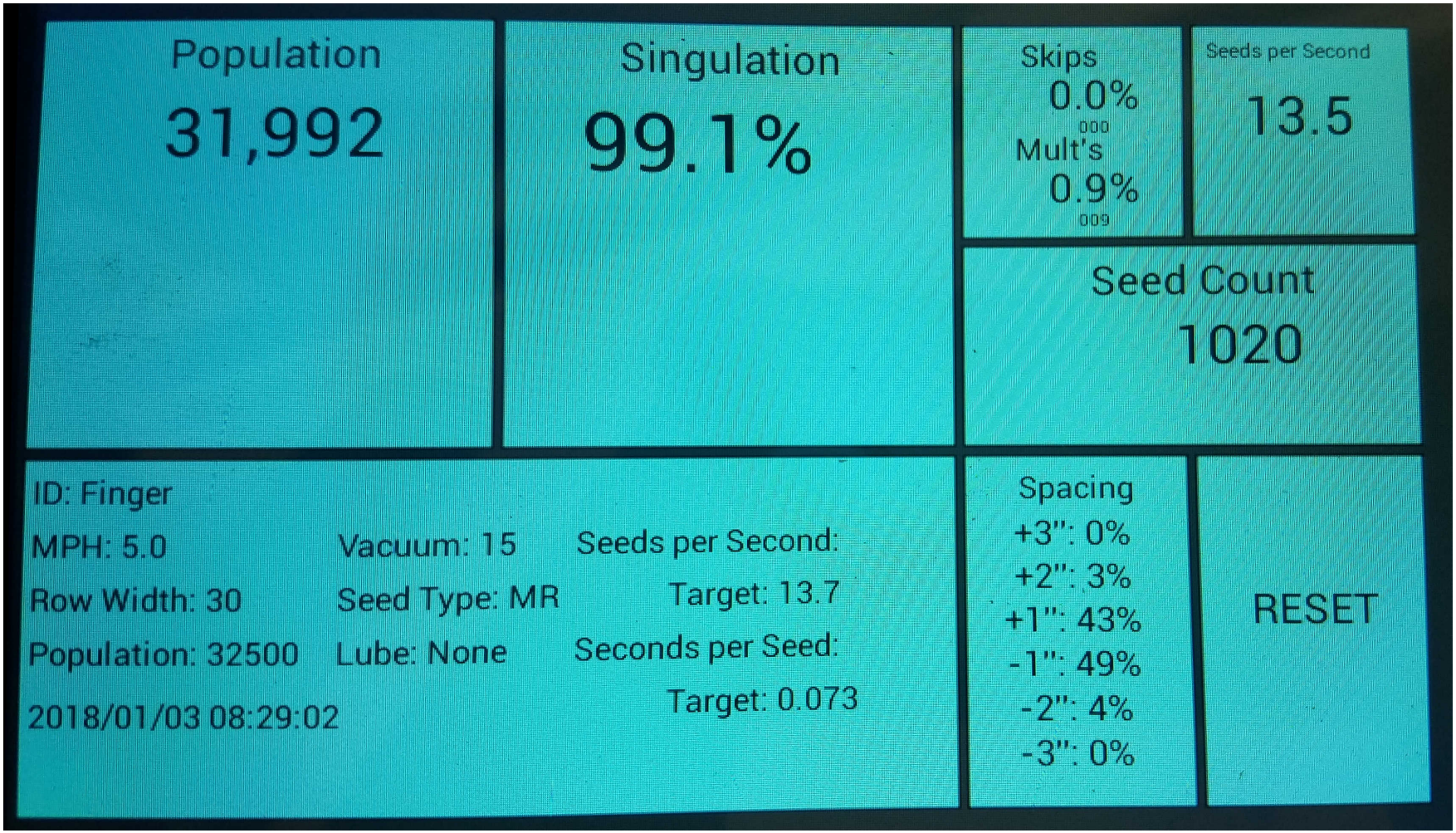
Seed meter app with finger info



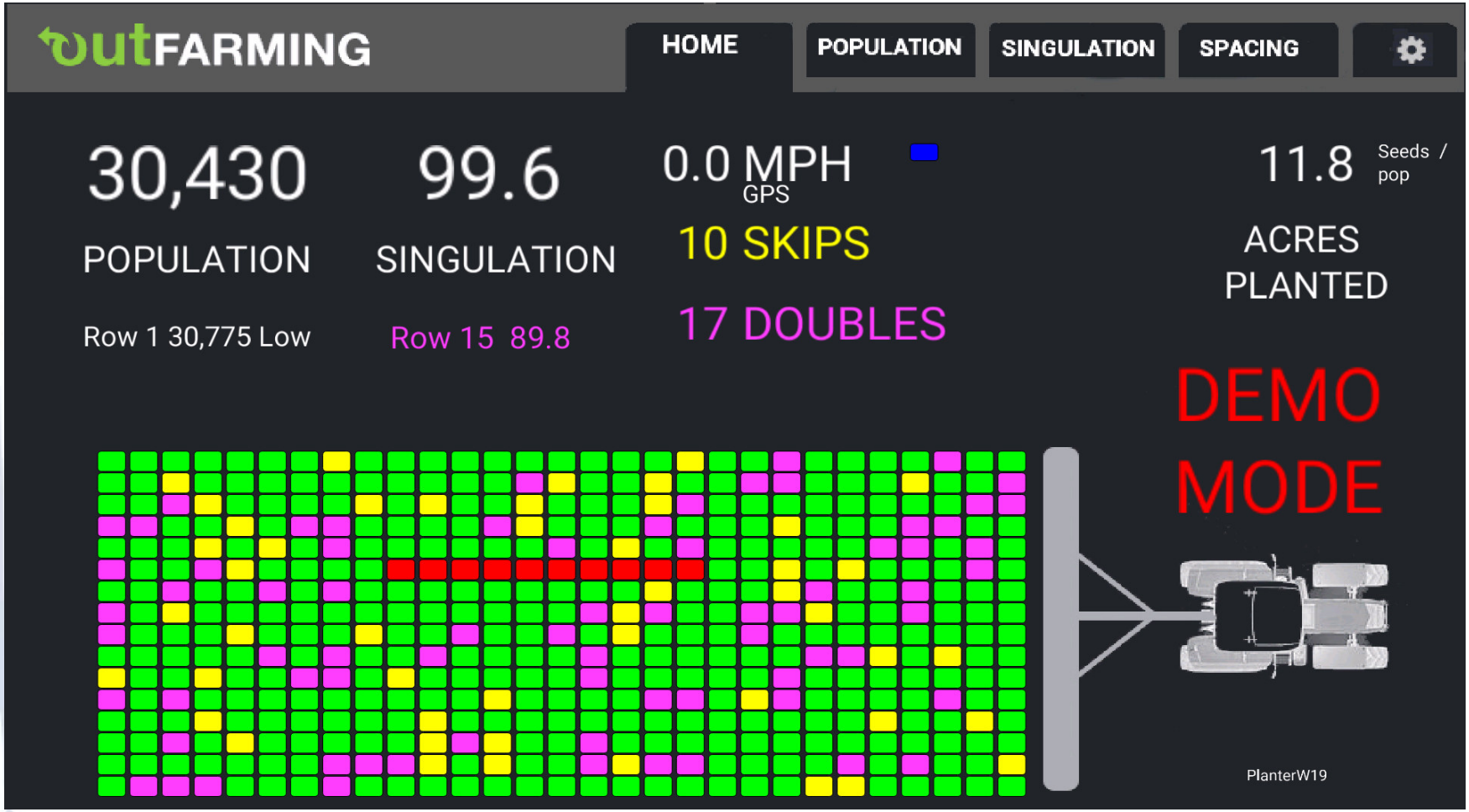
Forced to move to 12 row planter

Vac test stand using vacuum cleaner

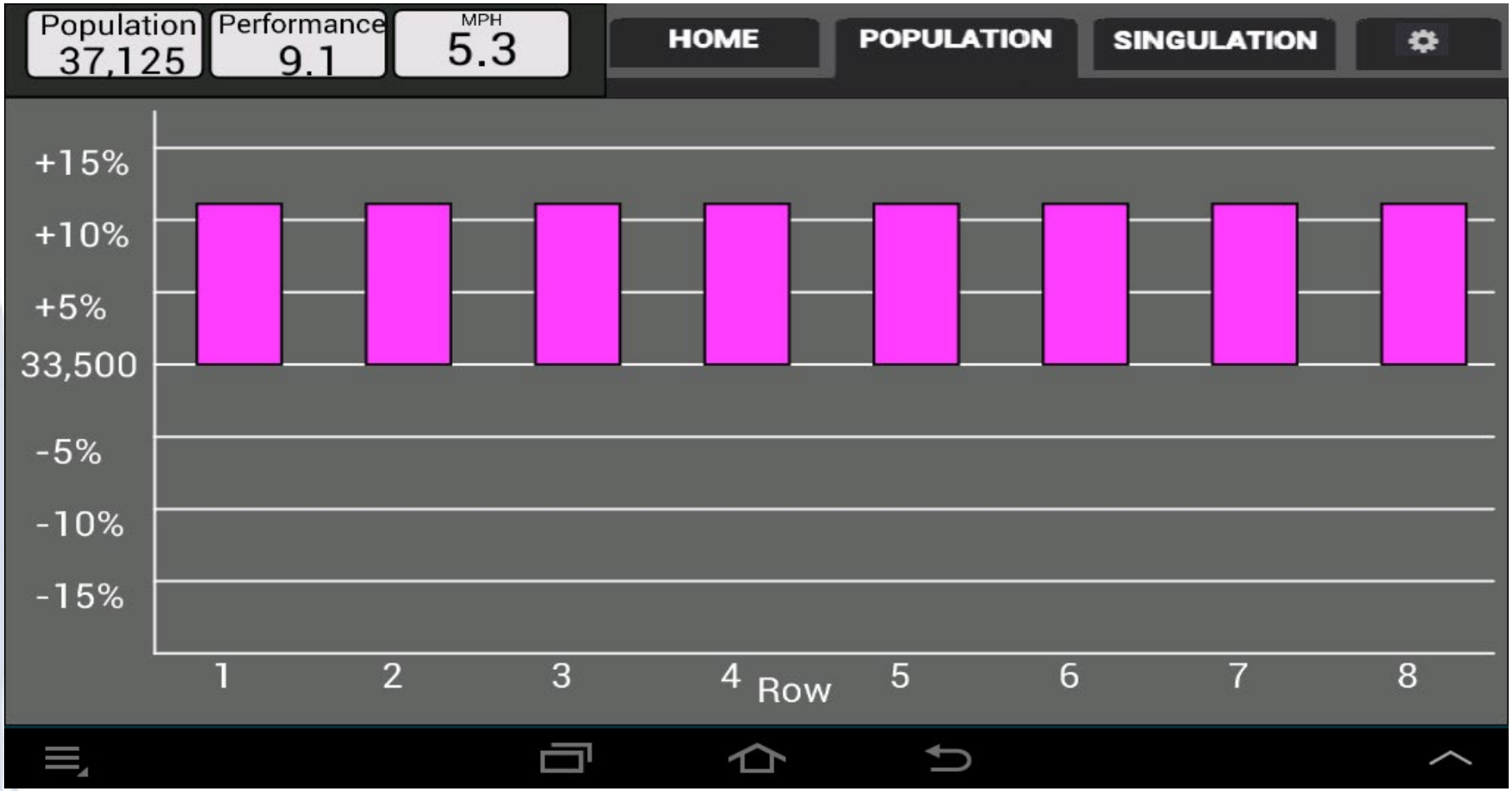
App with spacing info



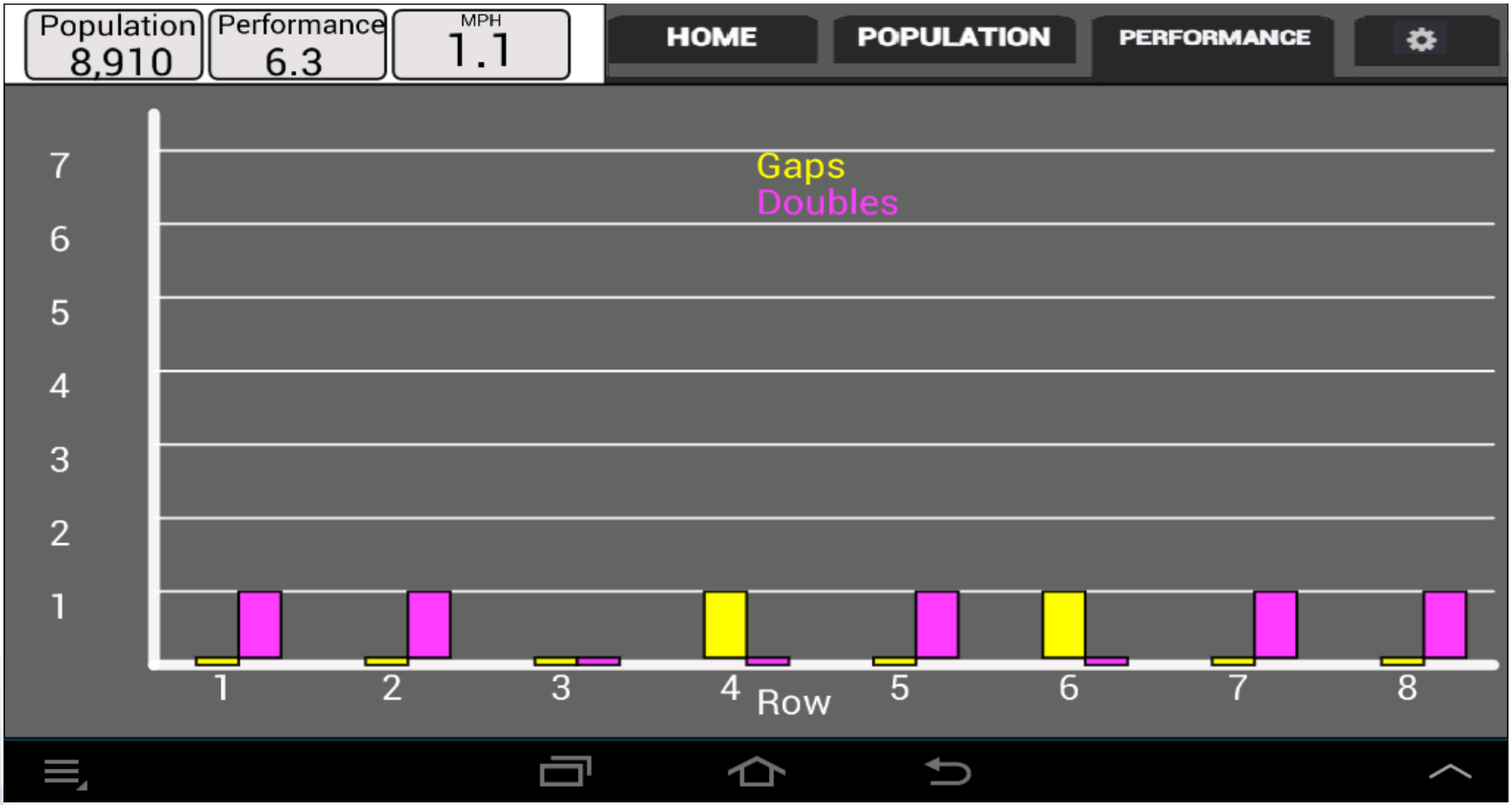
Planter Monitor based on test stand



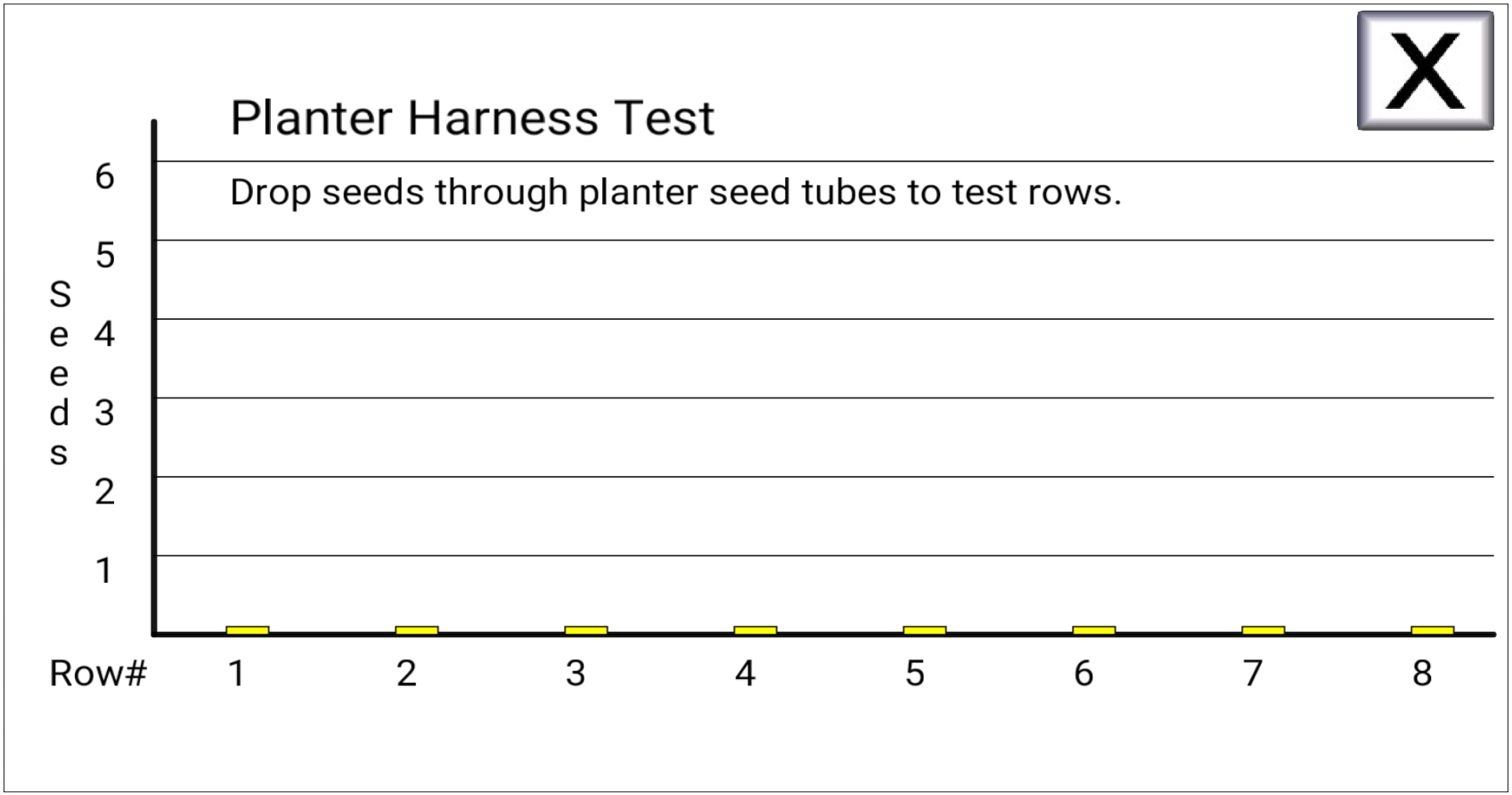
Population


Population
