Irrigation Systems Evaluation and Management

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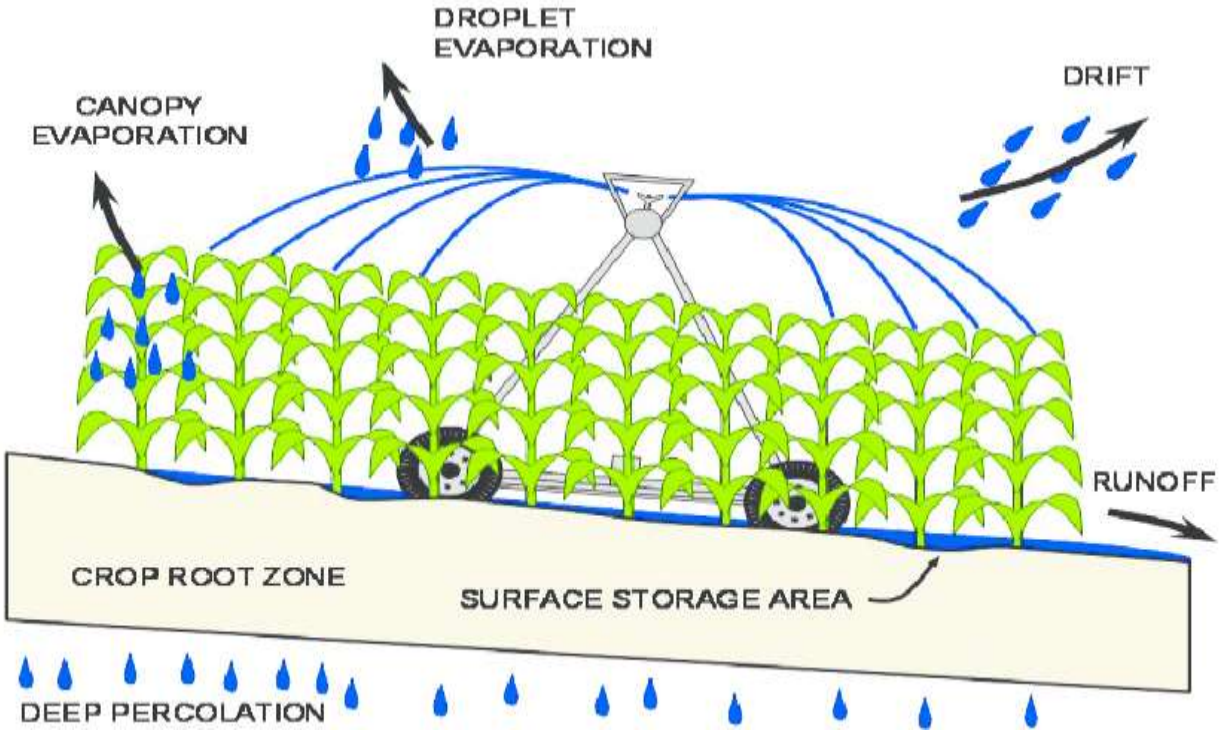
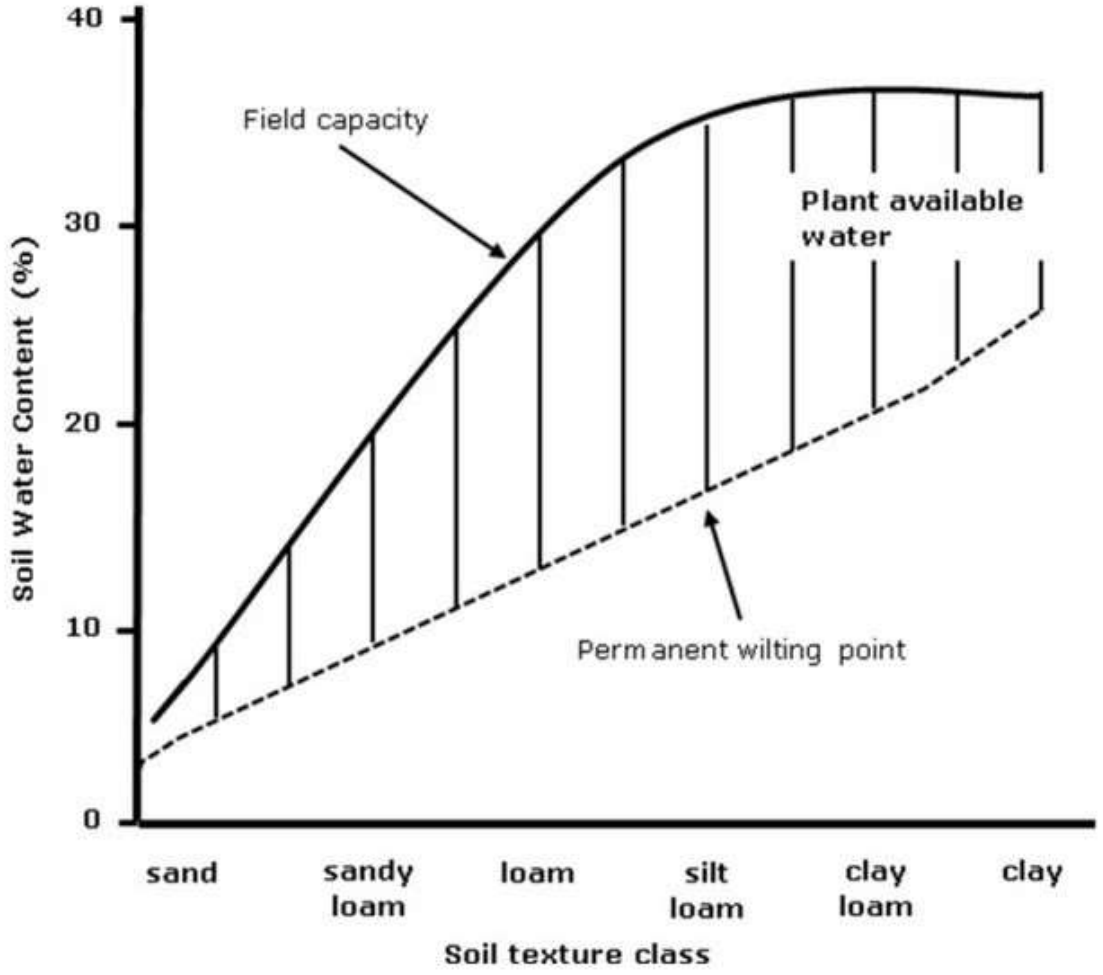
Irrigation Efficiency

