Sprayer Calibration For Citrus

Thanks to Beth Grafton-Cardwell for photos.

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UC Cooperative Extension-Central Sierra

Sprayer Calibration and Coverage Training For Improved CA. Red Scale Control in Citrus

Lindcove, June 13, 2017

Calibration, defined

"the act of

selecting,

establishing,

maintaining, and

verifying

sprayer operation parameters which result in a

known,

desired and

uniform

application rate of spray material".

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The cost of not calibrating…

Replacing nozzles.
Say a 24 nozzle airblast sprays a product that costs $50/acre

Nozzle tips are worn by an average 20%, which sprays (or leaks) an additional $10/acre,
or $1000 more per 100 acres sprayed.

24 new ceramic hollow cone tips cost $120 at $5 each.

The nozzles pay for themselves in 12 acres.

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The cost of not calibrating…

Sources of loss:

- Evaporation
- Drift
- Ground run-off
- Droplets bounce off waxy leaf surfaces

Estimates between 75-95% loss depending on crop, time of year, etc.

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The cost of not calibrating- poor coverage, poor control…

The cost of not calibrating-regulations…

2014 CA Pesticide Illness Surveillance Program Data:
1073 pesticide illness cases;
265 (25%) Ag. use pesticide illness cases-132 due to drift.

6 of Ag. cases were children
4 of those 6 occurred due to drift
(0 occurred near schools)

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Application rate (gal/acre) = Flow rate (gal/min) / Land rate (ac/min)

This fundamental relationship works for all sprayers!

Application rate (gal/ac)= Flow rate (gal/min)
Land rate (ac/min)

Flow rate is dependent on nozzle selection and pressure.

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Application rate (gal/ac)= Flow rate (gal/min)
Land rate (ac/min)

Land rate is dependent on speed of travel and the swath width covered by the nozzle or set of nozzles.

This is the area that the nozzle or set of nozzles is covering per minute.

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Application rate (gal/ac)= Flow rate (gal/min)
Land rate (ac/min)

There are 3 ways to obtain the flow rate of a given nozzle, some more accurate than others:

1.) Look for the stamp on the nozzle body, indicating the flow rate for that nozzle at a particular pressure, typically 40 psi ("standard" pressure) for herbicide applications.

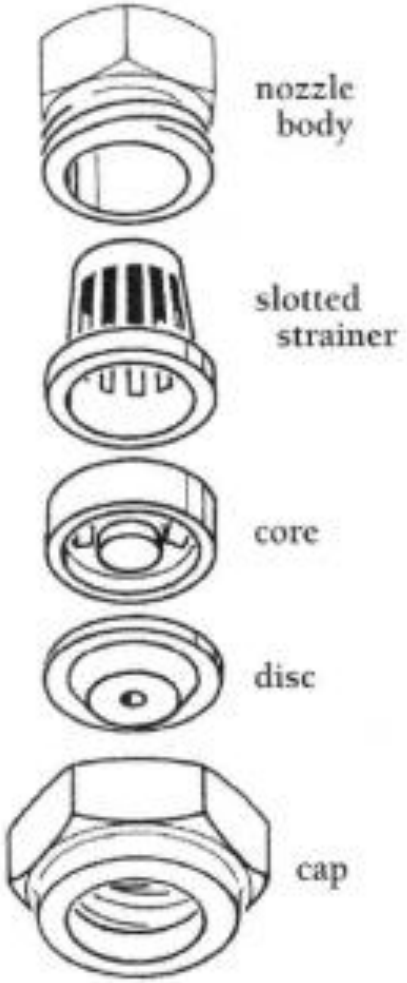
2.) Check the manufacturer's catalog which typically gives flow rates for a given nozzle at a range of pressures. (only valid for new nozzles at certain psi)

3.) Measure it!

Nozzle nomenclature can tell you something about flow rate-mostly applies to spraying “down”.

Herbicide ground spraying nozzles are conveniently color coded. So all of the “blue bodied” nozzles are 03s, built to deliver 0.3 gallons per minute, at 40 psi.

Disc-core nozzles are used in high volume applications.



D-3 through D-16

Numbers indicate diameter in 1/64 inch:

D-4=4/64=0.06”

D-8 = 8/64 = 0.125”

D-16= 16/64 = 0.25”