37,125
Performance
9.1
MPH
5.3
HOME
POPULATION
SINGULATION
+15%
+10%
+5%
33,500
-5%
-10%
-15%
1
2
3
4
Row
5
6
7
8

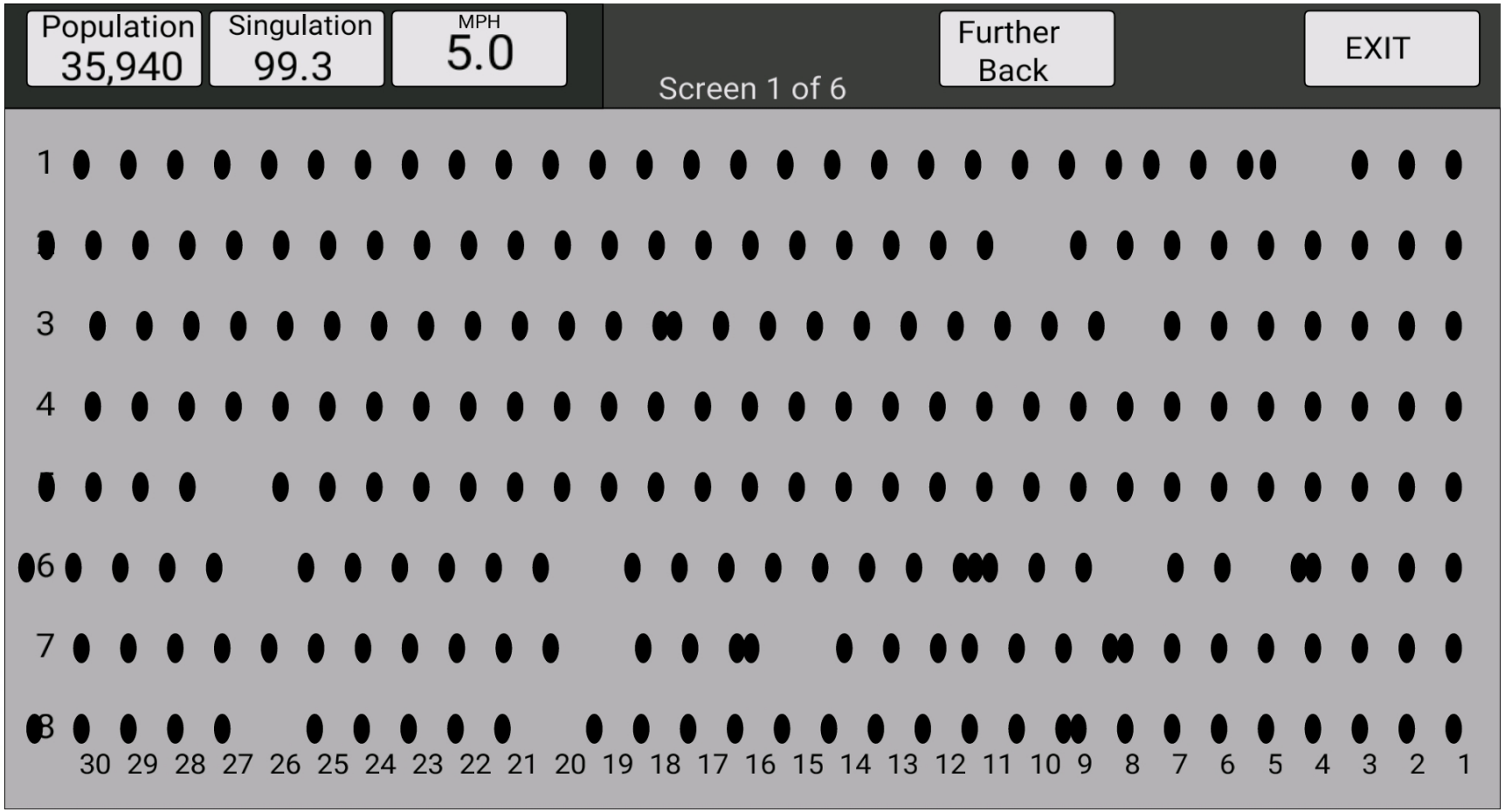
Skips and doubles by row



Pre-season System Test

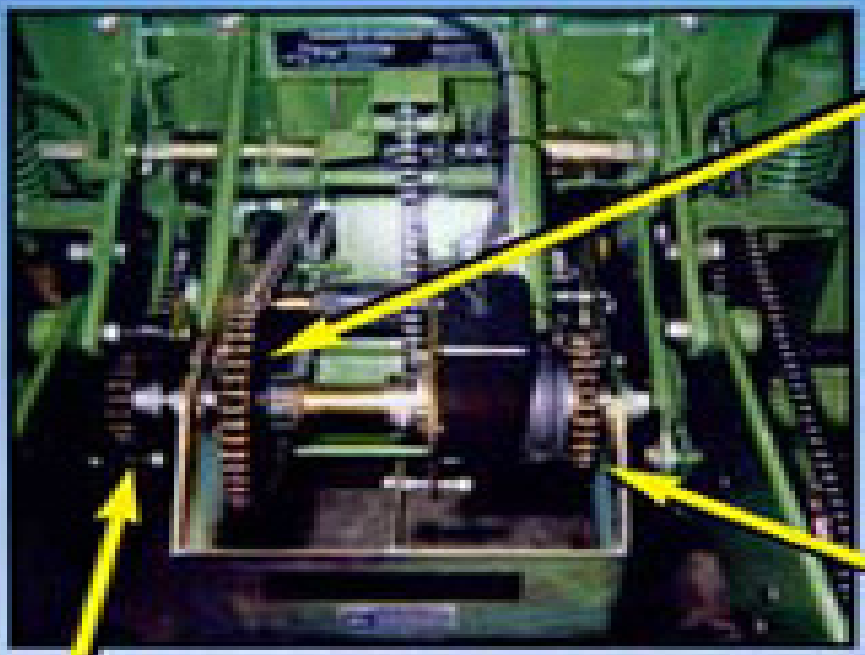


Spacing


Population
35,940
Singulation
99.3
MPH
5.0
Screen 1 of 6
Further
Back
EXIT
1
3
4
6
7
8
30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