is the ratio of the amount of water consumed by the crop to the amount of water supplied through irrigation



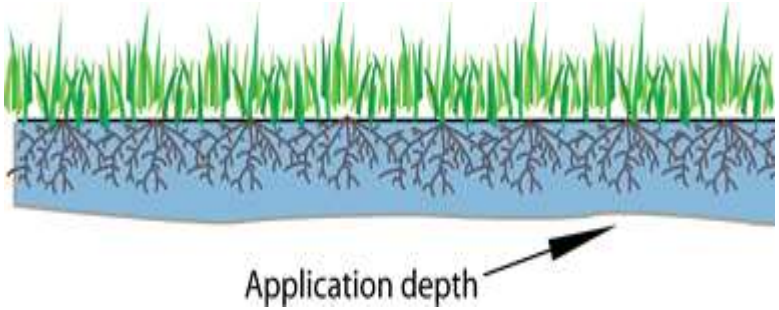
(Source: Addink, J. W., et al. "Design and operation of sprinkler systems." Design and operation of sprinkler systems.)

Field Capacity and Wilting Point

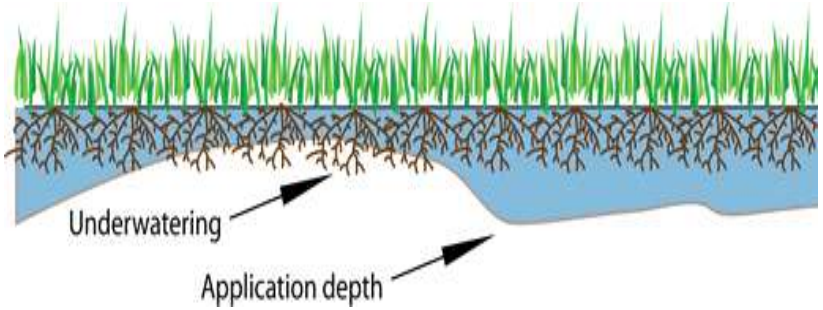


Distribution Uniformity (DU)

- To determine the rate that water is being applied, and how uniformly that water is being distributed. To check these you need to know DU which is the measure of how uniformly the water is applied



