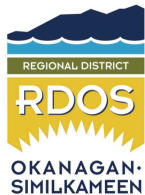


FARM IRRIGATION FACT SHEETS

SET 2: SPRINKLERS & GUNS

Sprinkler and Gun Pressure,
Spacing, Nozzle Sizes, &
Application Rates



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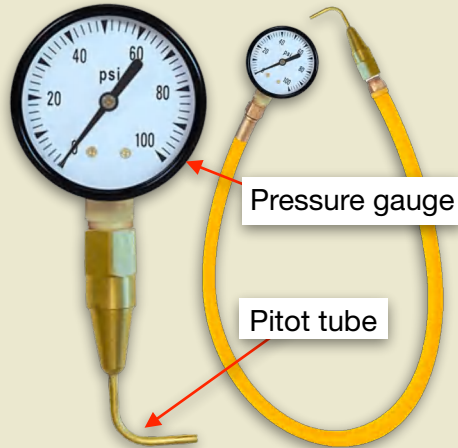
Andrew Bennett, MSc PAg CID
Living Lands Agroecology, 2023

Pressure

MEASURE PRESSURE

Use a gauge on a “pitot tube.”

Measure the **actual operating pressure** with this simple tool. Just put the tip of the **pitot tube** directly into the gun or sprinkler nozzle, or right into a drip line, pipe, or any stream of water.



PRESSURE EFFECTS

Get pressure right ... Not too high, not too low.

Droplet size and distribution are strongly affected by **pressure at the sprinkler nozzle**.

High pressure “mists” with short throws that wind pushes around easily. **Low pressure** makes fat drops that splat out in a ring.

Medium pressure gives the longest throws and most even distribution. **Check the specs and aim for the middle** (not at either extreme.)

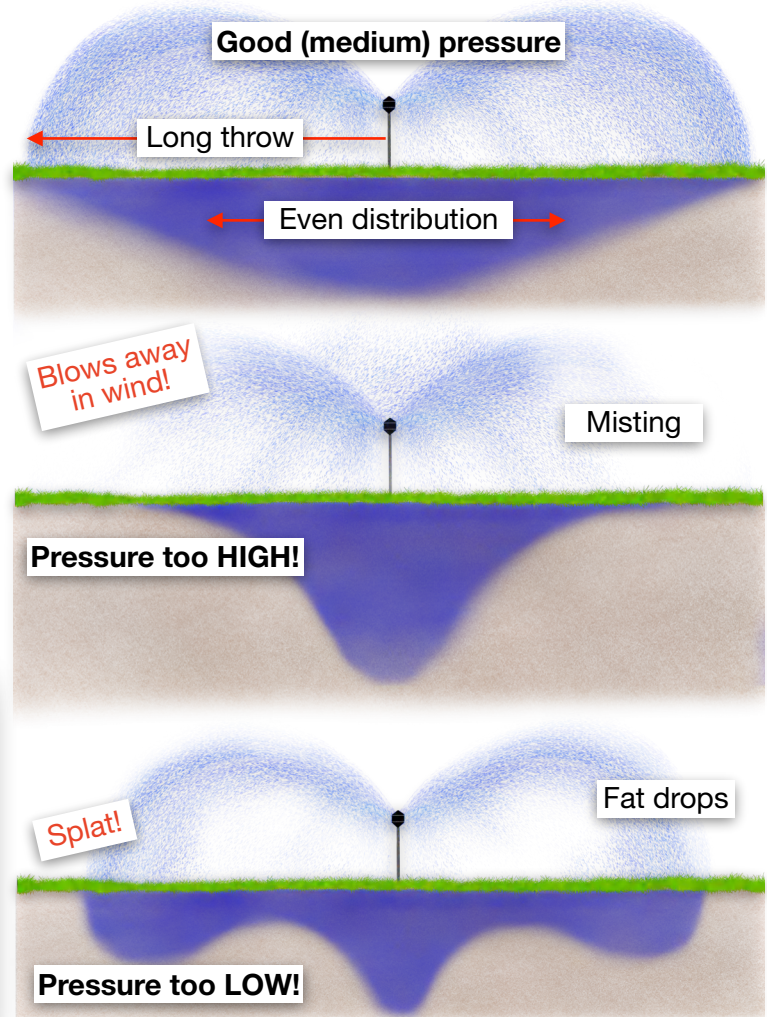
Microsprinklers: 15 to 30 psi
Low-press. sprinklers: 25 to 50 psi
Typical sprinklers: 40 to 65 psi
Small guns: 50 to 80 psi
100+ gpm guns: 65 to 110 psi

CONSISTENT PRESSURE

Every sprinkler in a zone should have about the same pressure.

Changes in elevation or high friction losses can strongly affect pressure.

One way to get the same pressure is to add a **flow control valve** to each sprinkler head that has excessive pressure.



Low pressure water “slops” and smashes the soil with large drops.