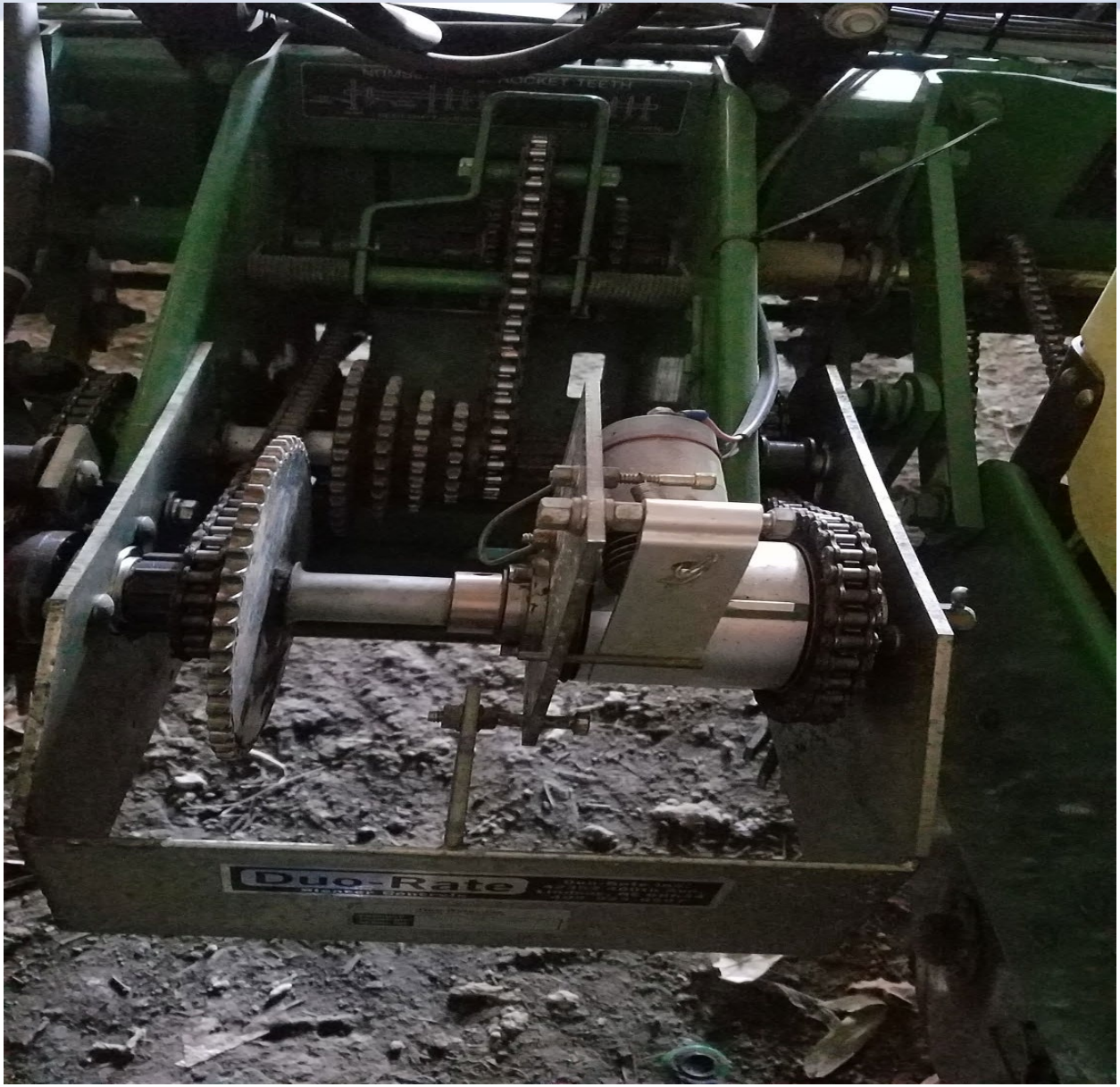
Lower Population near timber

Variable Rate Planting
Duorate.com



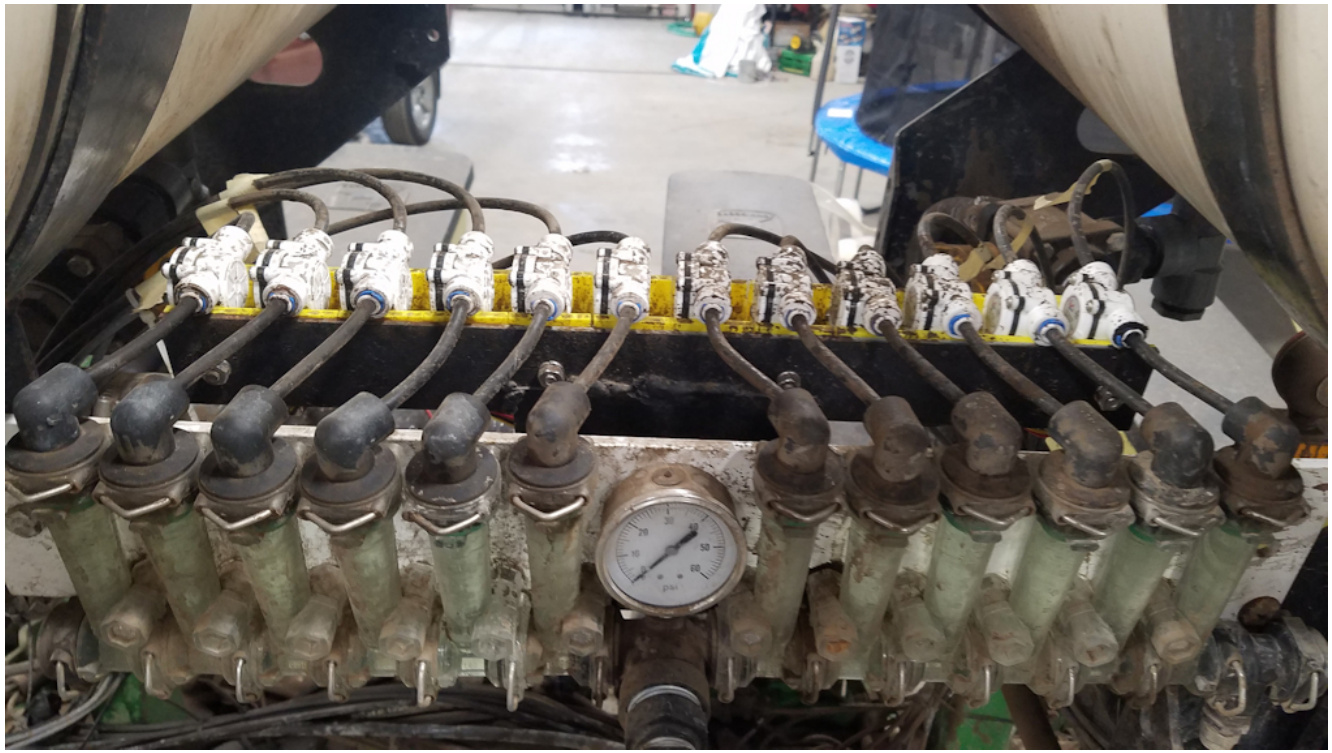
John Deere 7200

1. No. 1 sprocket, primary drive from planter wheel.
2. Electric clutch is direct drive side, in direct rate power transmits from 1 to 2 sprocket.
3. 20T one-way sprocket is reduced drive side, in reduced rate power is transmitted from 1 to 3 sprocket.


Duo-Rate

Got 4 tanks for $500, so....

24 site tubes!



Flowmeter app

Liquid flow system - $3,500 from dealer
Amazon flow meter - $9.49 $400 in parts

Roll over image to zoom in

DIGITEN G1/4" Quick Connect Hall Effect Sensor Water Flow Sensor Flowmeter Water Flow Counter Meter 0.3-10L/min - Arduino, Raspberry Pi, and Reverse Osmosis Filter Compatible

by DIGITEN

★★★★★ 1 rating

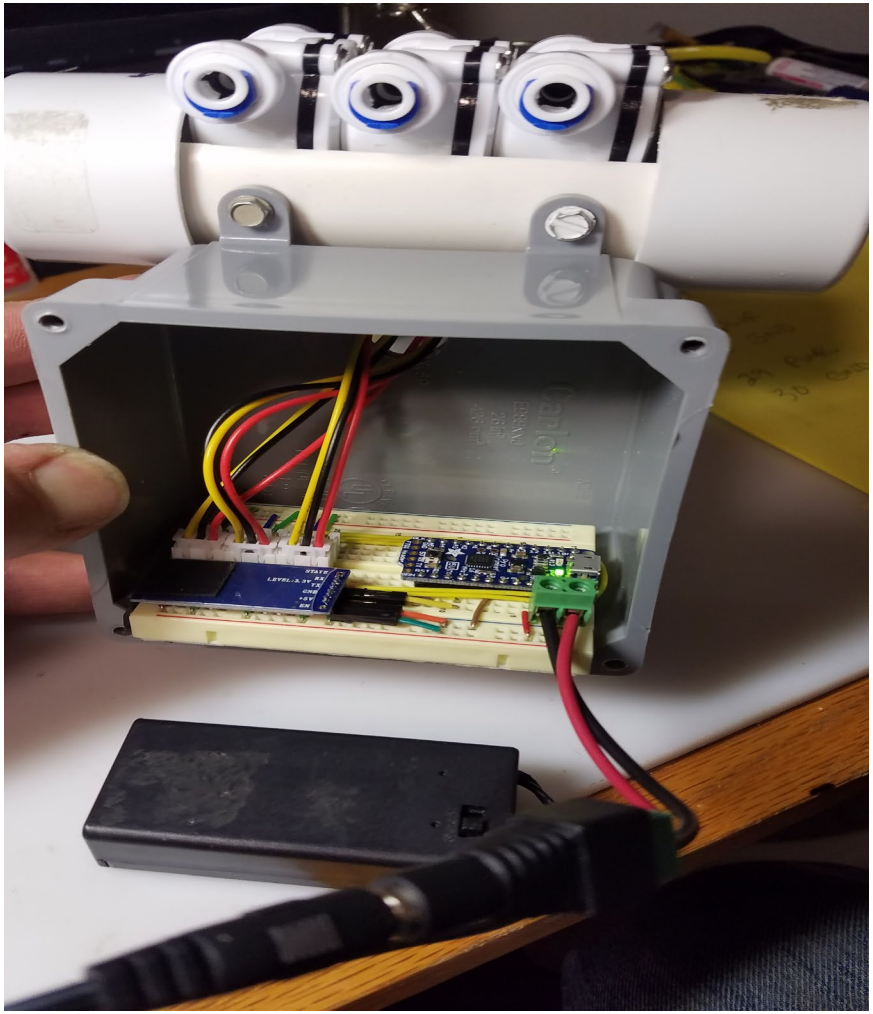
Price: $9.49 ✓prime & FREE Returns

Size: **G1/4" Quick Connect**

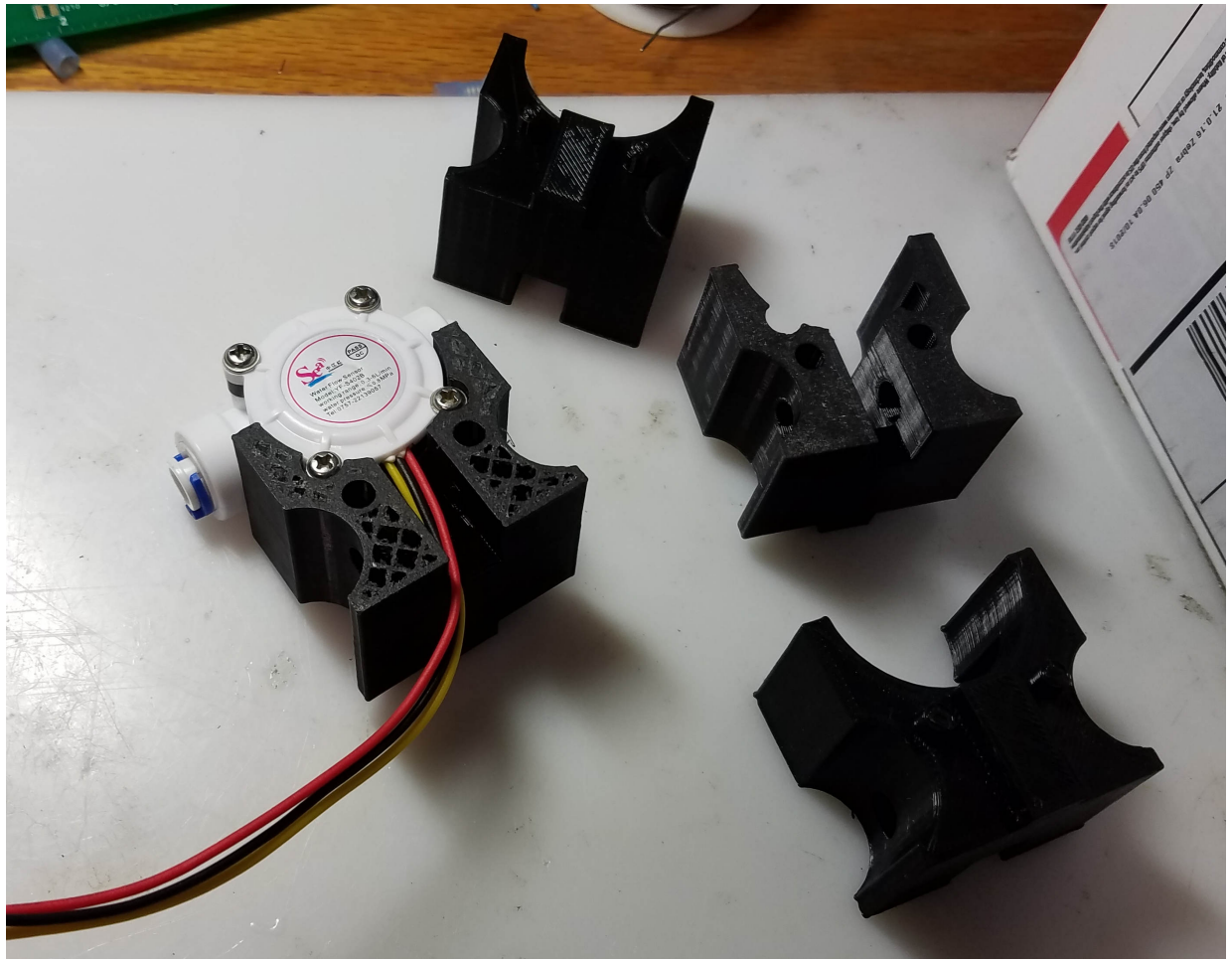
G1/4" Quick Connect	G3/8" Quick Connect
$9.49	$7.99
✓prime	✓prime