Good DU



Poor DU

Equipment needed

Catch can with a hook

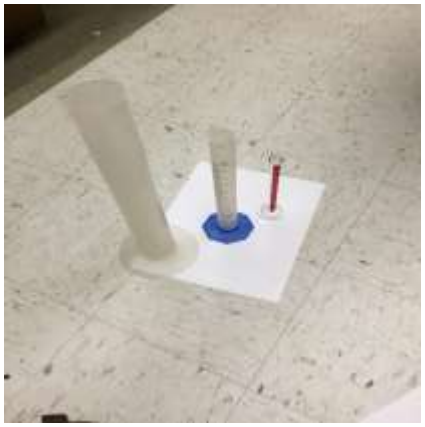
Stopwatch

Sprinkler Flowrate

Measuring Tape

Equipment needed

Flags



Graduate Cylinder

Pressure gauge

1-Hand Move and Side Roll System

Field Record Sheet

Name	Rod Rottinhavse	**Crop**	grass	**Observer**	Moneim	**Date**	8/16/2017	**Supervisor**	**Dr. Troy Peters**
Location	N Rothrock Rd	46.241964, -119.707506					**Evaporation Bucket:**		
Soil Texture	Silt Loam	**Sprinkler model**	Rainbird						
Sprinkler spacing along sprayline		40 ft		**Start Time**	9:00				
Sprinkler make	Rainbird	**Number of sprinklers**	17	**Finish Time**	12:43				
Nozzle Size	different size			**Test Duration**	1 hour				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National Resources Conservation Service
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Browse by Subject
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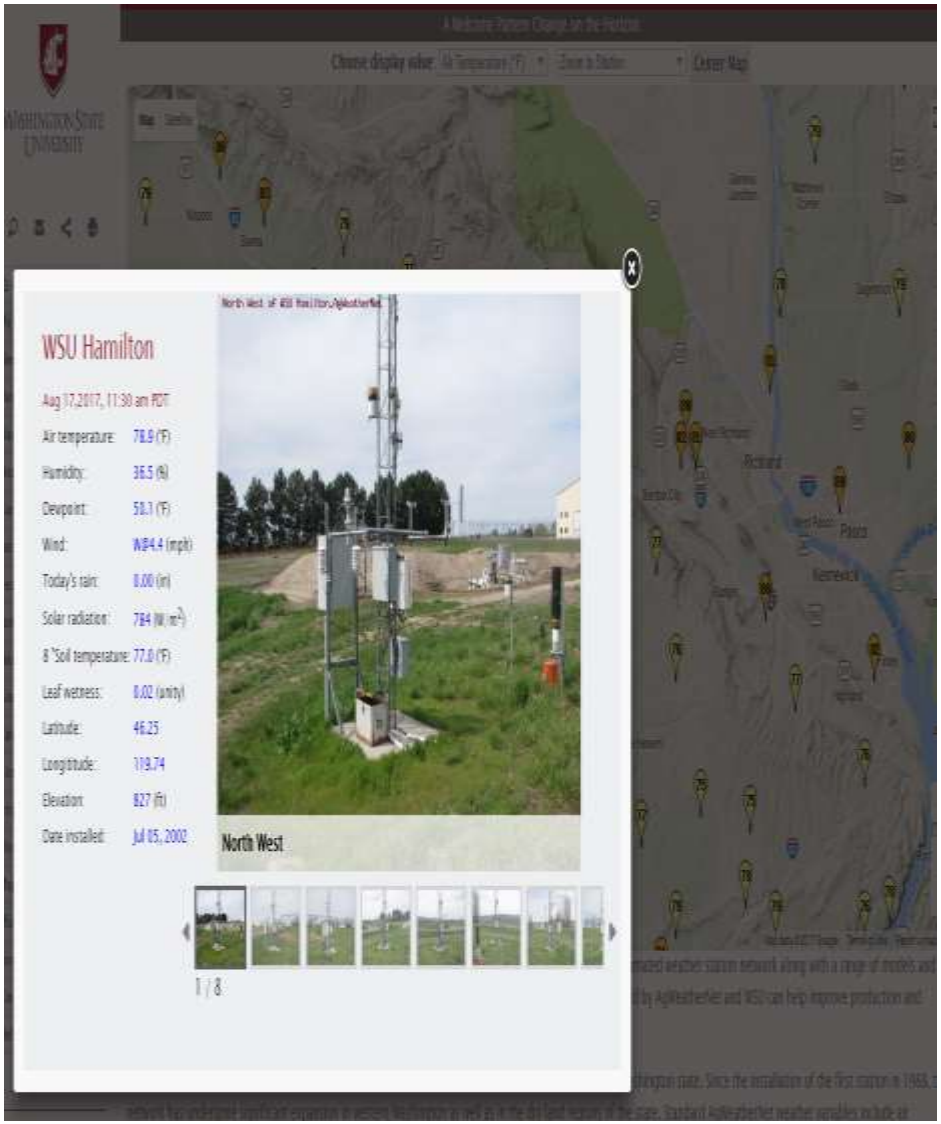
Archived Soil Surveys
Status Maps
Official Soil Series Descriptions (OSD)
Soil Series Extent Mapping Tool
Geospatial Data Gateway
eFOTG
National Soil Characterization Data
Soil Health
Soil Geography
The simple yet powerful way to access and use soil data.
START WSS
Welcome to Web Soil Survey (WSS)
Web Soil Survey (WSS) provides soil data and information produced by the National Cooperative Soil Survey. It is operated by the USDA Natural Resources Conservation Service (NRCS) and provides access to the largest natural resource information system in the world. NRCS has