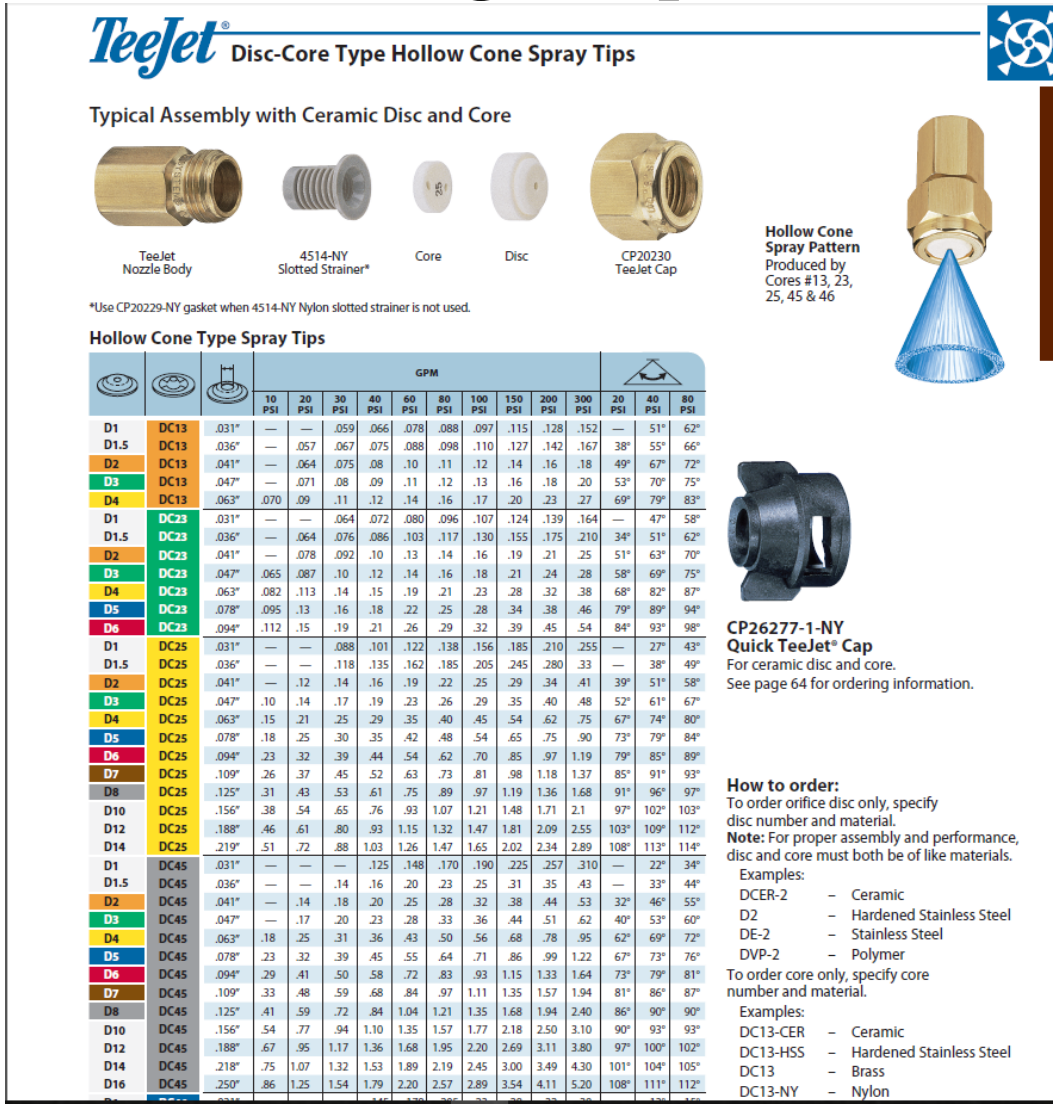
Paired with various core or “spinner plate” nozzles (i.e. DC13 –DC 56).

The stamp indicating the manufacturer's flow rate may be hard to see on disc and core nozzles.

This is a DC "35".


07/07/2016

Check the manufacturer's catalog to determine the manufacturer's flow rate for a given combination of disc and core nozzles at a given pressure.



TeeJet® Disc-Core Type Hollow Cone Spray Tips

Typical Assembly with Ceramic Disc and Core

TeeJet Nozzle Body | 4514-NY Slotted Strainer* | Core | Disc | CP20230 TeeJet Cap

*Use CP20229-NY gasket when 4514-NY Nylon slotted strainer is not used.