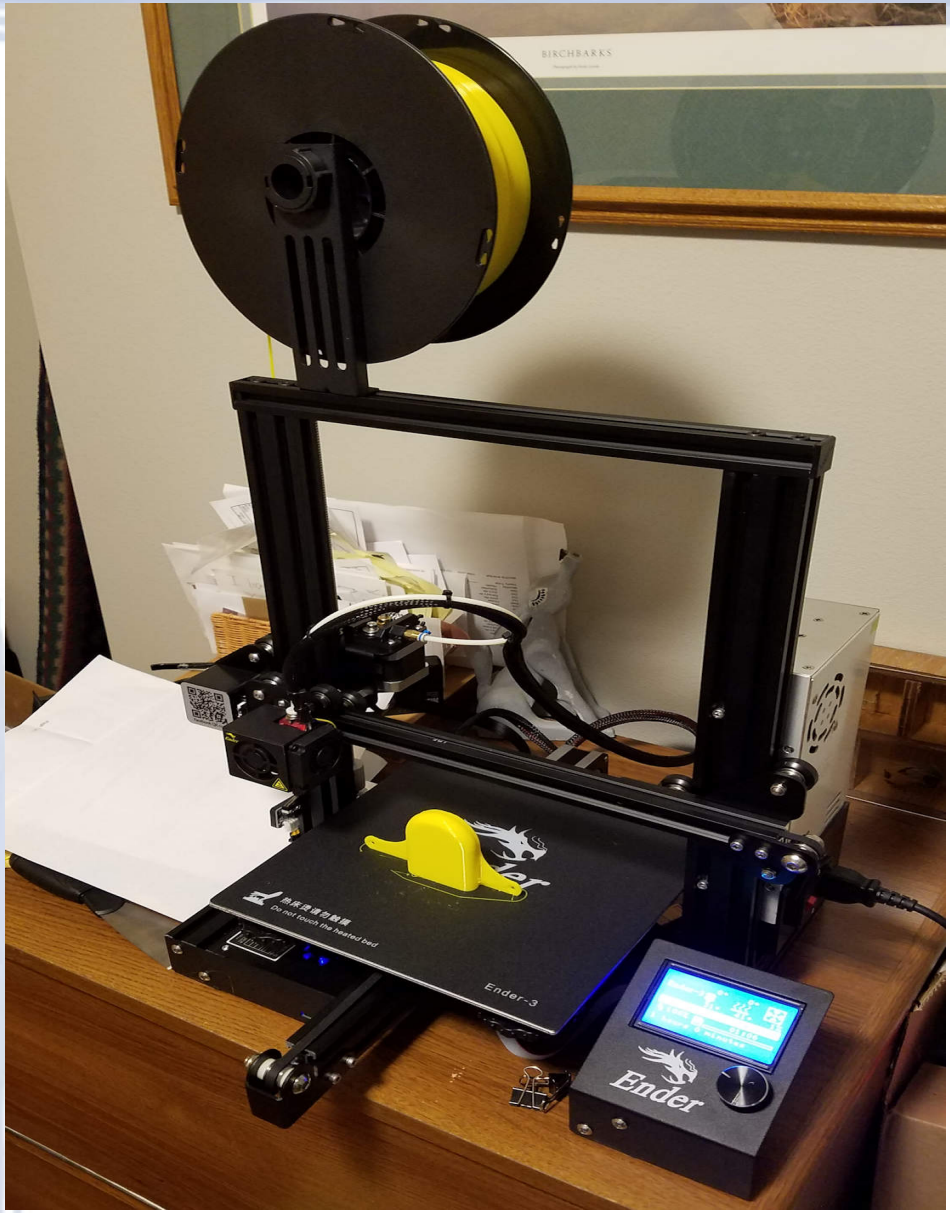
- ★Food grade: Liquid passed through is safe to drink.
- ★G1/4 inch Quick-Connect: Easy installation and removal, suitable for 1/4" tube and works with most Reverse Osmosis filtration systems.
- ★Flow range:0.3-10L/min, working voltage range: DC 5-18V.
- ★Waterproof, heat resistance, pressure resistance, cold resistance.
- ★Sensor: Hall effect. Application:water heater thermostat, water purifier, boiler, water dispensers, coffee machines, smart card equipment, the boiler and so on.

2018 - Test on 3 rows



2019 – how do I hold 12 in a row?





3D Printer - $200

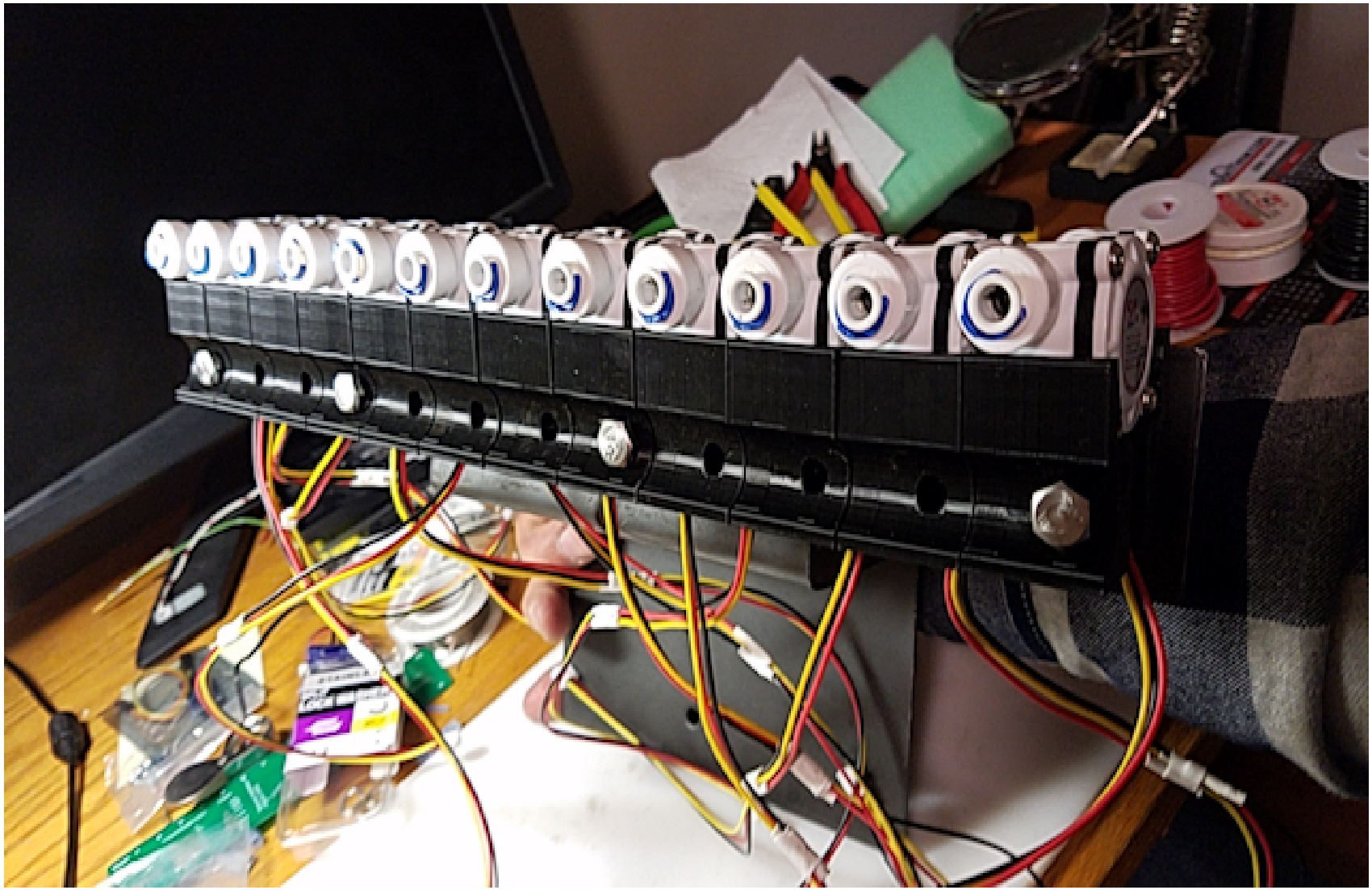
Free design software:

FreeCAD

Repetier Host

Ultimaker Cura

Download maker files at Thingiverse.com

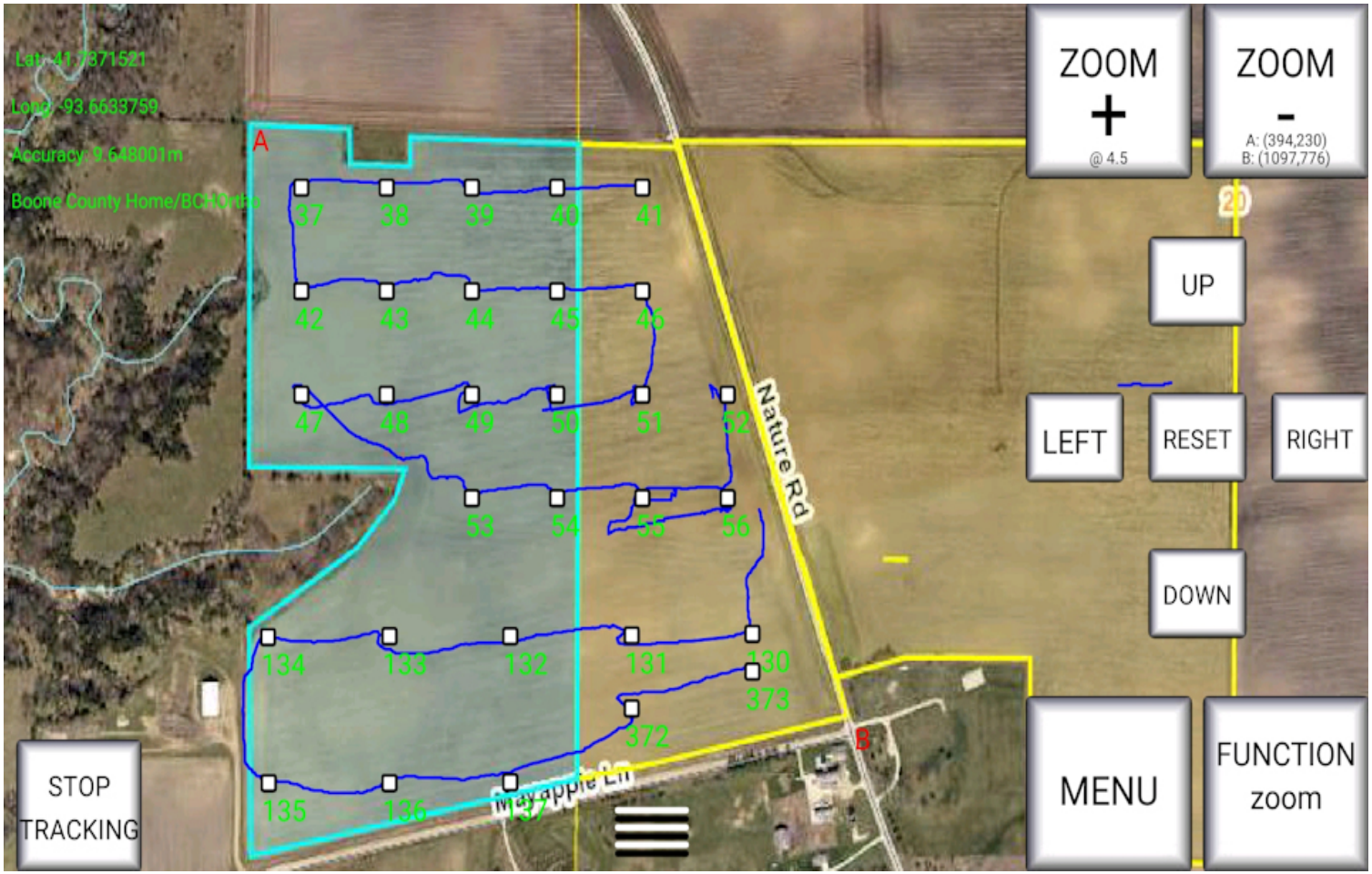


BENCO
039
OUTFARMING.COM (C) 2014-2018
Duo-Rate
REGULAR

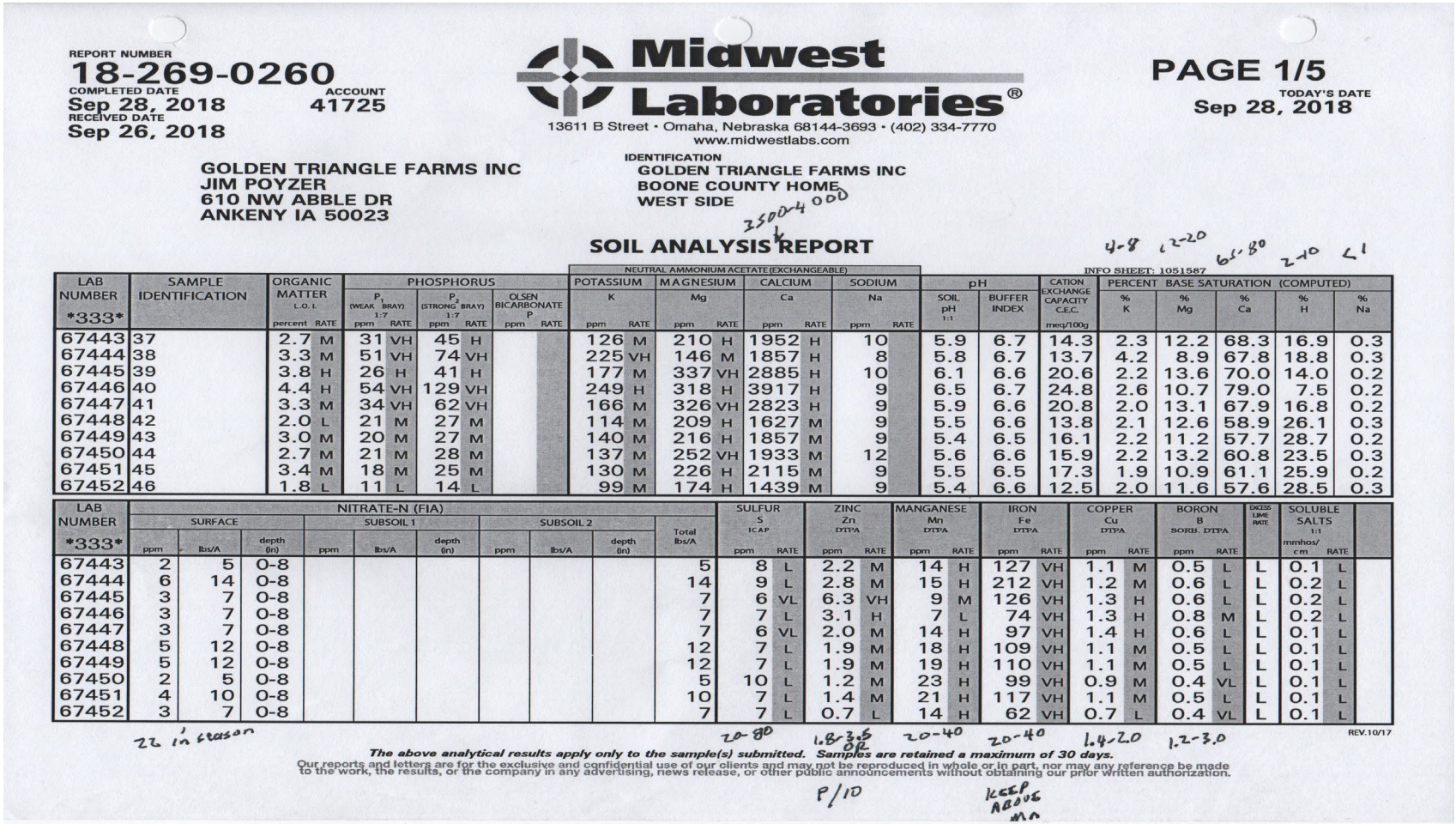
Timber soil and yield drive variable rate decisions

