

SPRAYER CALIBRATION + DESIGN

CALIBRATION IS IMPORTANT



FOOD SAFETY



PESTICIDE EFFICACY (+ RESISTANCE)



WORKER SAFETY (~DRIFT)

SPRAYER CALIBRATION SURVEY



CALIBRATION PROCEDURES

DETERMINE GROUND SPEED

CALCULATE GALLONS PER ACRE

MEASURE FLOW RATE PER NOZZLE

DETERMINE GROUND SPEED IN MPH

TIMER



½ FULL



FLAG



TRACTOR



GROUND SPEED

$$\text{MPH} = \frac{\text{DISTANCE (FT)}}{\text{TIME (SEC)}} \times 0.682$$

REPEAT 3X
HALF TANK

GALLONS PER ACRE

$$\text{GPA} = \frac{5940 \times \text{GPM}}{\text{SPEED} \times \text{WIDTH}}$$

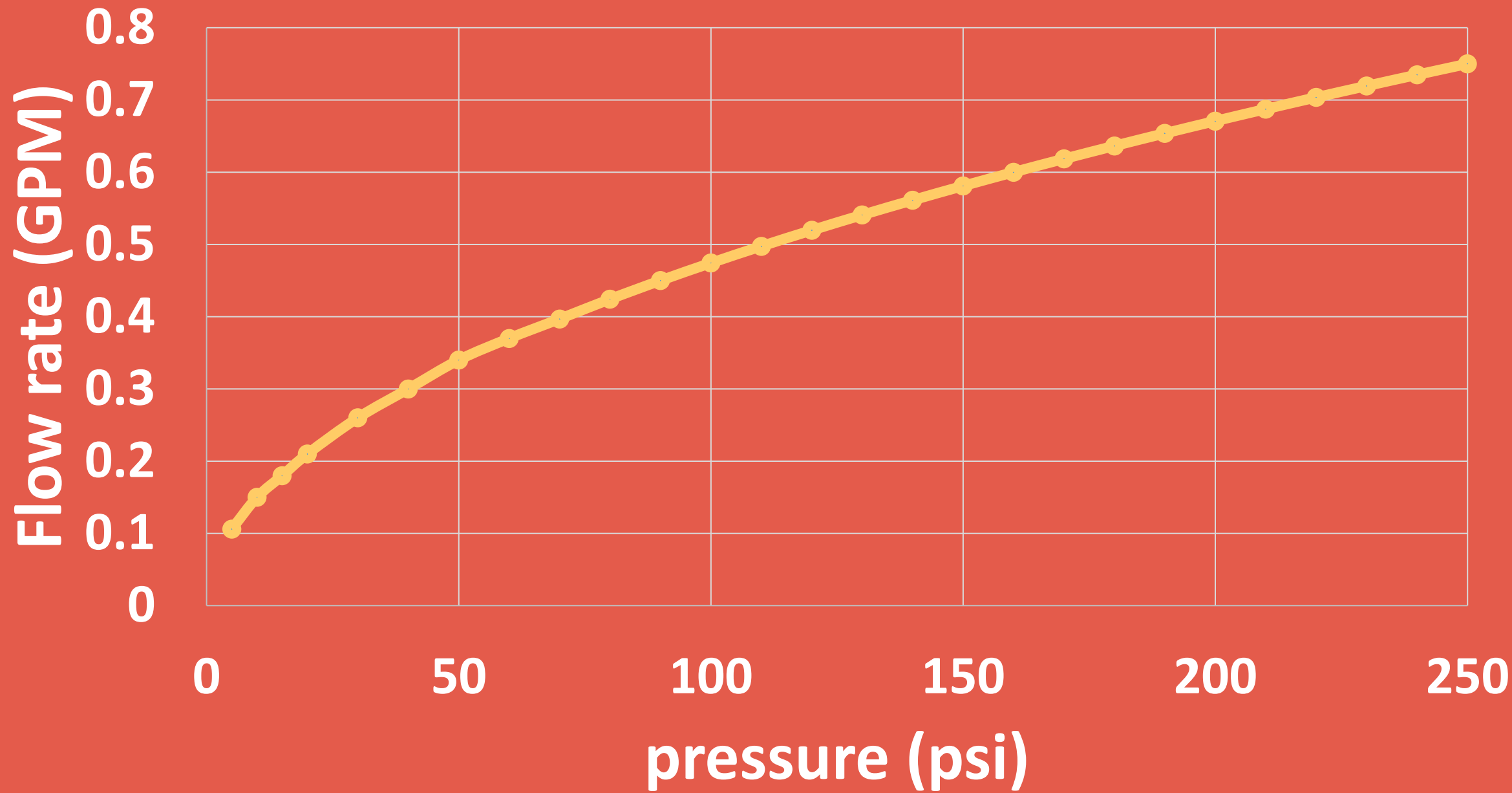


BED WIDTH (IN)

NOZZLES

FLOW RATE PER NOZZLE (GPM)

$$\frac{\text{GPM current}}{\text{GPM 40 psi}} = \sqrt{\frac{\text{PSI current}}{40 \text{ psi}}}$$



TYPE



XR TEEJET

8003VK

ANGLE



0.3 GPM @40 PSI



8003VK

XR TEEJET



01



015



02



03



**COLOR
CODE**

Icon	PSI	DROP SIZE		CAPACITY ONE NOZZLE IN GPM	CAPACITY ONE NOZZLE IN OZ./MIN.	GPA								GALLONS PER 1000 SQ. FT.			
		80°	110°			4 MPH	5 MPH	6 MPH	8 MPH	10 MPH	12 MPH	15 MPH	20 MPH	2 MPH	3 MPH	4 MPH	5 MPH
						20"	20"	20"	20"	20"	20"	20"	20"	20"	20"	20"	20"
XR8001 XR11001 (100)	15	F	F	0.061	7.8	4.5	3.6	3.0	2.3	1.8	1.5	1.2	0.91	0.21	0.14	0.10	0.08
	20	F	F	0.071	9.1	5.3	4.2	3.5	2.6	2.1	1.8	1.4	1.1	0.24	0.16	0.12	0.10
	30	F	F	0.087	11	6.5	5.2	4.3	3.2	2.6	2.2	1.7	1.3	0.30	0.20	0.15	0.12
	40	F	F	0.10	13	7.4	5.9	5.0	3.7	3.0	2.5	2.0	1.5	0.34	0.23	0.17	0.14