Hollow Cone Spray Pattern
Produced by Cores #13, 23, 25, 45 & 46

Hollow Cone Type Spray Tips

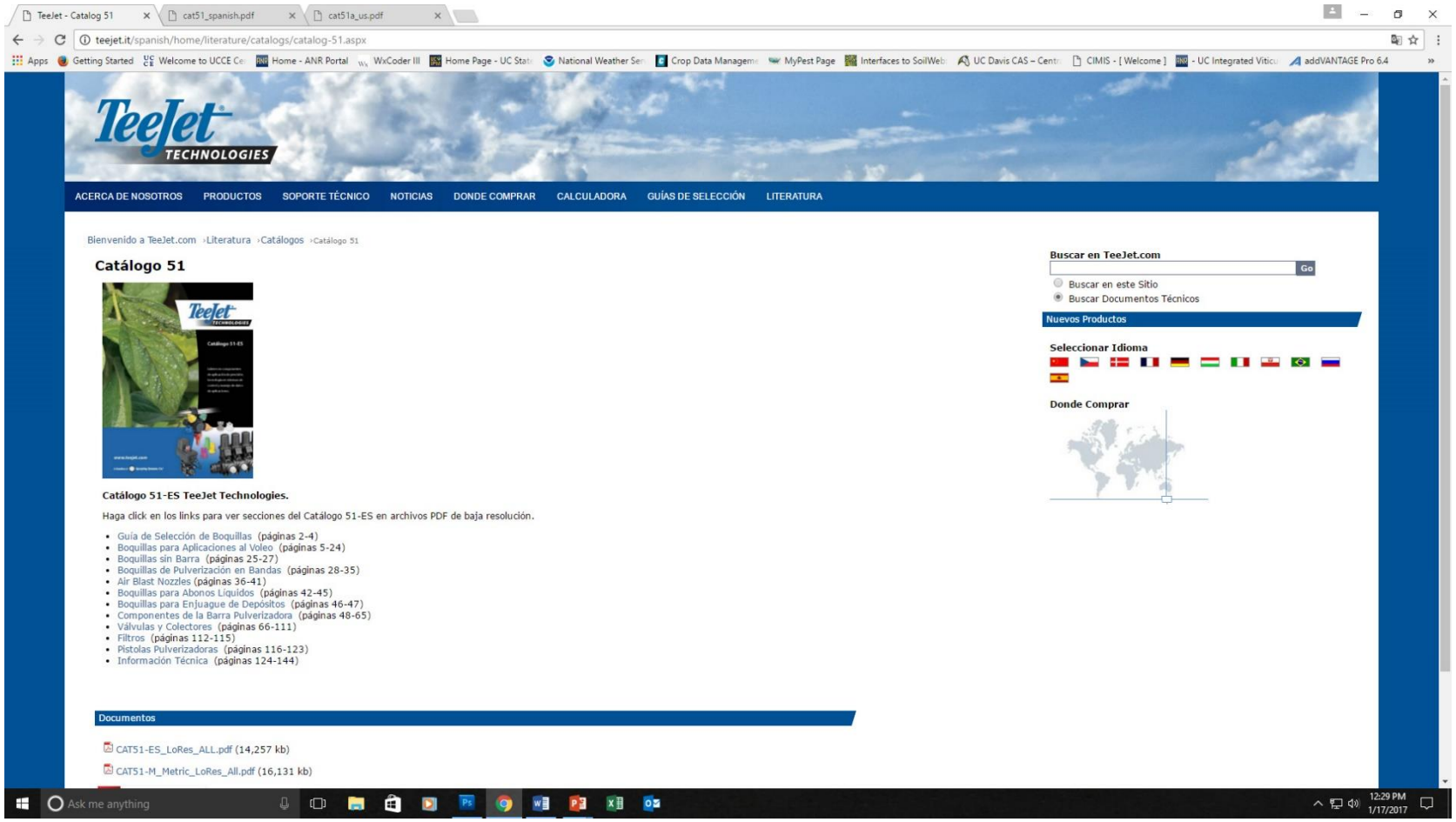
			GPM										Spray Angle		
			10 PSI	20 PSI	30 PSI	40 PSI	60 PSI	80 PSI	100 PSI	150 PSI	200 PSI	300 PSI	20 PSI	40 PSI	80 PSI
D1	DC13	.031"	—	—	.059	.066	.078	.088	.097	.115	.128	.152	—	51°	62°
D1.5	DC13	.036"	—	.057	.067	.075	.088	.098	.110	.127	.142	.167	38°	55°	66°
D2	DC13	.041"	—	.064	.075	.08	.10	.11	.12	.14	.16	.18	49°	67°	72°
D3	DC13	.047"	—	.071	.08	.09	.11	.12	.13	.16	.18	.20	53°	70°	75°
D4	DC13	.063"	.070	.09	.11	.12	.14	.16	.17	.20	.23	.27	69°	79°	83°
D1	DC23	.031"	—	—	.064	.072	.080	.096	.107	.124	.139	.164	—	47°	58°
D1.5	DC23	.036"	—	.064	.076	.086	.103	.117	.130	.155	.175	.210	34°	51°	62°
D2	DC23	.041"	—	.078	.092	.10	.13	.14	.16	.19	.21	.25	51°	63°	70°
D3	DC23	.047"	.065	.087	.10	.12	.14	.16	.18	.21	.24	.28	58°	69°	75°
D4	DC23	.063"	.082	.113	.14	.15	.19	.21	.23	.28	.32	.38	68°	82°	87°
D5	DC23	.078"	.095	.13	.16	.18	.22	.25	.28	.34	.38	.46	79°	89°	94°
D6	DC23	.094"	.112	.15	.19	.21	.26	.29	.32	.39	.45	.54	84°	93°	98°
D1	DC25	.031"	—	—	.088	.101	.122	.138	.156	.185	.210	.255	—	27°	43°
D1.5	DC25	.036"	—	—	.118	.135	.162	.185	.205	.245	.280	.33	—	38°	49°
D2	DC25	.041"	—	.12	.14	.16	.19	.22	.25	.29	.34	.41	39°	51°	58°
D3	DC25	.047"	.10	.14	.17	.19	.23	.26	.29	.35	.40	.48	52°	61°	67°
D4	DC25	.063"	.15	.21	.25	.29	.35	.40	.45	.54	.62	.75	67°	74°	80°
D5	DC25	.078"	.18	.25	.30	.35	.42	.48	.54	.65	.75	.90	73°	79°	84°
D6	DC25	.094"	.23	.32	.39	.44	.54	.62	.70	.85	.97	1.19	79°	85°	89°
D7	DC25	.109"	.26	.37	.45	.52	.63	.73	.81	.98	1.18	1.37	85°	91°	93°
D8	DC25	.125"	.31	.43	.53	.61	.75	.89	.97	1.19	1.36	1.68	91°	96°	97°
D10	DC25	.156"	.38	.54	.65	.76	.93	1.07	1.21	1.48	1.71	2.1	97°	102°	103°
D12	DC25	.188"	.46	.61	.80	.93	1.15	1.32	1.47	1.81	2.09	2.55	103°	109°	112°
D14	DC25	.219"	.51	.72	.88	1.03	1.26	1.47	1.65	2.02	2.34	2.89	108°	113°	114°
D1	DC45	.031"	—	—	—	.125	.148	.170	.190	.225	.257	.310	—	22°	34°
D1.5	DC45	.036"	—	—	.14	.16	.20	.23	.25	.31	.35	.43	—	33°	44°
D2	DC45	.041"	—	.14	.18	.20	.25	.28	.32	.38	.44	.53	32°	46°	55°
D3	DC45	.047"	—	.17	.20	.23	.28	.33	.36	.44	.51	.62	40°	53°	60°
D4	DC45	.063"	.18	.25	.31	.36	.43	.50	.56	.68	.78	.95	62°	69°	72°
D5	DC45	.078"	.23	.32	.39	.45	.55	.64	.71	.86	.99	1.22	67°	73°	76°
D6	DC45	.094"	.29	.41	.50	.58	.72	.83	.93	1.15	1.33	1.64	73°	79°	81°
D7	DC45	.109"	.33	.48	.59	.68	.84	.97	1.11	1.35	1.57	1.94	81°	86°	87°
D8	DC45	.125"	.41	.59	.72	.84	1.04	1.21	1.35	1.68	1.94	2.40	86°	90°	90°
D10	DC45	.156"	.54	.77	.94	1.10	1.35	1.57	1.77	2.18	2.50	3.10	90°	93°	93°
D12	DC45	.188"	.67	.95	1.17	1.36	1.68	1.95	2.20	2.69	3.11	3.80	97°	100°	102°
D14	DC45	.218"	.75	1.07	1.32	1.53	1.89	2.19	2.45	3.00	3.49	4.30	101°	104°	105°
D16	DC45	.250"	.86	1.25	1.54	1.79	2.20	2.57	2.89	3.54	4.11	5.20	108°	111°	112°

CP26277-1-NY
Quick TeeJet® Cap
For ceramic disc and core.
See page 64 for ordering information.