2019 West Side Yield Goals

App to locate soil sample spots



Soil Reports from Lab



REPORT NUMBER
18-269-0260
COMPLETED DATE
Sep 28, 2018
ACCOUNT
41725
RECEIVED DATE
Sep 26, 2018

Midwest Laboratories®
13611 B Street • Omaha, Nebraska 68144-3693 • (402) 334-7770
www.midwestlabs.com

PAGE 1/5
TODAY'S DATE
Sep 28, 2018

GOLDEN TRIANGLE FARMS INC
JIM POYZER
610 NW ABBLE DR
ANKENY IA 50023

IDENTIFICATION
GOLDEN TRIANGLE FARMS INC
BOONE COUNTY HOME
WEST SIDE

3500-4000

SOIL ANALYSIS REPORT

4-8 12-20 60-80 2-10 <1

INFO SHEET: 1051587

LAB NUMBER *333*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent RATE	PHOSPHORUS P1 (WEAK BRAY) 1:7 ppm RATE	PHOSPHORUS P2 (STRONG BRAY) 1:7 ppm RATE	OLSEN BICARBONATE P ppm RATE	NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE) POTASSIUM K ppm RATE	MAGNESIUM Mg ppm RATE	CALCIUM Ca ppm RATE	SODIUM Na ppm RATE	pH SOIL pH 1:1	pH BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
67443	37	2.7 M	31 VH	45 H		126 M	210 H	1952 H	10	5.9	6.7	14.3	2.3	12.2	68.3	16.9	0.3
67444	38	3.3 M	51 VH	74 VH		225 VH	146 M	1857 H	8	5.8	6.7	13.7	4.2	8.9	67.8	18.8	0.3
67445	39	3.8 H	26 H	41 H		177 M	337 VH	2885 H	10	6.1	6.6	20.6	2.2	13.6	70.0	14.0	0.2
67446	40	4.4 H	54 VH	129 VH		249 H	318 H	3917 H	9	6.5	6.7	24.8	2.6	10.7	79.0	7.5	0.2
67447	41	3.3 M	34 VH	62 VH		166 M	326 VH	2823 H	9	5.9	6.6	20.8	2.0	13.1	67.9	16.8	0.2
67448	42	2.0 L	21 M	27 M		114 M	209 H	1627 M	9	5.5	6.6	13.8	2.1	12.6	58.9	26.1	0.3
67449	43	3.0 M	20 M	27 M		140 M	216 H	1857 M	9	5.4	6.5	16.1	2.2	11.2	57.7	28.7	0.2
67450	44	2.7 M	21 M	28 M		137 M	252 VH	1933 M	12	5.6	6.6	15.9	2.2	13.2	60.8	23.5	0.3
67451	45	3.4 M	18 M	25 M		130 M	226 H	2115 M	9	5.5	6.5	17.3	1.9	10.9	61.1	25.9	0.2
67452	46	1.8 L	11 L	14 L		99 M	174 H	1439 M	9	5.4	6.6	12.5	2.0	11.6	57.6	28.5	0.3

LAB NUMBER *333*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm RATE	ZINC Zn DTPA ppm RATE	MANGANESE Mn DTPA ppm RATE	IRON Fe DTPA ppm RATE	COPPER Cu DTPA ppm RATE	BORON B SORB. DTPA ppm RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm RATE
67443	2	5	0-8							5	8 L	2.2 M	14 H	127 VH	1.1 M	0.5 L	L	0.1 L
67444	6	14	0-8							14	9 L	2.8 M	15 H	212 VH	1.2 M	0.6 L	L	0.2 L
67445	3	7	0-8							7	6 VL	6.3 VH	9 M	126 VH	1.3 H	0.6 L	L	0.2 L
67446	3	7	0-8							7	7 L	3.1 H	7 L	74 VH	1.3 H	0.8 M	L	0.2 L
67447	3	7	0-8							7	6 VL	2.0 M	14 H	97 VH	1.4 H	0.6 L	L	0.1 L
67448	5	12	0-8							12	7 L	1.9 M	18 H	109 VH	1.1 M	0.5 L	L	0.1 L
67449	5	12	0-8							12	7 L	1.9 M	19 H	110 VH	1.1 M	0.5 L	L	0.1 L
67450	2	5	0-8							5	10 L	1.2 M	23 H	99 VH	0.9 M	0.4 VL	L	0.1 L
67451	4	10	0-8							10	7 L	1.4 M	21 H	117 VH	1.1 M	0.5 L	L	0.1 L
67452	3	7	0-8							7	7 L	0.7 L	14 H	62 VH	0.7 L	0.4 VL	L	0.1 L

22 in season 20-80 1.8-3.5 OR 20-40 20-40 1.4-2.0 1.2-3.0

REV.10/17

The above analytical results apply only to the sample(s) submitted. Samples are retained a maximum of 30 days.

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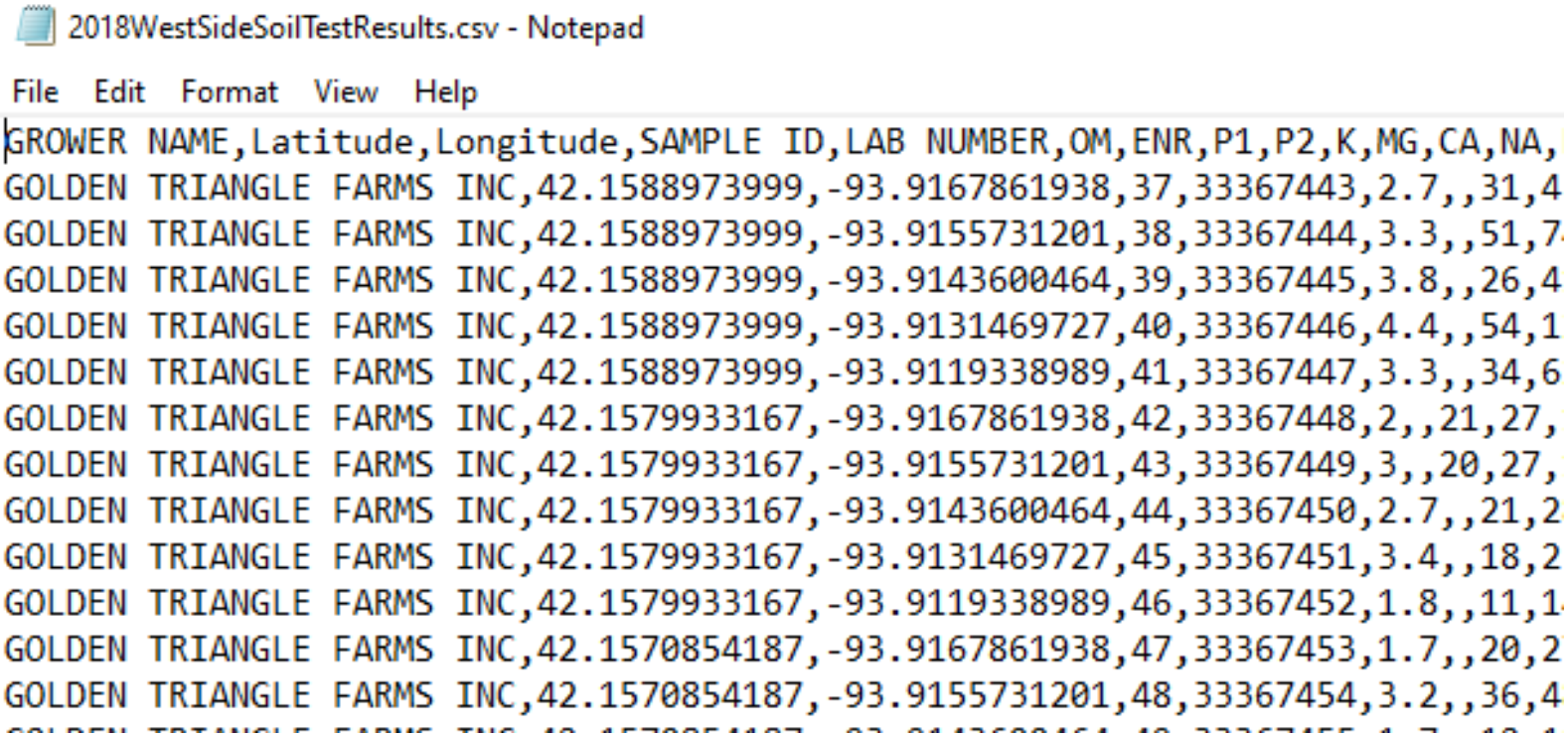
P/10 KEEP ABOVE #N

CSV = comma separated values file


2018WestSideSoilTestResults.csv - Notepad

File Edit Format View Help

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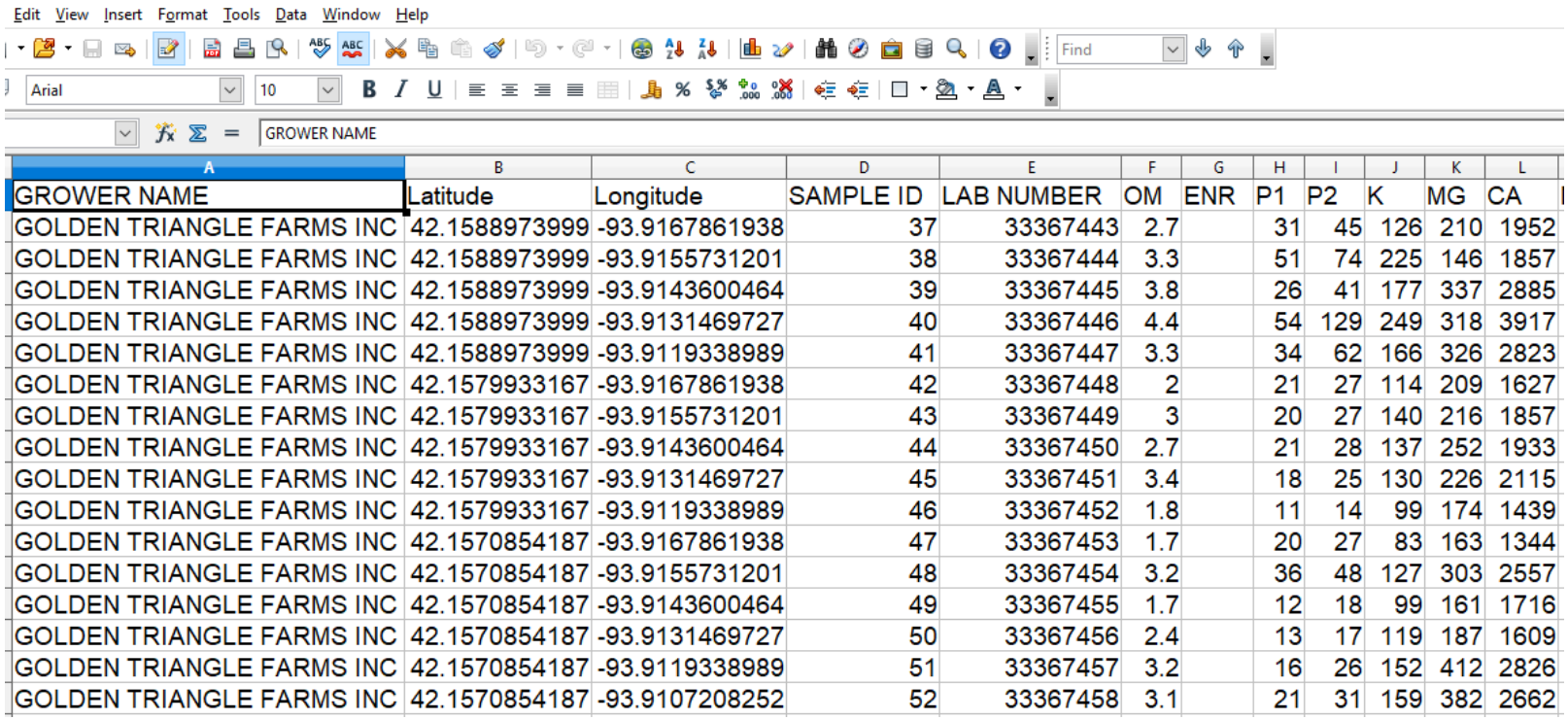
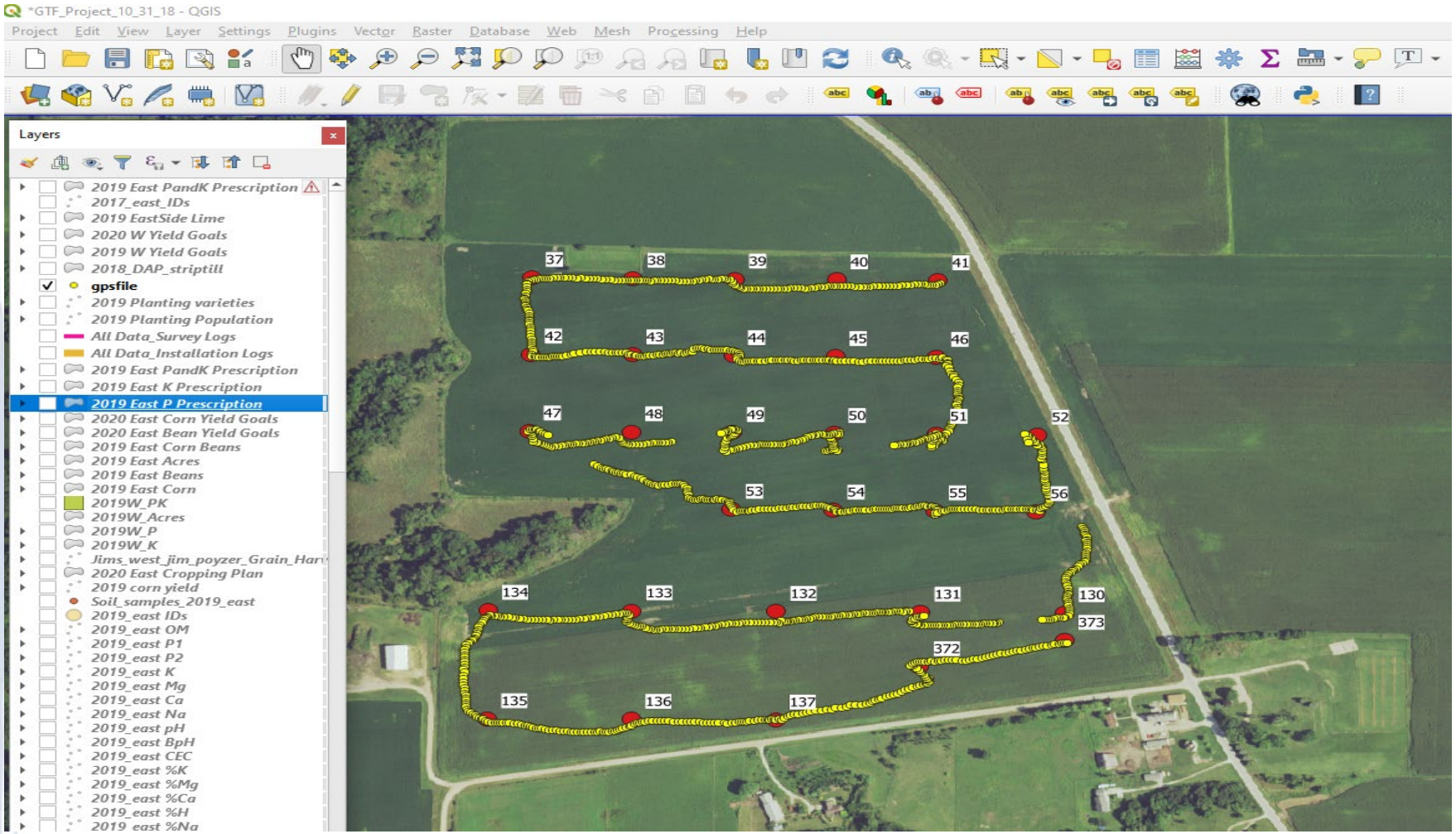
Open Office Spreadsheet (free)