	50	F	F	0.11	14	8.2	6.5	5.4	4.1	3.3	2.7	2.2	1.6	0.37	0.25	0.19	0.15
XR80015 XR110015 (100)	15	M	F	0.092													
	20	F	F	0.11													
	30	F	F	0.13													
	40	F	F	0.15													
	50	F	F	0.17													
XR8002 XR11002 (50)	15	M	M	0.12													
	20	M	F	0.14													
	30	F	F	0.17													
	40	F	F	0.20													
	50	F	F	0.22													
XR80025 XR110025 (50)	15	M	M	0.15													
	20	M	M	0.18													
	30	F	F	0.22													
	40	F	F	0.25													
	50	F	F	0.28													
XR8003 XR11003 (50)	15	M	M	0.18													
	20	M	M	0.21													
	30	F	F	0.26													
	40	F	F	0.30													
	50	F	F	0.34													
XR80035 (50)	15	M		0.21	27	15.6	12.5	10.4	7.8	6.2	5.2	4.2	3.1	0.71	0.48	0.36	0.29
	20	M		0.25	32	18.6	14.9	12.4	9.3	7.4	6.2	5.0	3.7	0.85	0.57	0.43	0.34
	30	M		0.30	38	22	17.8	14.9	11.1	8.9	7.4	5.9	4.5	1.0	0.68	0.51	0.41
	40	M		0.35	45	26	21	17.3	13.0	10.4	8.7	6.9	5.2	1.2	0.79	0.60	0.48
	50	F		0.39	50	29	23	19.3	14.5	11.6	9.7	7.7	5.8	1.3	0.88	0.66	0.53
XR8004 XR11004 (50)	15	C	M	0.24	31	17.8	14.3	11.9	8.9	7.1	5.9	4.8	3.6	0.82	0.54	0.41	0.33
	20	M	M	0.28	36	21	16.6	13.9	10.4	8.3	6.9	5.5	4.2	1.0	0.63	0.48	0.38
	30	M	M	0.35	45	26	21	17.3	13.0	10.4	8.7	6.9	5.2	1.2	0.79	0.60	0.48
	40	M	M	0.40	51	30	24	19.8	14.9	11.9	9.9	7.9	5.9	1.4	0.91	0.68	0.54
	50	F	F	0.45	58	33	27	22	16.7	13.4	11.1	8.9	6.7	1.5	1.0	0.77	0.61
60	F	F	0.49	63	36	29	24	18.2	14.6	12.1	9.7	7.3	1.7	1.1	0.83	0.67	