How to order:
To order orifice disc only, specify disc number and material.
Note: For proper assembly and performance, disc and core must both be of like materials.
Examples:
DCER-2 – Ceramic
D2 – Hardened Stainless Steel
DE-2 – Stainless Steel
DVP-2 – Polymer
To order core only, specify core number and material.
Examples:
DC13-CER – Ceramic
DC13-HSS – Hardened Stainless Steel
DC13 – Brass
DC13-NY – Nylon

									80 psi	100 psi	150 psi					
D1	DC45	.031"	—	—	—	.125	.148	.170	.190	.225	.257	.310	—	22°	34°
D1.5	DC45	.036"	—	—	.14	.16	.20	.23	.25	.31	.35	.43	—	33°	44°
D2	DC45	.041"	—	.14	.18	.20	.25	.28	.32	.38	.44	.53	32°	46°	55°
D3	DC45	.047"	—	.17	.20	.23	.28	.33	.36	.44	.51	.62	40°	53°	60°
D4	DC45	.063"	.18	.25	.31	.36	.43	.50	.56	.68	.78	.95	62°	69°	72°
D5	DC45	.078"	.23	.32	.39	.45	.55	.64	.71	.86	.99	1.22	67°	73°	76°
D6	DC45	.094"	.29	.41	.50	.58	.72	.83	.93	1.15	1.33	1.64	73°	79°	81°
D7	DC45	.109"	.33	.48	.59	.68	.84	.97	1.11	1.35	1.57	1.94	81°	86°	87°
D8	DC45	.125"	.41	.59	.72	.84	1.04	1.21	1.35	1.68	1.94	2.40	86°	90°	90°
D10	DC45	.156"	.54	.77	.94	1.10	1.35	1.57	1.77	2.18	2.50	3.10	90°	93°	93°
D12	DC45	.188"	.67	.95	1.17	1.36	1.68	1.95	2.20	2.69	3.11	3.80	97°	100°	102°
D14	DC45	.218"	.75	1.07	1.32	1.53	1.89	2.19	2.45	3.00	3.49	4.30	101°	104°	105°
D16	DC45	.250"	.86	1.25	1.54	1.79	2.20	2.57	2.89	3.54	4.11	5.20	108°	111°	112°

http://teejet.it/media/427750/cat51_spanish.pdf



Pressure gauge: an essential component

Make sure it is operating properly and is maintained, is easy to read, and has a range that makes sense for the sprayer.

Flow rate is pressure dependent

$$Q=K'\sqrt{\Delta P}$$

Where Q= flow rate

K= overall nozzle coefficient (nozzle shape and area)

$\sqrt{\Delta P}$= square root of change of pressure

So, if you want to double the flow rate, the pressure must increase by the square of two (2^2).

Likewise, if you wish to triple the flow rate, the pressure must increase by the square of three (3^2).

HOWEVER, adjusting pressure is one of the least desirable ways to change flow rate volume…(why?)

ConeJet® VisiFlo® Hollow Cone Spray Tips

Typical Applications:

Use for directed applications in air blast spraying for orchards and vineyards and other specialty crops. Also well-suited for applications of insecticides, fungicides, defoilants and foliar fertilizers at pressures of 40 PSI (3 bar) and above.

Features:

- VisiFlo color-coded version consists of stainless steel or ceramic orifice in polypropylene body. Maximum operating pressure 300 PSI (20 bar). Spray angle is 80° at 100 PSI (7 bar).
- Finely atomized spray pattern provides thorough coverage.
- TX-VS1 and TX-VS2 available in VisiFlo color-coded stainless steel only.

How to order:

Specify tip number.

Examples:

TX-VS4	–	Stainless Steel with VisiFlo color-coding
TX-4	–	Brass
TX-SS4	–	Stainless Steel
TX-VK4	–	Ceramic with VisiFlo color-coding

TXR ConeJet® Hollow Cone Spray Tips

Typical Applications:

Use for directed applications in air blast spraying for orchards and vineyards and other specialty crops. Also well-suited for applications of insecticides, fungicides, defoliants and foliar fertilizers at pressures of 40 PSI (3 bar) and above.

Features:

- Produces uniform, 80° hollow cone spray pattern ideal for airblast, directed and specialty applications.
- Flow rates are matched to serve as a direct replacement for commonly used non-TeeJet hollow cone spray tips.
- High-quality ceramic orifice provides superior wear life, including high-pressure operation.
- Low profile acetal tip body provides minimal impact with foliage and excellent chemical resistance.
- Color-coded holder based on tip flow rate allows for easy capacity identification.
- Snap-fit backup plate provides positive retention when handled in field, but allows for tool-free removal for easy cleaning.
- Best suited for use with TeeJet 98450 series brass rollover fittings.
- Compatible with TeeJet cap CP20230 for use on rollovers and threaded nozzle bodies, tighten to a maximum torque of: 100 in-lbs (11 N-m).
- Suggested spray pressure range of 30–360 PSI (2–25 bar).
- Uses 114396-1-NYR Quick TeeJet® cap, gasket and O-ring. Reference page 64 for more information.