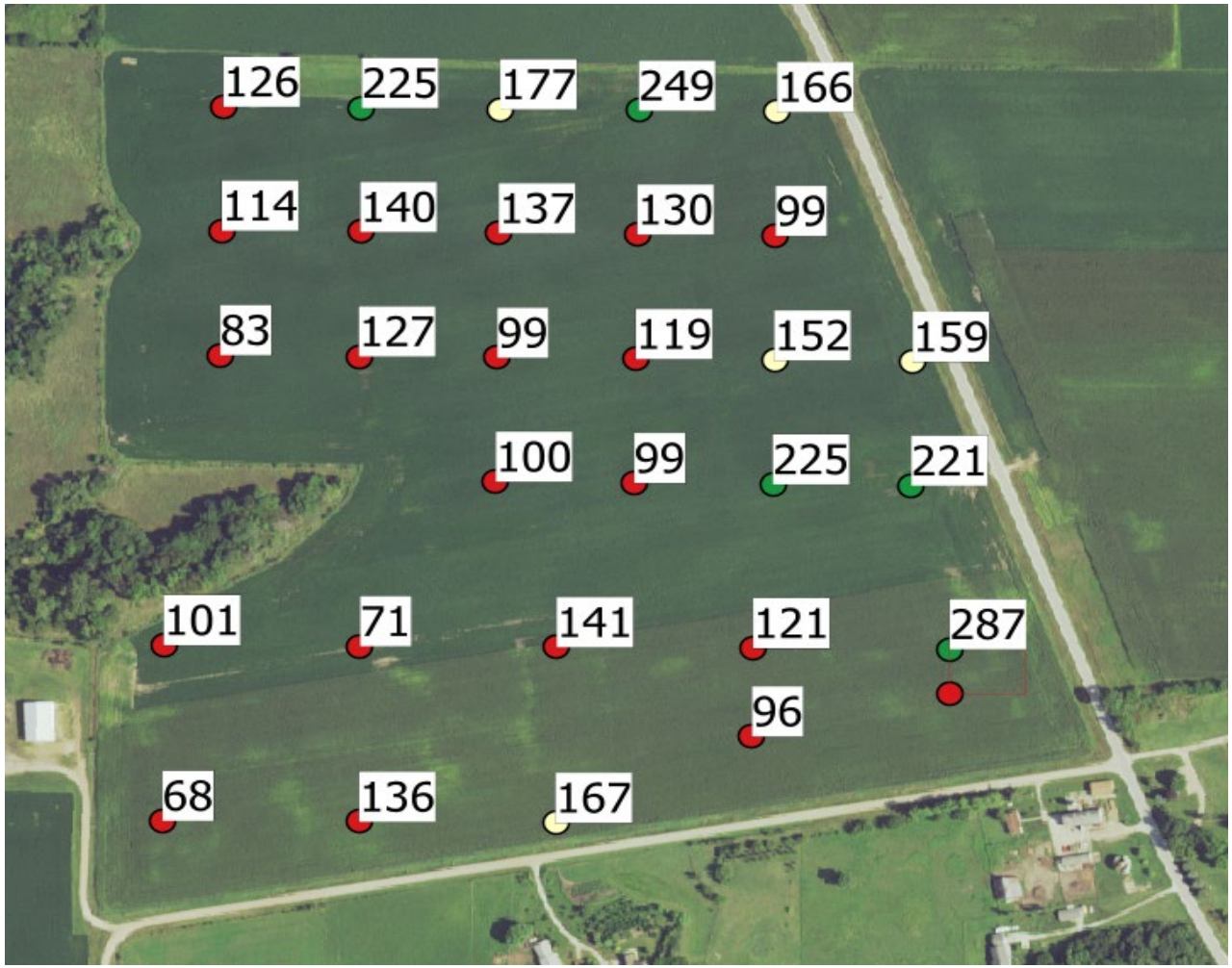


	A	B	C	D	E	F	G	H	I	J	K	L
	GROWER NAME	Latitude	Longitude	SAMPLE ID	LAB NUMBER	OM	ENR	P1	P2	K	MG	CA
	GOLDEN TRIANGLE FARMS INC	42.1588973999	-93.9167861938	37	33367443	2.7		31	45	126	210	1952
	GOLDEN TRIANGLE FARMS INC	42.1588973999	-93.9155731201	38	33367444	3.3		51	74	225	146	1857
	GOLDEN TRIANGLE FARMS INC	42.1588973999	-93.9143600464	39	33367445	3.8		26	41	177	337	2885
	GOLDEN TRIANGLE FARMS INC	42.1588973999	-93.9131469727	40	33367446	4.4		54	129	249	318	3917
	GOLDEN TRIANGLE FARMS INC	42.1588973999	-93.9119338989	41	33367447	3.3		34	62	166	326	2823
	GOLDEN TRIANGLE FARMS INC	42.1579933167	-93.9167861938	42	33367448	2		21	27	114	209	1627
	GOLDEN TRIANGLE FARMS INC	42.1579933167	-93.9155731201	43	33367449	3		20	27	140	216	1857
	GOLDEN TRIANGLE FARMS INC	42.1579933167	-93.9143600464	44	33367450	2.7		21	28	137	252	1933
	GOLDEN TRIANGLE FARMS INC	42.1579933167	-93.9131469727	45	33367451	3.4		18	25	130	226	2115
	GOLDEN TRIANGLE FARMS INC	42.1579933167	-93.9119338989	46	33367452	1.8		11	14	99	174	1439
	GOLDEN TRIANGLE FARMS INC	42.1570854187	-93.9167861938	47	33367453	1.7		20	27	83	163	1344
	GOLDEN TRIANGLE FARMS INC	42.1570854187	-93.9155731201	48	33367454	3.2		36	48	127	303	2557
	GOLDEN TRIANGLE FARMS INC	42.1570854187	-93.9143600464	49	33367455	1.7		12	18	99	161	1716
	GOLDEN TRIANGLE FARMS INC	42.1570854187	-93.9131469727	50	33367456	2.4		13	17	119	187	1609
	GOLDEN TRIANGLE FARMS INC	42.1570854187	-93.9119338989	51	33367457	3.2		16	26	152	412	2826
	GOLDEN TRIANGLE FARMS INC	42.1570854187	-93.9107208252	52	33367458	3.1		21	31	159	382	2662

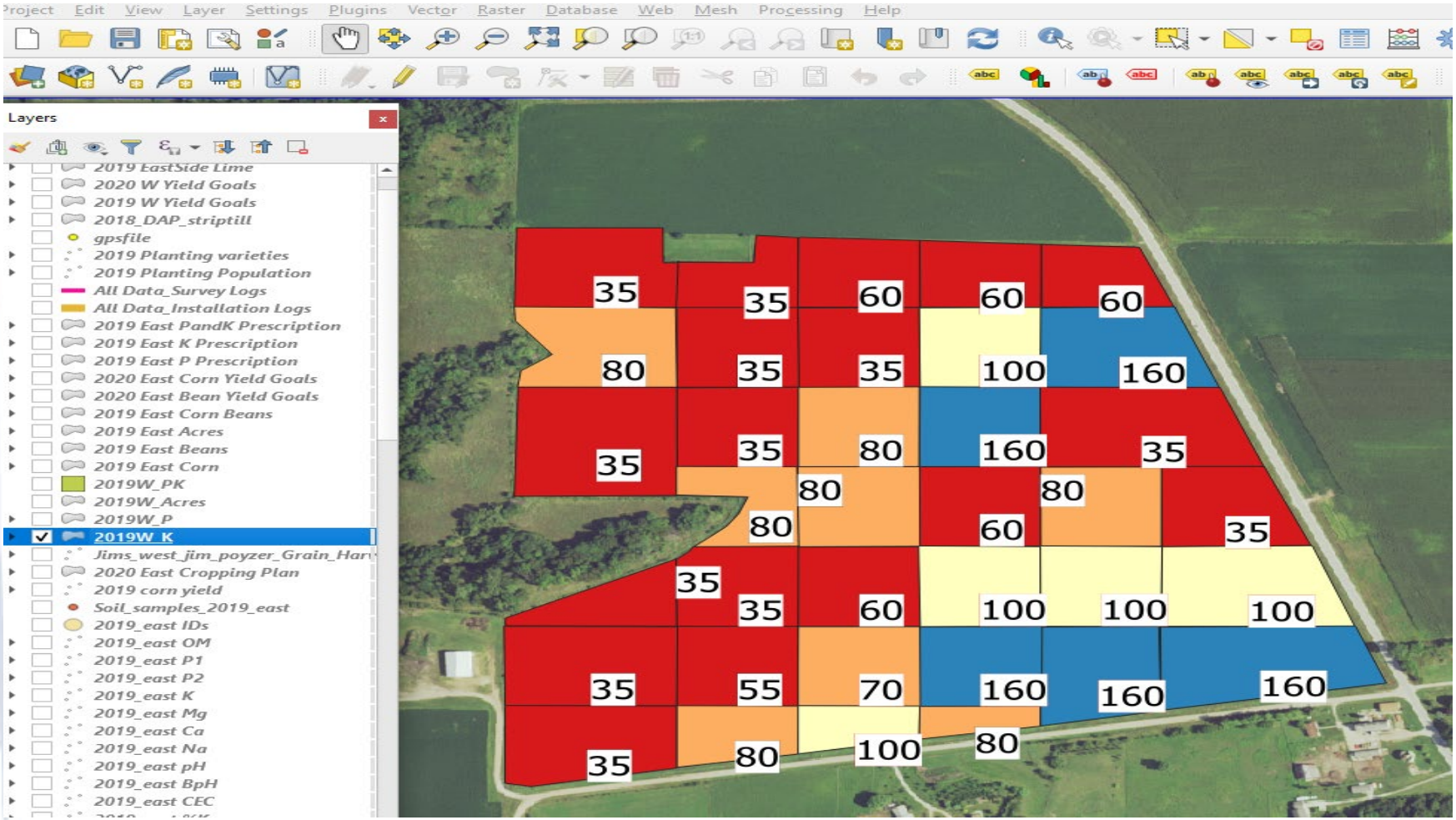
QGIS (free mapping software)