soil maps and data available online for more than 95 percent of the nation's counties and anticipates having 100 percent in the near future. The site is updated and maintained online as the single authoritative source of soil survey information.
Soil surveys can be used for general farm, local, and wider area planning. Onsite investigation is needed in some cases, such as soil quality assessments and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center or your NRCS State Soil Scientist.
Four Basic Steps
1 Define
Area of Interest (AOI)
Use the Area of Interest tab to define your area of interest.
Click to view larger image.
2 View
Soil Map
Click the Soil Map tab to view or print a soil map, and detailed descriptions of the soils in your Area of Interest.
I Want To...
Start Web Soil Survey (WSS)
Know the requirements for running Web Soil Survey -- will Web Soil Survey work in my web browser?
Know the Web Soil Survey hours of operation
Find what areas of the U.S. have soil data
Find information by topic
Know how to hyperlink from other documents to Web Soil Survey
Know the SSURGO data structure
Announcements/Events
Web Soil Survey 3.2 has been released! View description of new features and fixes.
Web Soil Survey Release History
Sign up for e-mail updates via GovDelivery
I Want Help With...
Getting Started With Web Soil Survey
How to use Web Soil Survey
How to use Web Soil Survey Online Help
Known Problems and Workarounds
Frequently Asked Questions
Citing Web Soil Survey as a source of soils data
Tips & Shortcuts
WSS