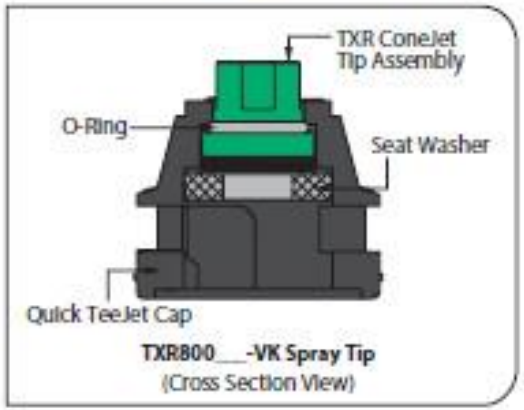
How to order:

Specify tip number.

Examples:

TXR8003VK – Ceramic with color-coding

TXR8003VK-100X – Ceramic with color-coding, 100 Tip Pack



TXR800___-VK Spray Tip
(Cross Section View)

		GPM																				
		30 PSI	40 PSI	50 PSI	60 PSI	70 PSI	80 PSI	90 PSI	100 PSI	120 PSI	140 PSI	160 PSI	180 PSI	200 PSI	220 PSI	240 PSI	260 PSI	280 PSI	300 PSI	320 PSI	340 PSI	360 PSI
TXR800053VK	100	0.046	0.053	0.059	0.064	0.069	0.073	0.077	0.081	0.089	0.095	0.101	0.107	0.113	0.118	0.123	0.127	0.132	0.136	0.140	0.144	0.148
		VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF
TXR800071VK	50	0.062	0.071	0.079	0.086	0.093	0.099	0.105	0.110	0.120	0.129	0.138	0.146	0.153	0.160	0.167	0.174	0.180	0.186	0.192	0.197	0.203
		F	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF
TXR8001VK	50	0.087	0.100	0.111	0.121	0.131	0.139	0.147	0.155	0.169	0.182	0.194	0.205	0.216	0.226	0.235	0.245	0.253	0.262	0.270	0.278	0.286
		F	F	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF
TXR80013VK	50	0.116	0.133	0.148	0.162	0.174	0.186	0.196	0.207	0.225	0.243	0.259	0.274	0.288	0.301	0.314	0.326	0.338	0.349	0.360	0.371	0.381
		F	F	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF
TXR80015VK	50	0.131	0.150	0.167	0.182	0.196	0.209	0.221	0.232	0.254	0.273	0.291	0.308	0.324	0.339	0.353	0.367	0.380	0.393	0.405	0.417	0.429
		F	F	F	F	F	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF
TXR80017VK	50	0.145	0.167	0.185	0.202	0.218	0.232	0.246	0.258	0.282	0.303	0.323	0.342	0.360	0.376	0.392	0.408	0.422	0.437	0.450	0.464	0.476
		F	F	F	F	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF
TXR8002VK	50	0.174	0.200	0.223	0.243	0.261	0.279	0.295	0.310	0.338	0.364	0.388	0.410	0.432	0.452	0.471	0.489	0.507	0.524	0.540	0.556	0.572
		F	F	F	F	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF
TXR80028VK	50	0.240	0.275	0.306	0.334	0.359	0.383	0.405	0.426	0.465	0.500	0.533	0.564	0.594	0.621	0.648	0.673	0.697	0.720	0.743	0.765	0.786
		F	F	F	F	F	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF
TXR8003VK	50	0.260	0.300	0.335	0.367	0.396	0.423	0.449	0.473	0.517	0.558	0.597	0.633	0.667	0.699	0.730	0.759	0.788	0.815	0.841	0.867	0.892
		F	F	F	F	F	F	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF
TXR80036VK	50	0.309	0.356	0.398	0.435	0.470	0.502	0.532	0.561	0.614	0.663	0.708	0.751	0.791	0.829	0.866	0.901	0.935	0.967	0.999	1.03	1.06
		F	F	F	F	F	F	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF
TXR8004VK	50	0.347	0.400	0.447	0.489	0.528	0.564	0.598	0.630	0.690	0.745	0.796	0.843	0.889	0.932	0.973	1.01	1.05	1.09	1.12	1.16	1.19
		F	F	F	F	F	F	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF
TXR80049VK	50	0.423	0.488	0.545	0.597	0.644	0.688	0.730	0.769	0.842	0.909	0.971	1.03	1.09	1.14	1.19	1.24	1.28	1.33	1.37	1.41	1.45
		F	F	F	F	F	F	F	F	F	F	F	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF