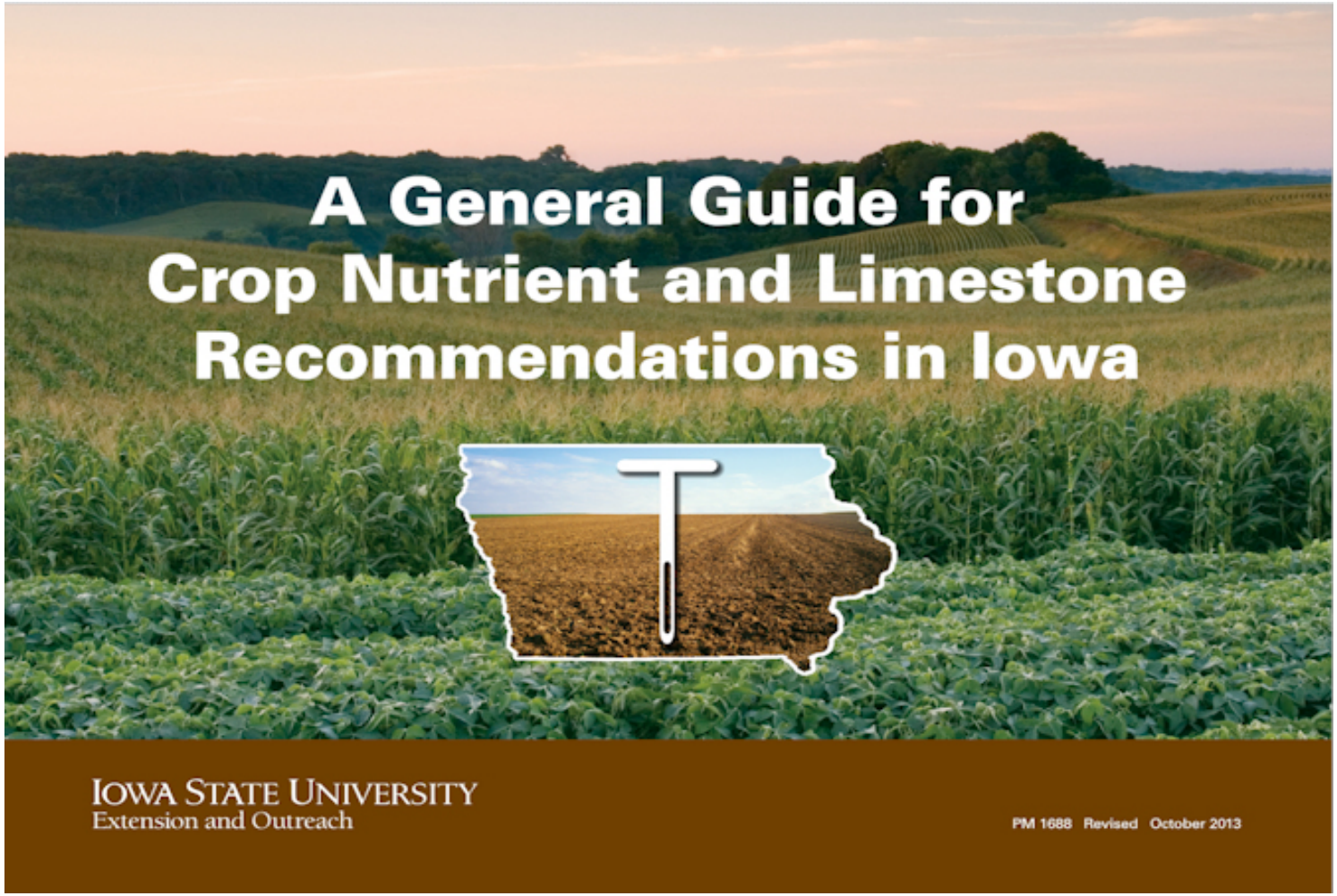
Mapping K(ppm)



Shape files for fertilizer application



Search Internet for this



Look at the fine print for Iowa pH

Table 15. Zinc recommendations for corn and sorghum production.

	Zinc Soil Test (ppm)		
Soil Test Category	Low	Marginal	Adequate
DTPA Extractable Zinc	0–0.4	0.5–0.8	0.9+
	Zinc to apply broadcast (pounds/acre)		
	10	5	0
	Zinc to apply in band (pounds/acre)*		
	2	1	0

*Recommendation for amount to apply in band is based on other states' information.

Recommendations are given to increase soil pH to 6.0, 6.5, or 6.9. Soil pH 6.9 is recommended for alfalfa or alfalfa-grass mixed hay is sufficient for other forage legumes or legume-grass corn and soybean, soil pH 6.5 is considered to be suf subsoil, but 6.0 is sufficient in areas with high-pH (ca a four-foot depth of the surface. General soil association ar hich include several soil associations) with low or high subsoil pH hav n summarized in Figure 1. The soil association areas with high pH subsoil Clarion-Nicollet-Webster, Galva-Primghar-Sac, Moody, Monona-Ida-Ham rg, Marshall, and Luton-Onawa-Salix. Therefore, when liming is required or corn or soybean, lime is recommended to raise soil pH to 6.5 for fields in soil association areas with low subsoil pH, and to 6.0 in association areas with high subsoil pH.

6.0 pH for 1/3 of Iowa

The amount of lime material to be applied should be adjusted for the incorporation depth from tillage, which determines the volume of soil to be neutralized. The recommended sampling depth for no-tillage, strip-tillage, haylands, or pastures is 2 to 3 inches. It is very important that the laboratory knows the sampling depth. Samples taken from a 6-inch depth for P and K testing can be used for lime requirement determination, but lime application rates should be adjusted to about one-half of the amounts recommended for a 6-inch depth. A footnote in Table 16 shows the equations derived from calibration data used to calculate the amounts of $CaCO_3$ needed to raise soil pH to desired levels.

Table 16. Lime recommendations based on SMP or Sikora buffer pH methods, given in pounds per acre of finely ground pure calcium carbonate ($CaCO_3$) to increase soil pH from its present level to pH 6.0, 6.5, or 6.9 for the soil depth to be neutralized.†

	Depth of Soil to be Neutralized								
	2 inches			3 inches			6 inches		
	Target Soil pH								
Buffer pH	pH 6.0	pH 6.5	pH 6.9	pH 6.0	pH 6.5	pH 6.9	pH 6.0	pH 6.5	pH 6.9
	Amount of Calcium Carbonate to Apply (pounds/acre) ‡								
7.0	0	0	400	0	0	600	0	0	1,100
6.9	0	0	600	0	0	1,000	0	0	1,900
6.8	0	200	900	0	300	1,400	0	600	2,700
6.7	0	400	1,200	0	700	1,800	0	1,300	3,500
6.6	0	700	1,500	0	1,100	2,200	0	2,100	4,400
6.5	100	900	1,700	100	1,400	2,600	200	2,800	5,200
6.4	300	1,200	2,000	400	1,800	3,000	800	3,500	6,000
6.3	500	1,400	2,300	700	2,100	3,400	1400	4,200	6,800
6.2	700	1,700	2,600	1000	2,500	3,900	2000	5,000	7,700
6.1	900	1,900	2,800	1300	2,900	4,300	2500	5,700	8,500
6.0	1000	2,200	3,100	1600	3,200	4,700	3100	6,400	9,300
5.9	1200	2,400	3,400	1900	3,600	5,100	3700	7,100	10,100
5.8	1400	2,600	3,700	2200	4,000	5,500	4300	7,900	11,000
5.7	1600	2,900	3,900	2500	4,300	5,900	4900	8,600	11,800

† For corn and soybean, soil pH 6.5 is recommended in soil association areas without calcareous subsoil and soil pH 6.0 is recommended in areas with calcareous subsoil (see text and Figure 1). Soil pH 6.9 is recommended for alfalfa and alfalfa-grass mixtures in all soil association areas. Soil pH 6.0 is recommended for other forage legumes or legume-grass mixtures and grasses in all association areas.

‡ Amounts were derived from the following calibration equations and rounded to 100 pounds:
Pounds of $CaCO_3$ to raise pH to 6.0 = [38619 - (5915 x Buffer pH)] x [Depth x 0.167]
Pounds of $CaCO_3$ to raise pH to 6.5 = [49886 - (7245 x Buffer pH)] x [Depth x 0.167]
Pounds of $CaCO_3$ to raise pH to 6.9 = [58776 - (8244 x Buffer pH)] x [Depth x 0.167]

CNW, GPS, Mo,MIH,M,LOS area lime to 6.0 pH

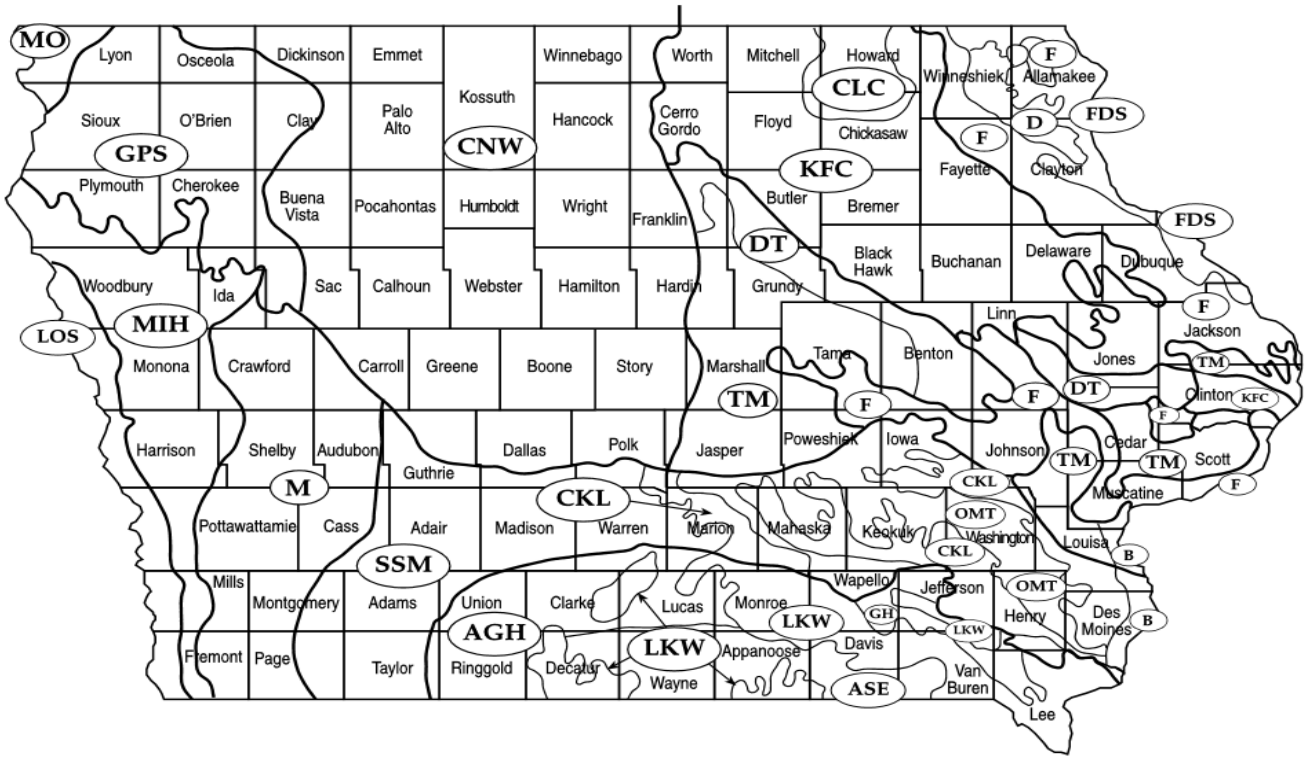


Figure 1. Map of Iowa delineating the 21 principal soil association areas (letters). B designates the Mississippi bottomland.

AGH:	Adair-Grundy-Haig	DT:	Dinsdale-Tama	KFC:	Kenyon-Floyd-Clyde	Mo:	Moody
ASE:	Adair-Seymour-Edina	F:	Fayette	LKW:	Lindley-Keswick-Weller	OMT:	Otley-Mahaska-Taintor
CKL:	Clinton-Keswick-Lindley	FDS:	Fayette-Dubuque-Stonyland	LOS:	Luton-Onawa-Salix	SSM:	Shelby-Sharpsburg-Macksburg
CLC:	Cresco-Lourdes-Clyde	GPS:	Galva-Primghar-Sac	M:	Marshall	TM:	Tama-Muscatine
CNW:	Clarion-Nicollet-Webster	GH:	Grundy-Haig	MIH:	Monona-Ida-Hamburg		
D:	Downs						