Spacing & Flow

SPRINKLER SPACING

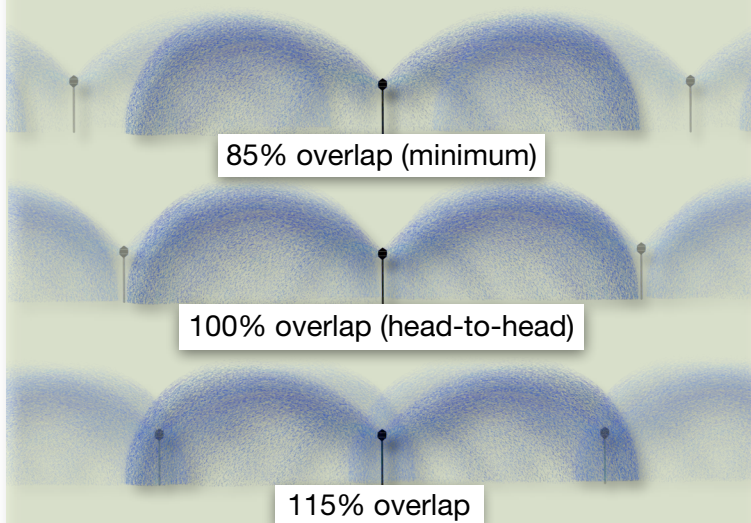
Sprinklers need at least 85% overlap to irrigate evenly.

Without lots of overlap, areas between sprinklers will be significantly under-watered, even as areas near the sprinklers get overwatered.

The throw should reach at least 85% of the way to adjacent heads, when winds are usually less than 5 kph. (Equivalently: head spacing should be less than 60% of the wetted diameter.)

“Head-to-head” spacing (100% overlap) is great for moderate winds. That means each sprinkler’s throw reaches the neighbouring sprinkler heads.

Tighter spacing is better in windy conditions, or for wind-affected irrigation like guns.



If the in-row and between-row spaces are different, overlap is based on the **average space**.

E.g. **Wheelline sprinklers** 40 feet apart (in-row) moved 60 feet each time (between-row) have an **average spacing of 50 feet**, so the sprinklers’ minimum throw (85%) should be 42 feet.

Travelling guns should reach 75% of the way to the next lane.

E.g. If travelling gun lanes are 200 feet apart, the gun’s throw (radius) should be at least 150 feet.

NOZZLE FLOWS

Use the manufacturer’s specs to know the flow.

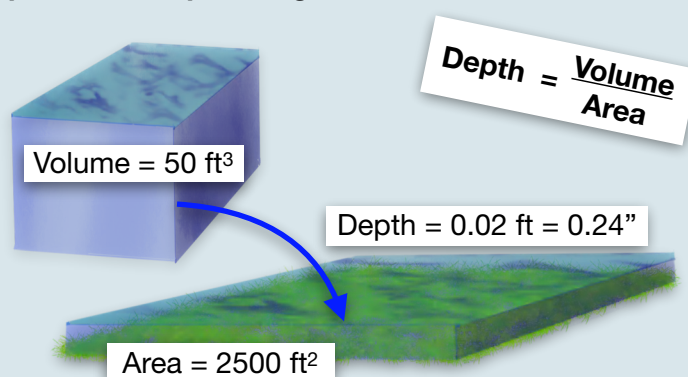
Nozzle Pressure	40 psi	45 psi	50 psi	55 psi	60 psi
Nozzle Size	Flow (gpm)				
9/64"	3.6	3.9	4.1	4.3	4.5
5/32"	4.5	4.7	5.0	5.2	5.5
11/64"	5.4	5.7	6.0	6.3	6.6
3/16"	6.4	6.8	7.2	7.5	7.9
13/64"	7.6	8.0	8.4	8.8	9.2

E.g. If you’ve got an **11/64"** nozzle at **50 psi**, each sprinkler head puts out **6 gpm**.

APPLICATION RATE

How fast is water applied?

From spacing and flow, you can calculate “application rate” — the **depth of water** put out **per hour of sprinkling**.



E.g. If sprinklers spaced **50' by 50'** (2500 ft² per sprinkler) put out **6 gpm** (50 ft³ per hour), then the system applies **0.24 inches per hour** (50 ft³ spread over 2500 ft² is 0.02 ft).

Sprinkler Rates

Below, sprinkler **application rates at 50 psi** with spacings from 25 to 50 feet.

Percent overlap is for the maximum throw in windless conditions.