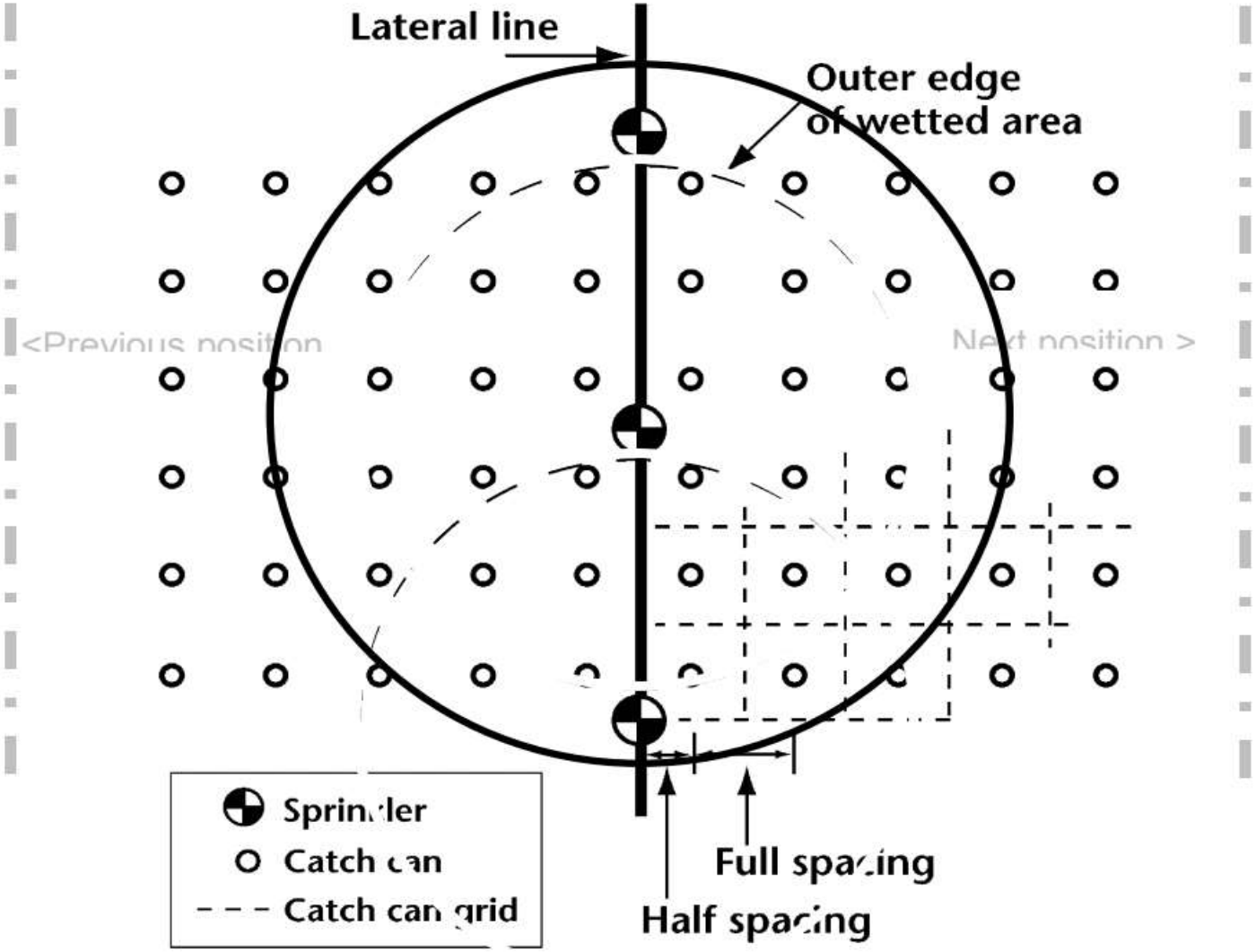

WSU Hamilton
Aug 17,2017, 11:30 am PDT
Air temperature: 78.9 (°F)
Humidity: 36.5 (%)
Dewpoint: 50.1 (°F)
Wind: W@4.4 (mph)
Today's rain: 0.00 (in)
Solar radiation: 784 (W/m²)
8 "Soil temperature: 77.0 (°F)
Leaf wetness: 0.02 (unity)
Latitude: 46.25
Longitude: 119.74
Elevation: 827 (ft)
Date installed: Jul 05, 2002
North West
1 / 8

Hand Move and Side Roll System

Pressure and Flow record sheet

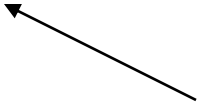
	Pressure and Flow				
	1st sprinkler	1st mid-position	2nd mid-position	last sprinkler	
Pressure (psi)	38	38	38	39	
Container volume	5	5	5	5	gal
Catch time (min)	1.08	1.08	1.2	1.19	min
Calculated flow rate (gal/min)	4.63	4.63	4.17	4.20	gal/min

Catch Can Layout



Catch Can Record Sheet (ml)

	Left Side							Right Side					
Can	6	5	4	3	2	1		1	2	3	4	5	6
Distance from Center	-55	-45	-35	-25	-15	-5		5	15	25	35	45	55
Row 1	0	0	10	23	39	52		67	47	40	25	4	0
Row 2	0	0	8	31	53	58		60	51	48	30	5	0
Row 3	0	0	2	35	50	56		54	48	45	38	9	0
Row 4	0	0	2	27	36	43		46	41	37	31	12	0
Row 5	0	0	4	29	29	31		41	30	28	24	12	0
Row 6	0	0	2	30	44	48		39	35	36	30	12	0
Row 7	0	0	1	30	51	48		32	41	43	37	10	0
Row 8	0	0	2	27	34	46		19	39	34	28	12	0
Row 9	0	0	5	26	25	40		103	36	24	18	14	0



Wind direction

Converting ml to mm (application depth)

Overlapping

Order to get the low quarter Lq

$$DU = \frac{Average\ of\ low\ quarter}{Average\ of\ all} \times 100$$

Converting mL to mm

Diameter of catch can (mm)	Figure to divide the collected amount by
75	4.4
80	5.0
90	6.4
100	7.9
102	8.2
104	8.5
106	8.8
108	9.2
110	9.5
112	9.9
113	10.0
114	10.2
115	10.4
120	11.3
125	12.25
145	16.5
165	21.3
200	31.4
220	38.0

2- Big gun

Travel speed + wetted diameter + space between each run

BIG GUN® PERFORMANCE (U.S. UNITS)

Flow and diameter (feet) information at various pressures with different nozzle sizes. (See information at bottom of page 11.)