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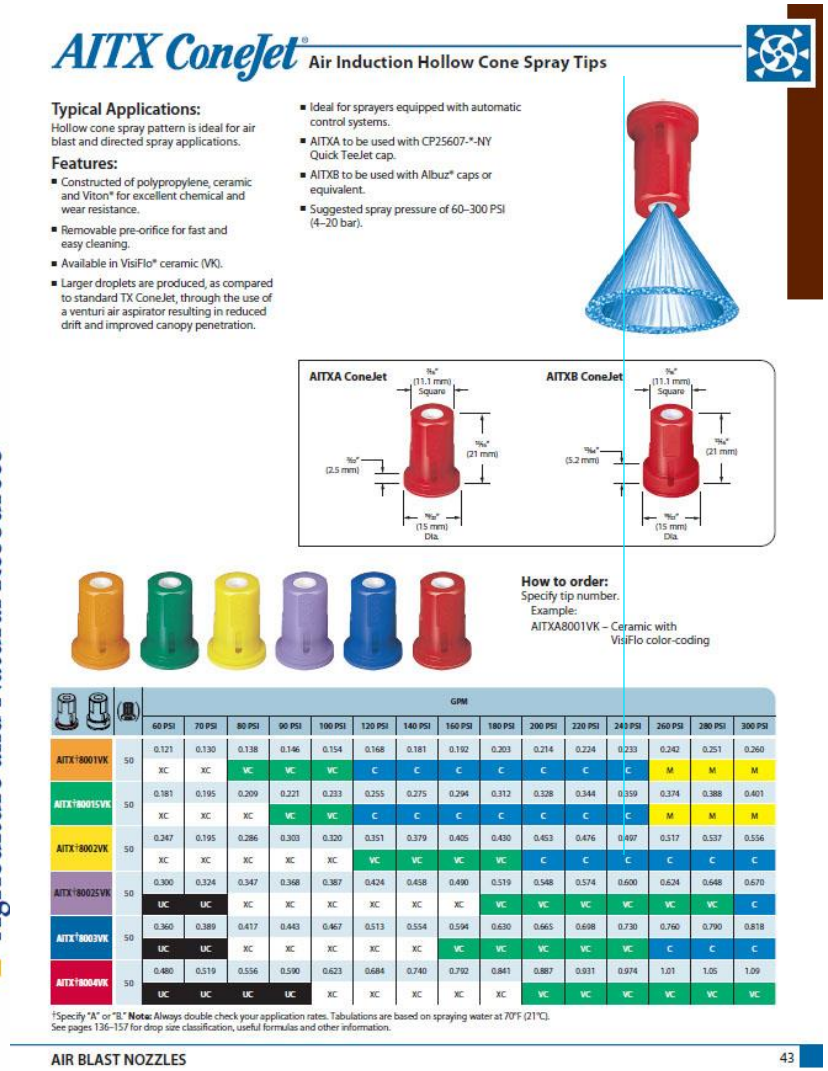
Use the manufacturer's catalog to see flow rates at a given pressure.



AITX ConeJet Air Induction Hollow Cone Spray Tips

Typical Applications:
Hollow cone spray pattern is ideal for air blast and directed spray applications.

Features:
- Constructed of polypropylene, ceramic and Viton® for excellent chemical and wear resistance.
- Removable pre-orifice for fast and easy cleaning.
- Available in VisiFlo® ceramic (VK).
- Larger droplets are produced, as compared to standard TX ConeJet, through the use of a venturi air aspirator resulting in reduced drift and improved canopy penetration.
- Ideal for sprayers equipped with automatic control systems.
- AITXA to be used with CP25607-*-NY Quick TeeJet cap.
- AITXB to be used with Albuz® caps or equivalent.
- Suggested spray pressure of 60–300 PSI (4–20 bar).

AITXA ConeJet — AITXB ConeJet

How to order:
Specify tip number.
Example:
AITXA8001VK – Ceramic with VisiFlo color-coding

		GPM														
		60 PSI	70 PSI	80 PSI	90 PSI	100 PSI	120 PSI	140 PSI	160 PSI	180 PSI	200 PSI	220 PSI	240 PSI	260 PSI	280 PSI	300 PSI
AITX†8001VK	50	0.121	0.130	0.138	0.146	0.154	0.168	0.181	0.192	0.203	0.214	0.224	0.233	0.242	0.251	0.260
		XC	XC	VC	VC	VC	C	C	C	C	C	C	C	M	M	M
AITX†80015VK	50	0.181	0.195	0.209	0.221	0.233	0.255	0.275	0.294	0.312	0.328	0.344	0.359	0.374	0.388	0.401
		XC	XC	XC	VC	VC	C	C	C	C	C	C	C	M	M	M
AITX†8002VK	50	0.247	0.195	0.286	0.303	0.320	0.351	0.379	0.405	0.430	0.453	0.476	0.497	0.517	0.537	0.556
		XC	XC	XC	XC	XC	VC	VC	VC	VC	C	C	C	C	C	C
AITX†80025VK	50	0.300	0.324	0.347	0.368	0.387	0.424	0.458	0.490	0.519	0.548	0.574	0.600	0.624	0.648	0.670
		UC	UC	XC	XC	XC	XC	XC	XC	VC	VC	VC	VC	VC	VC	C
AITX†8003VK	50	0.360	0.389	0.417	0.443	0.467	0.513	0.554	0.594	0.630	0.665	0.698	0.730	0.760	0.790	0.818
		UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	VC	VC	C	C	C
AITX†8004VK	50	0.480	0.519	0.556	0.590	0.623	0.684	0.740	0.792	0.841	0.887	0.931	0.974	1.01	1.05	1.09
		UC	UC	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	VC	VC	VC

†Specify "A" or "B." **Note:** Always double check your application rates. Tabulations are based on spraying water at 70°F (21°C).
See pages 136–157 for drop size classification, useful formulas and other information.

AIR BLAST NOZZLES 43

This chart also tells you something about spray "Quality"

		GPM														
		60 PSI	70 PSI	80 PSI	90 PSI	100 PSI	120 PSI	140 PSI	160 PSI	180 PSI	200 PSI	220 PSI	240 PSI	260 PSI	280 PSI	300 PSI
AITX†8001VK	50	0.121	0.130	0.138	0.146	0.154	0.168	0.181	0.192	0.203	0.214	0.224	0.233	0.242	0.251	0.260
		XC	XC	VC	VC	VC	C	C	C	C	C	C	C	M	M	M
AITX†80015VK	50	0.181	0.195	0.209	0.221	0.233	0.255	0.275	0.294	0.312	0.328	0.344	0.359	0.374	0.388	0.401
		XC	XC	XC	VC	VC	C	C	C	C	C	C	C	M	M	M
AITX†8002VK	50	0.247	0.195	0.286	0.303	0.320	0.351	0.379	0.405	0.430	0.453	0.476	0.497	0.517	0.537	0.556
		XC	XC	XC	XC	XC	VC	VC	VC	VC	C	C	C	C	C	C
AITX†80025VK	50	0.300	0.324	0.347	0.368	0.387	0.424	0.458	0.490	0.519	0.548	0.574	0.600	0.624	0.648	0.670
		UC	UC	XC	XC	XC	XC	XC	XC	VC	VC	VC	VC	VC	VC	C
AITX†8003VK	50	0.360	0.389	0.417	0.443	0.467	0.513	0.554	0.594	0.630	0.665	0.698	0.730	0.760	0.790	0.818
		UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	VC	VC	C	C	C
AITX†8004VK	50	0.480	0.519	0.556	0.590	0.623	0.684	0.740	0.792	0.841	0.887	0.931	0.974	1.01	1.05	1.09
		UC	UC	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	VC	VC	VC