XR8003
XR11003
(50)

15	M	M	0.18
20	M	M	0.21
30	F	F	0.26
40	F	F	0.30
50	F	F	0.34
60	F	F	0.37

FLOW RATE PER NOZZLE (GPM)



REPLACE IF GPM $\pm 10\%$

FLOW RATE PER NOZZLE (GPM)

$$\text{GPM} = \frac{\text{VOLUME (OZ)} / 128}{\text{TIME (MIN)}}$$

DIFFERENT FLOW RATE (GPM)

LOWER



HIGHER



WEB APP

bit.do/calibrating

NOZZLE TYPE



NOZZLE SELECTION

SPRAYING PATTERN

DROPLET SIZE

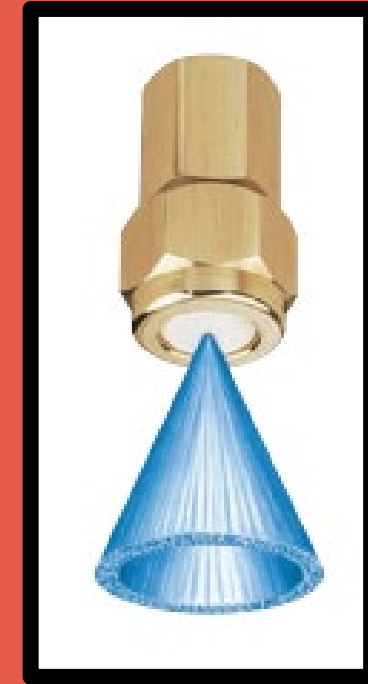
PRESSURE RANGE

MATERIAL

SPRAYING PATTERN



FLAT FAN



HOLLOW CONE

+




-

DROPLET SIZE

DROPLET SIZE

XR TeeJet® (XR)

	PSI						
	15	20	25	30	40	50	60
XR8001	F	F	F	F	F	F	F
XR80015	M	F	F	F	F	F	F
XR8002	M	M	F	F	F	F	F
XR80025	M	M	F	F	F	F	F
XR8003	M	M	M	F	F	F	F
XR80035	M	M	M	M	M	F	F
XR8004	C	M	M	M	M	F	F
XR8005	C	C	M	M	M	M	F
XR8006	C	C	C	M	M	M	M
XR8008	VC	VC	C	C	M	M	M
XR8010	XC	VC	VC	C	C	C	C
XR8015	XC	XC	VC	VC	VC	C	C



DROPLET SIZE (microns)