75 TAPER RING NOZZLE — 24° TRAJECTORY

PSI	0.4"		0.45"		0.5"		0.55"		0.6"		0.65"		0.7"		0.75"		0.8"	
	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT
25*	—	—	—	—	—	—	42	146	50	155	59	161	69	167	80	174	91	182
30*	—	—	—	—	37	158	45	158	55	165	64	172	75	182	87	187	99	192
35	—	—	32	154	40	164	49	172	59	178	69	191	81	196	93	202	106	208
40	27	149	35	160	43	171	52	180	63	190	74	198	87	204	98	213	112	221
45	29	155	37	167	46	180	56	189	67	198	79	206	91	214	104	223	118	230
50	30	161	39	174	48	186	59	195	70	203	83	212	95	220	109	230	123	237
55	32	165	41	179	50	193	62	203	74	213	87	221	100	230	115	239	130	247
60	33	169	42	184	53	198	64	208	77	220	91	228	104	237	120	245	136	254
65	35	172	44	189	55	205	67	216	80	227	95	237	109	247	125	254	142	263
70	36	175	45	194	57	210	69	221	83	232	98	243	113	254	129	260	147	270
75	37	179	47	201	59	217	72	228	86	239	101	250	117	261	134	268	153	277
80	39	182	49	207	61	222	74	234	89	244	105	256	121	266	138	274	158	283

*Operating at pressures above 30 PSI provides better performance.

100 TAPER BORE NOZZLE — 24° TRAJECTORY

PSI	0.5"		0.55"		0.6"		0.65"		0.7"		0.75"		0.8"		0.85"		0.9"		1.0"	
	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT
40	47	191	57	202	66	213	78	222	91	230	103	240	118	250	134	256	152	262	—	—
50	50	205	64	215	74	225	87	235	100	245	115	256	130	265	150	273	165	280	204	300
60	55	215	69	227	81	240	96	250	110	260	126	270	143	280	164	288	182	295	224	316
70	60	225	75	238	88	250	103	263	120	275	136	283	155	295	177	302	197	310	243	338
80	64	235	79	248	94	260	110	273	128	285	146	295	165	305	189	314	210	325	258	354
90	68	245	83	258	100	270	117	283	135	295	155	306	175	315	201	326	223	335	274	362
100	72	255	87	268	106	280	123	293	143	305	163	316	185	325	212	336	235	345	289	372
110	76	265	92	278	111	290	129	303	150	315	171	324	195	335	222	344	247	355	304	380

150 TAPER BORE NOZZLE — 24° TRAJECTORY

PSI	0.7"		0.8"		0.9"		1.0"		1.1"		1.2"		1.3"		1.4"	
	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT
50	100	250	130	270	165	290	205	310	255	330	300	345	350	360	408	373
60	110	265	143	285	182	305	225	325	275	345	330	365	385	380	446	396
70	120	280	155	300	197	320	245	340	295	360	355	380	415	395	483	412
80	128	290	165	310	210	335	260	355	315	375	380	395	445	410	516	427
90	135	300	175	320	223	345	275	365	335	390	405	410	475	425	547	442
100	143	310	185	330	235	355	290	375	355	400	425	420	500	440	577	458
110	150	320	195	340	247	365	305	385	370	410	445	430	525	450	605	471
120	157	330	204	350	258	375	320	395	385	420	465	440	545	460	632	481