At 160 psi, this AITX8004 nozzle should deliver 0.702 gpm

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Citrus airblast example: At 150 psi, the Teejet catalog gives a total of 27.8 gal/min per side (55.6 gal/min entire sprayer) with this nozzle set up.

1 D4-DC45= .68

2 D5-DC45= .86

3 D7-DC45= 1.35

4 D7-DC45= 1.35

5 D7-DC45= 1.35

6 D8-DC45= 1.68

7 D8-DC45= 1.68

8 D8-DC45= 1.68

9 D8-DC45= 1.68

10 D8-DC45= 1.68

11 D8-DC45= 1.68

12 D8-DC45= 1.68

13 D8-DC45= 1.68

14 D8-DC45= 1.68

15 D8-DC45= 1.68

16 D7-DC45=1.35

17 D7-DC45=1.35

18 D7-DC45=1.35

19 D4-DC45= .68

20 D4-DC45= .68

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Even if you have the manufacturer's listed rate from the catalog, it's still a good idea to measure the *actual* flow rate from the nozzle (*why might these differ*?)

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Measuring actual flow rate for air-blast sprayers involves several steps

1. Park the sprayer on a level surface and fill up the tank with clean water to a line observed at the top of the tank.

2. Open up the nozzles and run the sprayer (or half of the sprayer bank of nozzles) for a set amount of time, from 15 seconds to 2 minutes. Be sure to record the pressure during this time.

3. Measure the amount of water it takes to fill the sprayer back up to the line observed in 1.

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Citrus airblast example: At 150 psi, the Teejet catalog gives a total of 27.8 gal/min per side (55.6 gal/min entire sprayer) with this nozzle set up. But the actual flow rate measured =56.5 gal/min.

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The **“Fundamental Relationship”** for calibration:

$$\textbf{Application rate (gal/ac)} = \frac{\textbf{Flow rate (gal/min)}}{\textbf{Land rate (ac/min)}}$$

What is land rate?

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Land Rate: AREA covered in time

- not just tractor speed
- *Area* covered per unit time (ft.²/min)

- **Speed (ft/min) x Swath width (ft.)**
- Convert ft.²/min to acres/min

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Application rate (gal/ac)= $\frac{\text{Flow rate (gal/min)}}{\text{Land rate (ac/min)}}$

What swath width to measure?

Can be applied to:

-one nozzle

-bank of nozzles

-entire sprayer

BUT: Swath width measured must be the **width covered for nozzle(s) used for flow rate measurement.**

Swath width for trees and vines is typically the row spacing width.

This can be easily measured with a tape. Distances of 6-25 feet are common swath widths for air assisted applications.

Measuring speed

To measure speed:

Tank should be about ½ full.

Terrain should be typical for the spray job.

Measure time (convert to feet per minute) to travel at least 100 feet.

Note tractor gear and RPM.

Time multiple runs and take an average.

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Land rate example: air-blast application

1 mile=5280 feet
1 acre=43,560 ft.²

Tractor speed measured

(John Deere tractor at 4 turtle):

1. 100 ft./45 sec
2. 100 ft./43sec
3. 100 ft./45 sec

average: 100 feet/44.3 sec.

$$\frac{\text{Ft.} * 0.68}{\text{Time (sec)}} = \text{MPH}$$

$$\frac{100 \text{ ft.} * 0.68}{44.3} = 1.53 \text{ mph}$$

Note: Conversion to MPH is not necessary for the calibration calculation, but it is a nice unit to know for reference.

1. Convert speed to feet per min:

(100 ft./44.3sec) (60 sec/min)=135 ft./min **OR**

(1.5 miles/hour)(1 hr./60 min)(5280 ft./mile) = 132 ft./min

2. **Multiply speed (ft./min) by swath width (ft.) to obtain ft.² /min.**

Our swath width is the vine row spacing, 22 feet.

135 ft./min * 22 ft. = 2970 ft.² /min (area covered/min)

3. Convert ft.² /min to acres per min.

2970 ft.²/min * 1 acre/43,560 ft.²= **0.068 acre/min.**

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$$\text{App. Rate} = \frac{\text{Flow Rate}}{\text{Land Rate}}$$

If we slow down to 1 mph:
= 88 ft/min * 22 ft swath
=1936 ft.^{2}
=1936ft.^{2}/43560ft.^{2}

=.044 ac/min land rate

56.5 gal/min/.044 ac/min= 1284 gal/acre

gal./acre= $\frac{56.5 \text{ gal/min}}{.068 \text{ ac./min}}$

@ 150 psi with noted nozzle configuration

@ 1.5 mph, 22 ft. swath

= 831 gal./acre

This is the application rate, the spray volume per acre.

But how much pesticide (a.i.) goes in the tank?