UF

<60

VF

61-105

F

106-235

M

236-340

C

341-403

VC

404-502

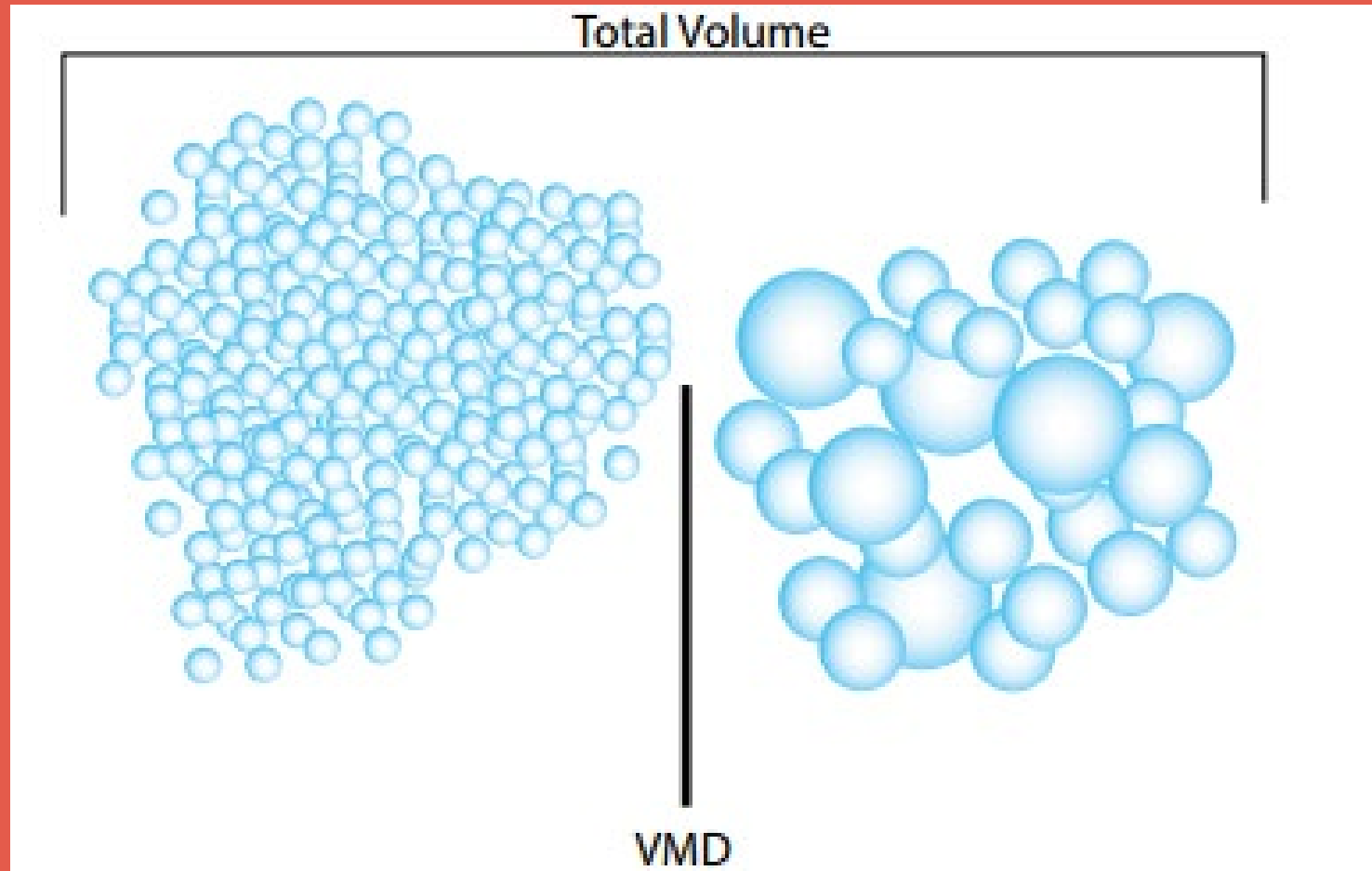
XC

503-665

UC

>666

VOLUME MEDIAN DIAMETER (VMD)



50% volume < VMD

50% volume > VMD

DROPLET SIZE

> PRESSURE



< DROPLET SIZE

< DROPLET SIZE



> DRIFT

< DROPLET SIZE



> RETENTION

PRESSURE RANGE



30-60 psi



15-60 psi



15-90 psi






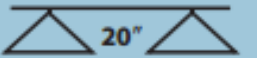
40-350 psi



30-100 psi



10-300 psi

 	 PSI	DROP SIZE		CAPACITY ONE NOZZLE IN GPM	CAPACITY ONE NOZZLE IN OZ./MIN.	 20°								GALLONS PER 1000 SQ. FT.			
		80°	110°			GPA								2 MPH	3 MPH	4 MPH	5 MPH
						4 MPH	5 MPH	6 MPH	8 MPH	10 MPH	12 MPH	15 MPH	20 MPH				