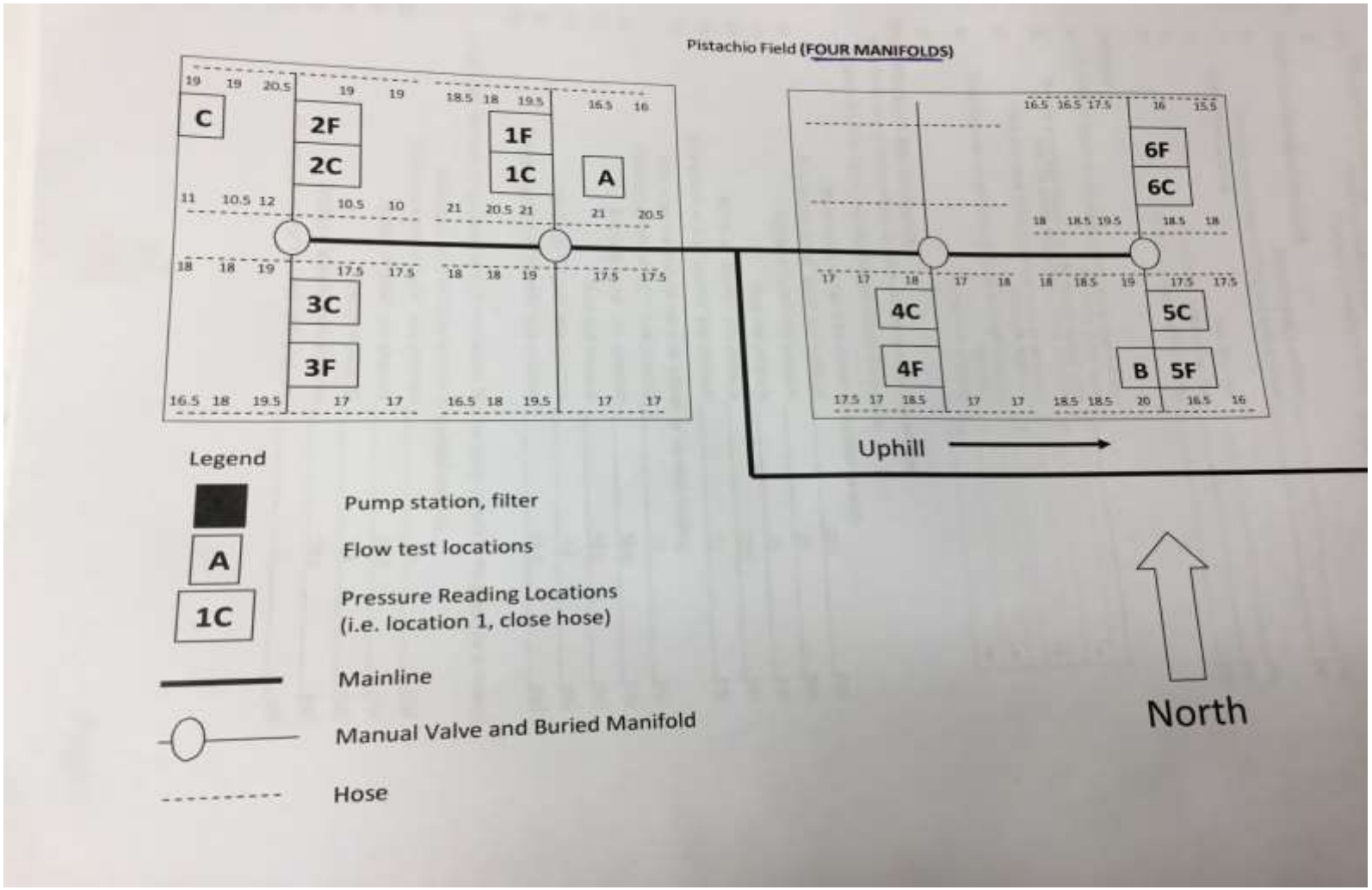
200 TAPER BORE NOZZLE — 27° TRAJECTORY

PSI	1.05"		1.1"		1.2"		1.3"		1.4"		1.5"		1.6"		1.75"		1.9"	
	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT	GPM	DIAM. FT
60	250	345	285	355	330	375	385	390	445	410	515	430	585	445	695	470	825	495
70	270	360	310	380	355	395	415	410	480	430	555	450	630	465	755	495	890	515
80	290	375	330	395	380	410	445	430	515	450	590	470	675	485	805	515	950	535
90	310	390	350	410	405	425	475	445	545	465	625	485	715	505	855	535	1005	555
100	325	400	370	420	425	440	500	460	575	480	660	500	755	520	900	550	1060	575
110	340	410	390	430	445	450	525	470	605	495	695	515	790	535	945	565	1110	590
120	355	420	405	440	465	460	545	480	630	505	725	530	825	550	985	580	1160	605
130	370	425	425	445	485	465	565	485	655	515	755	540	860	560	1025	590	1210	620

Measuring the flowrate to get the efficiency

3- Drip and Micro sprinkler irrigation

3- Drip and Micro sprinkler irrigation



Maintain the system efficiency

For the **Big gun** depends on your situation:
Consider:

- increasing travel speed
- changing the lane spacing
- changing nozzle size and type, and pressure
- changing irrigation time to eliminate the wind effect