Resources

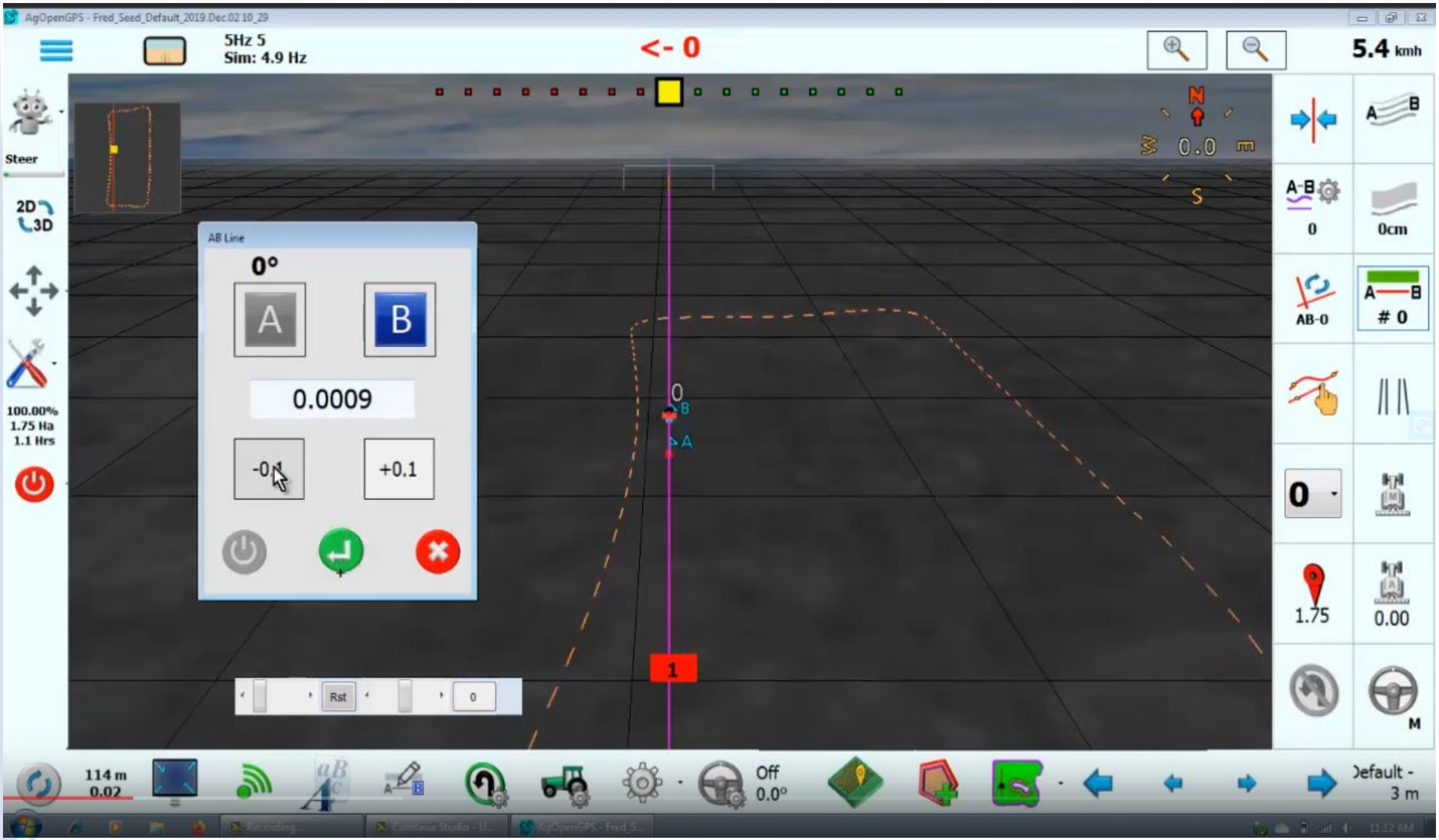
- Adafruit.com (hobby boards & Arduino, parts, example code)
- Sparkfun.com (hobby boards, parts, example code)
- YouTube.com (FarmerBrianTee, AgOpenGPS;)
- Element14.com (instruction on programming the Arduino)
- Arduino.cc (microprocessors, programming language, examples)
- Processing.org (programming for Windows tablet or Android)
- Digikey.com (many electronics parts)
- outFARMING.com (my website)
- Openoffice.org (spreadsheet) QGIS.org (mapping)
- Creality Ender 3 (3D printer) FreeCAD

Free Soils Clinic – Jan. 30, 2020

What others are doing

- Variable rate planting: Duo-Rate device
- FarmerBrianTee – AgOpenGPS search YouTube.
- Kyler Laird – driverless tractors planted corn in Sac City, IA in 2019. Robotic soil sampling with a go kart.
- Yield monitor: DIY'er went production. FarmTRX – $1,849
- Pioneer's yield estimator app
- Purdue University agBOT

AgOpenGPS open source autosteer



Driverless Planting in Iowa 2019
Kyler Laird

FarmTRX yield monitor - $1,849

Yield Estimating using Pioneer app

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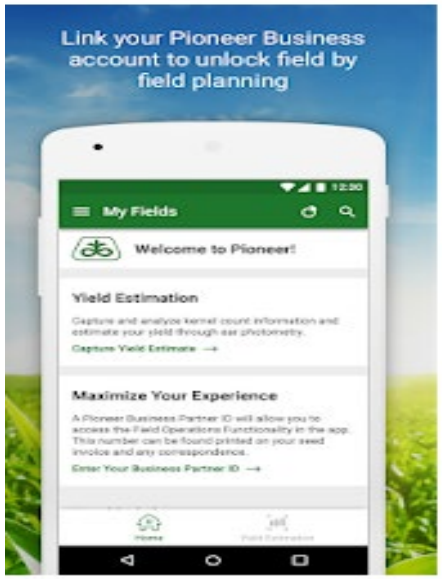
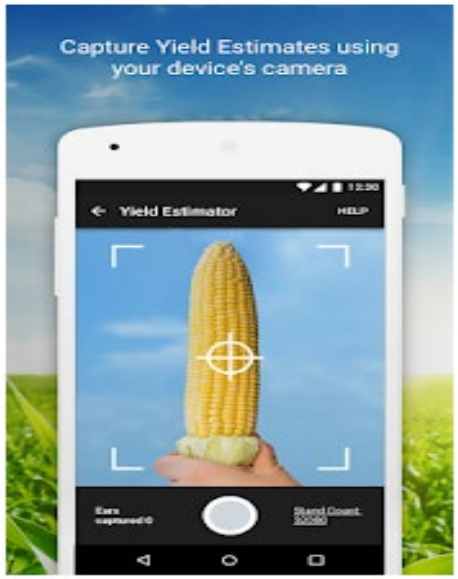
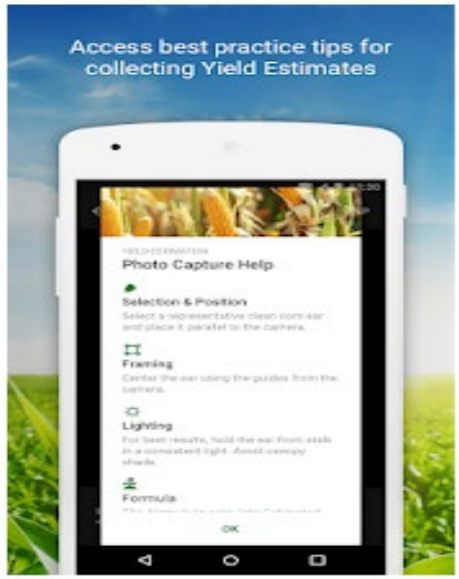
E **Everyone**

This app is compatible with some of your devices.





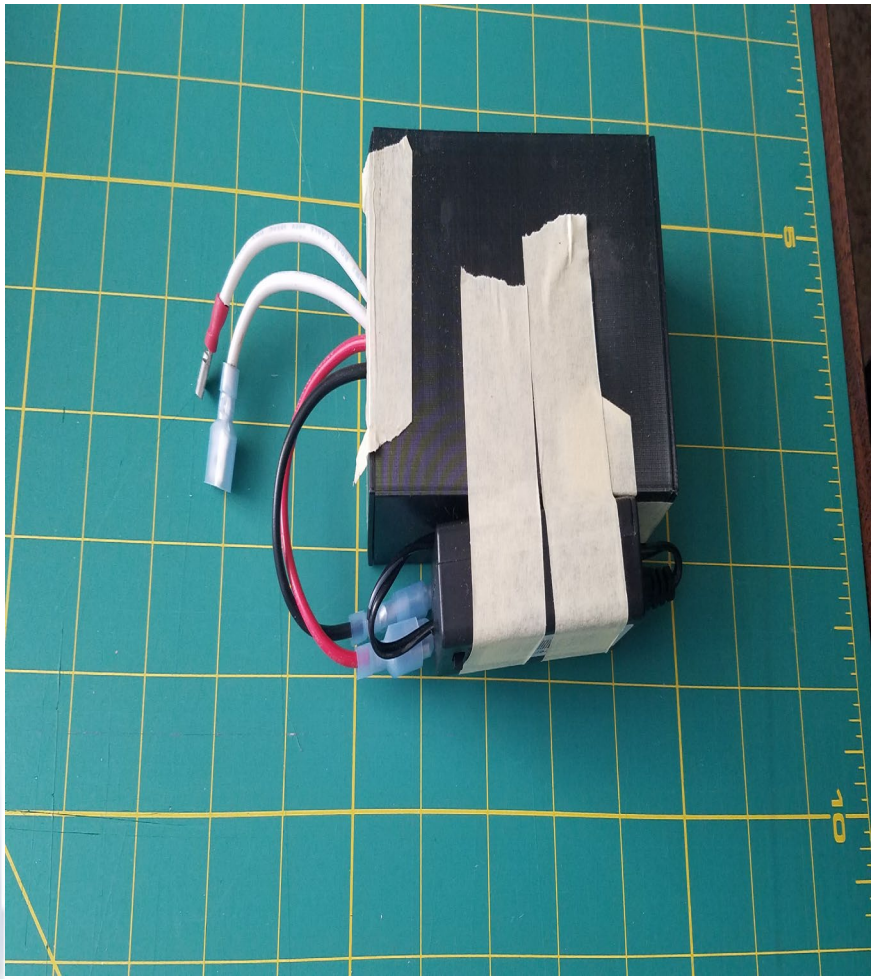


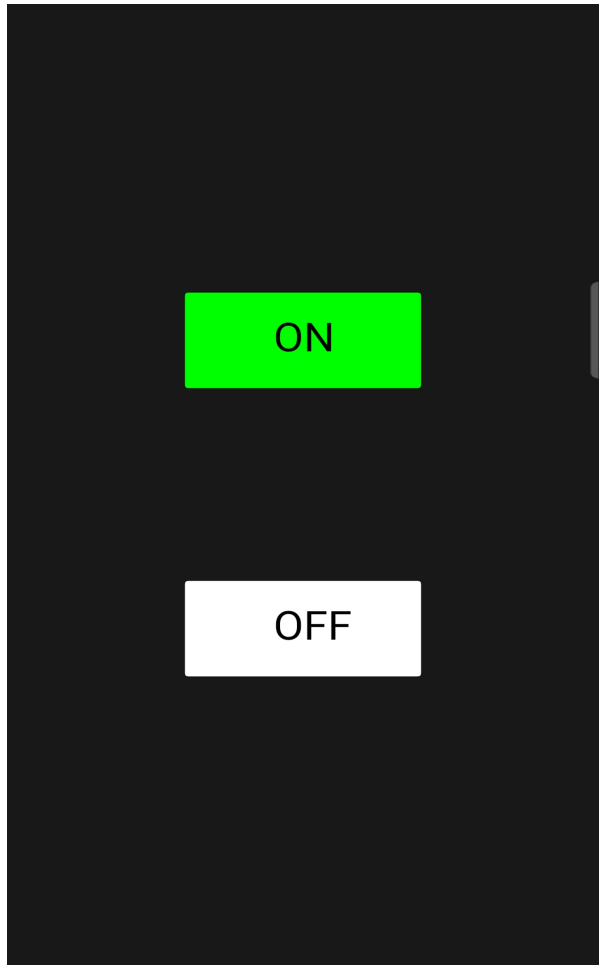
Seed Counter for accurate yield estimates & app on my website

Purdue University agBOT weeder

Cameras, artificial intelligence, 4 chemical sprayer, rototillers

Other gadgets: Remote on/off switch

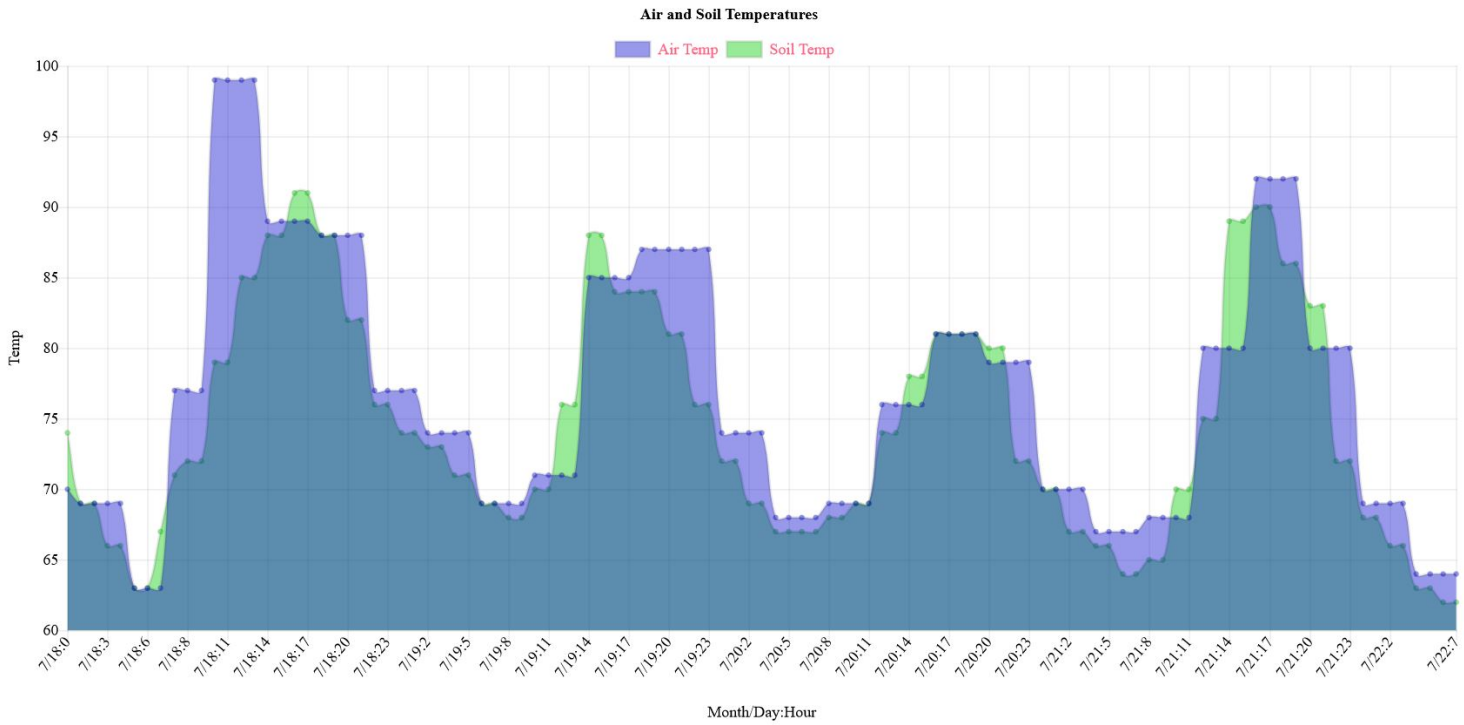




RTK base and rover for Autosteer - $600

Soil temp and moisture sensors powered by solar cell

Graphing air and soil temps for planting



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