XR8001 XR11001 (100)	15	F	F	0.061	7.8	4.5	3.6	3.0	2.3	1.8	1.5	1.2	0.91	0.21	0.14	0.10	0.08
	20	F	F	0.071	9.1	5.3	4.2	3.5	2.6	2.1	1.8	1.4	1.1	0.24	0.16	0.12	0.10
	30	F	F	0.087	11	6.5	5.2	4.3	3.2	2.6	2.2	1.7	1.3	0.30	0.20	0.15	0.12
	40	F	F	0.10	13	7.4	5.9	5.0	3.7	3.0	2.5	2.0	1.5	0.34	0.23	0.17	0.14
	50	F	F	0.11	14	8.2	6.5	5.4	4.1	3.3	2.7	2.2	1.6	0.37	0.25	0.19	0.15

XR80015 XR110015 (100)	15	M	F	0.092													
	20	F	F	0.11													
	30	F	F	0.13													
	40	F	F	0.15													
	50	F	F	0.17													

XR8002 XR11002 (50)	15	M	M	0.12													
	20	M	F	0.14													
	30	F	F	0.17													
	40	F	F	0.20													
	50	F	F	0.22													

XR80025 XR110025 (50)	15	M	M	0.15													
	20	M	M	0.18													
	30	F	F	0.22													
	40	F	F	0.25													
	50	F	F	0.28													

XR8003 XR11003 (50)	15	M	M	0.18													
	20	M	M	0.21													
	30	F	F	0.26													
	40	F	F	0.30													
	50	F	F	0.34													

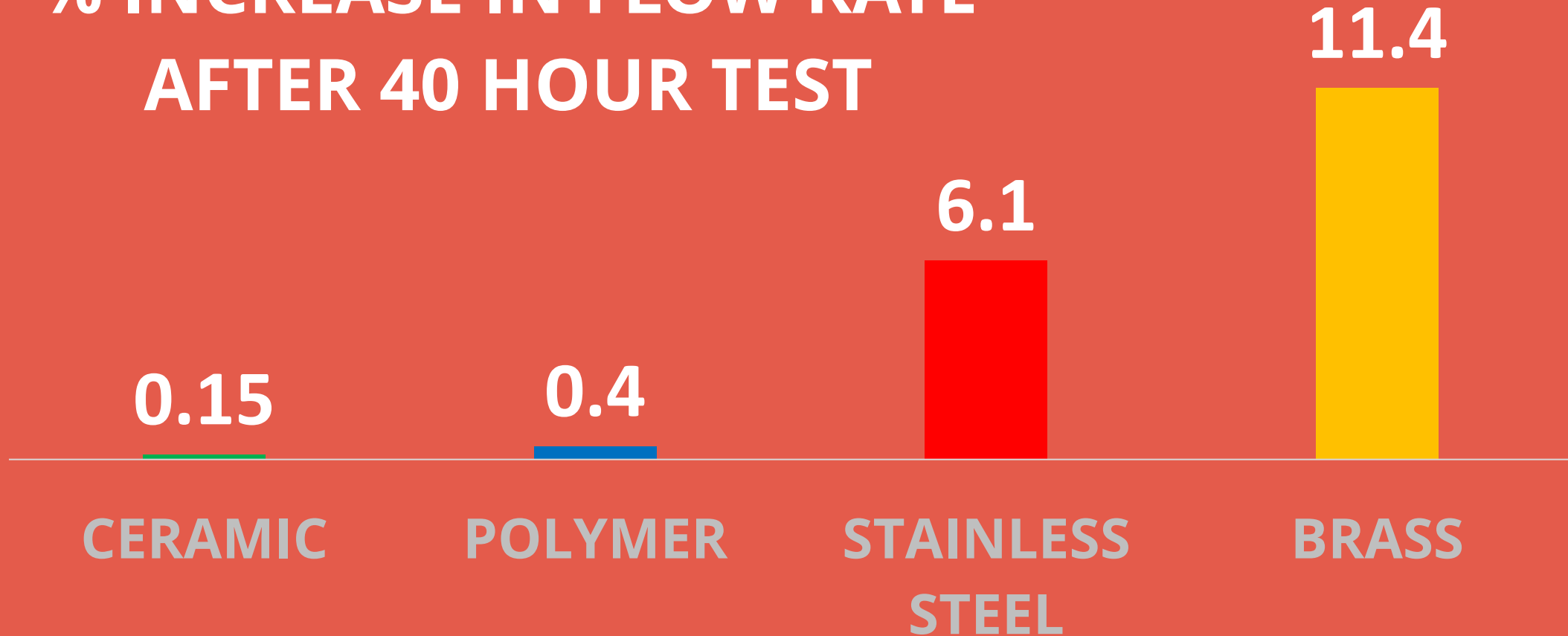
XR80035 (50)	15	M		0.21	27	15.6	12.5	10.4	7.8	6.2	5.2	4.2	3.1	0.71	0.48	0.36	0.29
	20	M		0.25	32	18.6	14.9	12.4	9.3	7.4	6.2	5.0	3.7	0.85	0.57	0.43	0.34
	30	M		0.30	38	22	17.8	14.9	11.1	8.9	7.4	5.9	4.5	1.0	0.68	0.51	0.41
	40	M		0.35	45	26	21	17.3	13.0	10.4	8.7	6.9	5.2	1.2	0.79	0.60	0.48
	50	F		0.39	50	29	23	19.3	14.5	11.6	9.7	7.7	5.8	1.3	0.88	0.66	0.53