An 11/64" nozzle at 50 psi with 40x60 spacing (e.g. a wheelline) applies water at **0.24"/hr**

Space between heads (feet)				25x25 (21x30)		30x30 (25x36)		40x40 (32x50)		40x60 (48x50)	
Area per head (sq. ft.)				625		900		1600		2400	
Nozzle				50 psi Flow (gpm)	Max. Throw (feet)	Over-lap	Rate (" /hr)	Over-lap	Rate (" /hr)	Over-lap	Rate (" /hr)
Large microsprinklers	1/16"	0.85	28	112%	0.13	93%	0.09	70%	~	57%	~
	9/128"	1.00	31	124%	0.15	103%	0.11	78%	~	63%	~
Sprinklers	5/64"	1.25	34	136%	0.19	113%	0.13	85%	0.08	69%	~
	11/128"	1.5	35	140%	0.24	117%	0.16	88%	0.09	71%	~
	3/32"	1.8	36	144%	0.28	120%	0.19	90%	0.11	73%	~
	13/128"	2.1	37	148%	0.33	123%	0.23	93%	0.13	76%	~
	7/64"	2.4	38	152%	0.37	127%	0.26	95%	0.14	78%	~
	15/128"	2.8	39	156%	0.43	130%	0.30	98%	0.17	80%	0.11
	1/8"	3.2	40	160%	0.50	133%	0.35	100%	0.19	82%	0.13
	9/64"	4.1	42	168%	0.63	140%	0.44	105%	0.25	86%	0.16
	5/32"	5.0	44	176%	0.77	147%	0.53	110%	0.30	90%	0.20
	11/64"	6.0	46	184%	0.92	153%	0.64	115%	0.36	94%	0.24
Small irrigation guns	3/16"	7.2	48	192%	1.11	160%	0.77	120%	0.43	98%	0.29
	13/64"	8.4	50	200%	1.29	167%	0.90	125%	0.51	102%	0.34
	7/32"	9.9	52	208%	1.52	173%	1.06	130%	0.60	106%	0.40
	0.4"	30	81	324%	4.62	270%	3.21	203%	1.80	165%	1.20
	0.5"	48	93	372%	7.39	310%	5.13	233%	2.89	190%	1.92

Watch your soil... beware of **fast** application rates!

PART-CIRCLE SPRINKLERS

Nozzle down for part-circles

If a sprinkler only covers part of a circle, then the **same flow rate on the smaller area** means water is applied more quickly.

Choose nozzles so **all sprinklers in the same zone share the same application rate.**



A **full-circle** sprinkler with a **6 gpm** nozzle applies 0.24"/hr.

A **180° "road guard"** would double the rate to 0.48"/hr, so keep the rate consistent with a **3 gpm** nozzle.

Road Guard

Nozzles and Soil

RUN-OFF & EROSION

Watch your soil!

Even small soil movements add up quickly and can destroy an area's productivity for decades to come.

If the soil is fine or bare (no plants or mulch), even the slightest slope can lead to run-off and erosion. Fast application rates and fat, high-impact droplets (e.g. from guns) make the problem worse.

The application rate must not exceed the rate that your soil is able to absorb water.

There's no substitute for watching the system in action for signs of any soil movement at all.

If the soil is moving, use smaller nozzles.



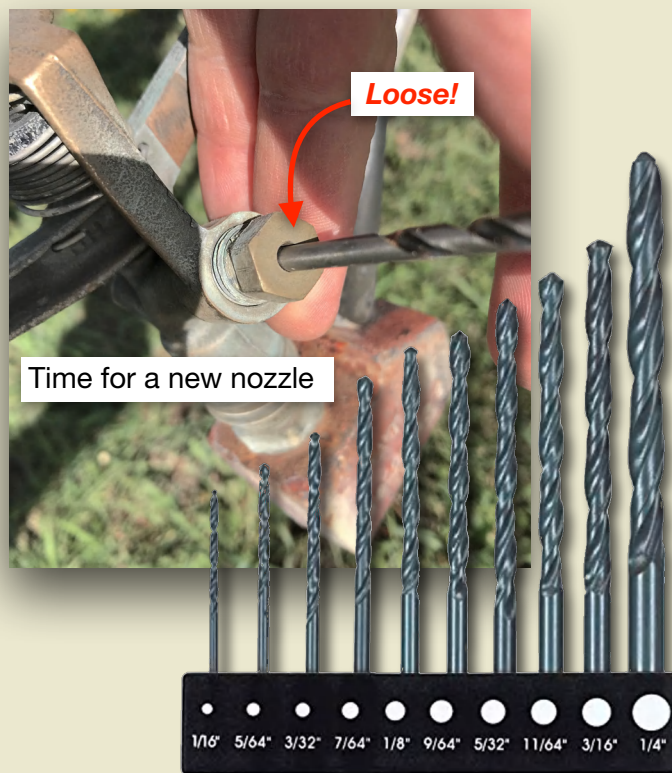
NOZZLES WEAR OUT

Check with the "Drill Bit Test"

Nozzles need to be replaced periodically. If there's fine sand in your water, nozzles might wear out quite frequently. (A screen or filter will help!)

As nozzles wear out, they widen — increasing the **flow rate** — but the shape also changes, making **water distribution less even**.

To check a nozzle's condition, put in the butt end of a drill bit of a known size.



SOIL INFILTRATION

Measure it and match it.

You can measure your soil's infiltration rate and match the irrigation system to it.

Pound a short piece of a wide pipe in the ground deep enough to hold water without leaking.

Next, pour in **an inch of water** and **start a timer** until it is **entirely soaked in**.

Now, pour on another inch and time it again. This **second round is used for the rate**.

E.g. If the second inch took 2 hours to soak in, the infiltration rate is 0.5\"/hr.