Side Roll and hand shift system

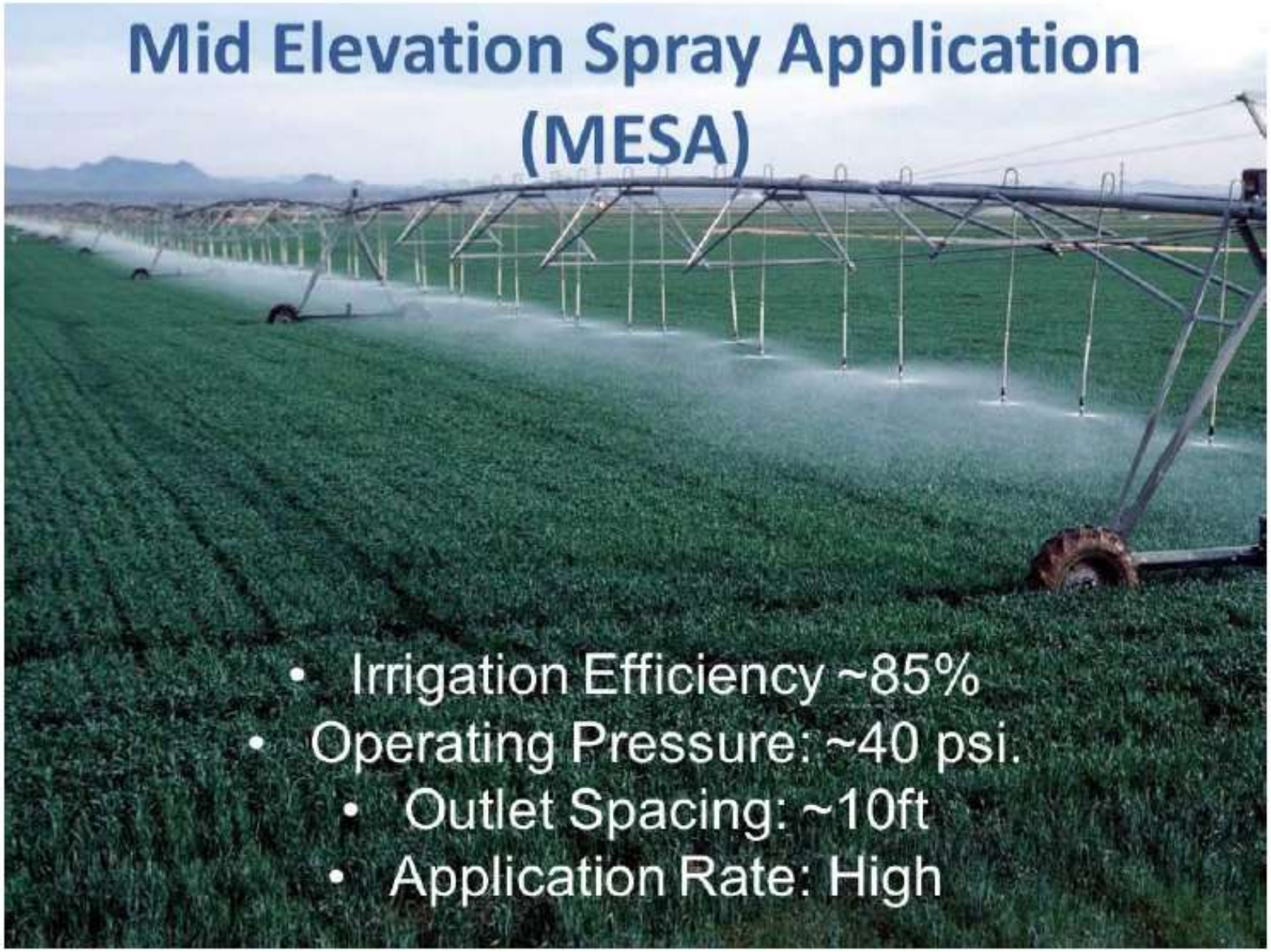
Drip system and Micro sprinklers

Pressure Problems
(lack of pressure regulators)

Flow variation
(hose leaks, emitter plugging)

- Flush lines monthly
- Clean and maintain filters
- Keep application rates less than infiltration rates
- Irrigate at night Less heat & less wind
- If the field has pressure/flow problems, install pressure compensating sprinklers and emitters
- Irrigate longer sets less often (minimize evaporation loss)

Mid Elevation Spray Application (MESA)



- Irrigation Efficiency ~85%
- Operating Pressure: ~40 psi.
- Outlet Spacing: ~10ft
- Application Rate: High

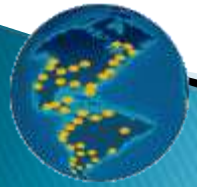
Low Elevation Spray Application (LESA)

Figure 28. Chemigation plates can be used to spray water upwards to improve canopy wetting for chemigation.

Pumping Costs Estimates.

LESA	LESA	MESA	Units
Power Requirements *	25	35	hp
Power Requirements	18.6	26.1	kw
Hours/season **	1700	2000	hrs
Energy Use/Season	31620	52200	kwh
Cost/kwh	0.073	0.073	$
Demand Charge/month	10	10	$
Months/year	5	5	
Pumping Cost/Season	**$ 3,238**	**$ 5,116**	**$/year**

* LESA assumes 35 psi & 900 gpm. MESA assumes 50 psi & 900 gpm @ pump.



Low Energy Precession Application (LEPA)

Precision Mobile Drip Irrigation (PMDI)

Questions?

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