XR8004 XR11004 (50)	15	C	M	0.24	31	17.8	14.3	11.9	8.9	7.1	5.9	4.8	3.6	0.82	0.54	0.41	0.33
	20	M	M	0.28	36	21	16.6	13.9	10.4	8.3	6.9	5.5	4.2	1.0	0.63	0.48	0.38
	30	M	M	0.35	45	26	21	17.3	13.0	10.4	8.7	6.9	5.2	1.2	0.79	0.60	0.48
	40	M	M	0.40	51	30	24	19.8	14.9	11.9	9.9	7.9	5.9	1.4	0.91	0.68	0.54
	50	F	F	0.45	58	33	27	22	16.7	13.4	11.1	8.9	6.7	1.5	1.0	0.77	0.61

XR8003 XR11003 (50)	15	M	M	0.18
	20	M	M	0.21
	30	F	F	0.26
	40	F	F	0.30
	50	F	F	0.34
	60	F	F	0.37

MATERIAL

**% INCREASE IN FLOW RATE
AFTER 40 HOUR TEST**



DESIGN ISSUES

NOZZLES/BED

PRESSURE DROP

PRESSURE GAUGE

OTHER (HOODS, LIGHTS)

NOZZLES/BED

RESEARCH (NORWAY & NY) RECOMMENDS
3-5 NOZZLES PER ROW

CA: OBSERVED UP TO 20 IN 48" BEDS

MORE NOZZLES TO INCREASE GPA?

SAME # NOZZLES/BED





**SAME NOZZLES
TYPE/PATTERN PER BED**





PRESSURE DROP

> FRICTION = > PRESSURE DROP





PRESSURE GAUGE = SPEEDOMETER

**SOMETIMES IN THE BACK,
ABSENT, OR BROKEN...**

**MAKE IT EASIER FOR THE
OPERATOR TO KEEP AN EYE ON
PRESURE**



WARNING
Never modify or
repair a ROPS
because welding,
grinding, drilling
or cutting any
portion may weaken
the structure.

CAUTION
TO AVOID INJURY
WHEN RAISING OR
FOLDING ROPS:
Set parking brake
and stop engine.
Remove any
obstruction that
may prevent
raising or folding
of the ROPS.
Do not allow any
bystanders.
Always perform
function from a
stable position at
maximum height.
Always use proper
technique to raise
and lower the ROPS.

MORE LIGHTS WHEN SPRAYING AT NIGHT

An aerial photograph of a golf course green. A white and red striped flagstick is positioned on the green. A yellow caution tape is stretched across the green. The green is surrounded by a brown mulch area. The text "54% REDUCTION IN DRIFT" is overlaid on the bottom left of the image.

54% REDUCTION IN DRIFT

Bjustad & Hermanen 2009



Thank you!

ARIEL ZAJDBAND

831-228-2404

azajdband@calstrawberry.org