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APPLICATION RATE CHART FOR CENTAUR WDG INSECT GROWTH REGULATOR

Citrus Fruits (Crop Group 10)
calamondin; citrus, citron; citrus hybrids (including chironja, tangelo, tangor); clementine; grapefruit; kumquat; lemon; lime; mandarin; orange, sour; orange, sweet; pummelo; satsuma mandarin; tangerine

Pest	Rate/Acre
Black scale California red scale Citricola scale Cottony cushion scale Glassy-winged sharpshooter Mealybugs	34.5 to 46.0 oz/acre (2.156 to 2.875 lbs/acre) (1.5 to 2.0 lbs ai/acre)

Notes and Use Restrictions

- Apply by ground application using a minimum of 750 gallons of water per acre.
- Do not make more than 2 applications per growing season.
- Allow at least 60 days between applications.
- Do not apply more than 92.0 oz (5.75 lbs) per acre per growing season.
- Preharvest Interval (PHI): 3 days

RECOMMENDATIONS

- **Red scale** – Applications should begin at early crawler emergence.
- **Citricola scale** – Applications should be after complete crawler hatch. Spring applications can provide suppression and minimize honeydew accumulation.
- **Cottony cushion scale** – Apply after July 1st for consistent control.
- **All other pests** - Application should be made when early crawler emergence occurs.

The label specifies the amount of pesticide, typically “per acre”

- For this example, the label recommended rate in citrus is 34.5 to 46 oz./acre in a minimum of 750 gallons. No more than 2 applications per growing season.

- Beginning at early crawler emergence.

How much pesticide in the tank?

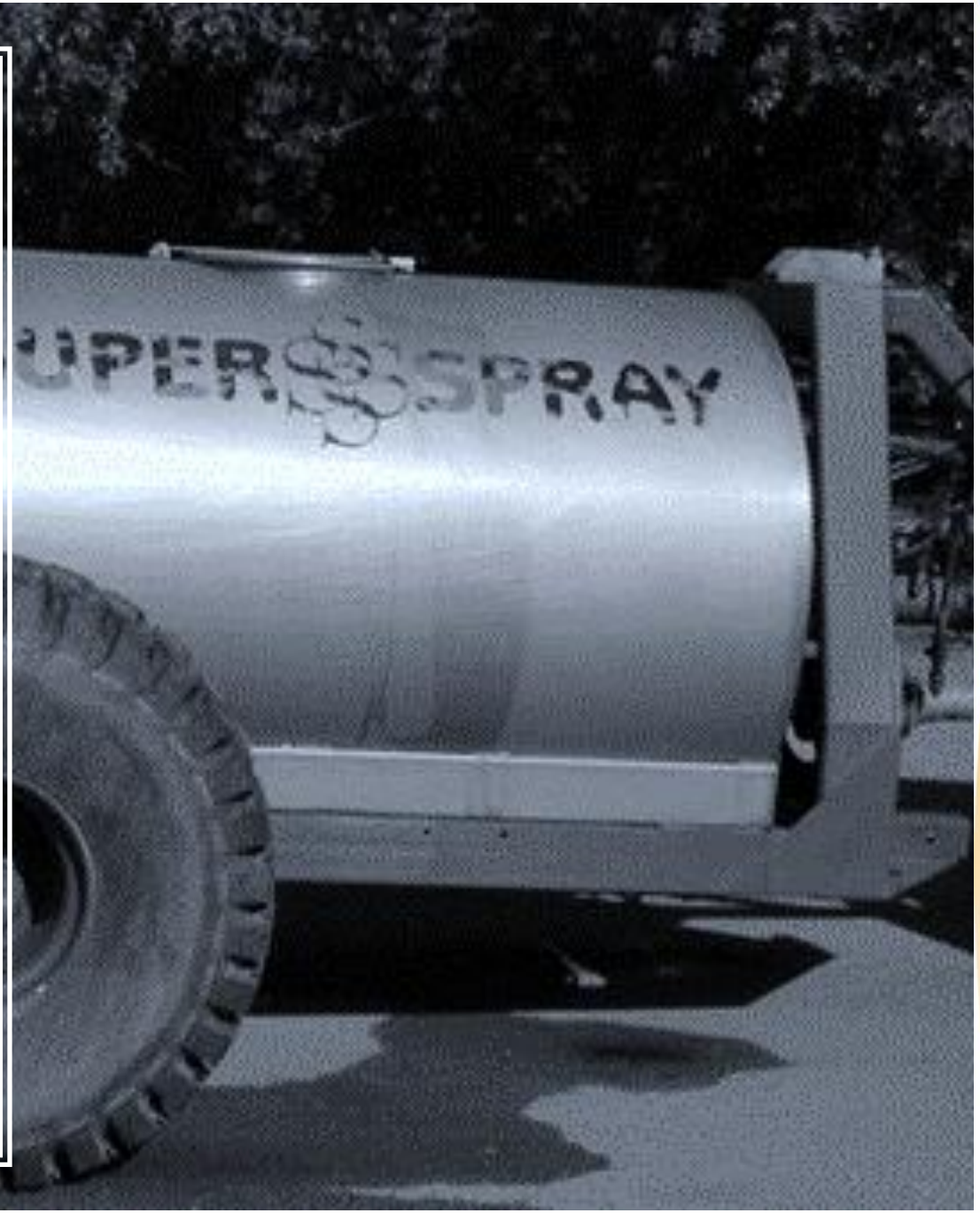
1. In our example, it is a 1000 gallon tank.

2. The label for the spray job will provide a rate per acre, in our example we choose 40 oz. per acre.

3. We calibrated our sprayer to deliver 831 gallons per acre.

Number of acres per tank: 1000 gallon tank/831 gallons per acre= **1.2 acres** can be sprayed with a full tank at this calibration.

Amount of pesticide per tank: 1.2acres * 40 oz. per acre= **48 ounces** of pesticide per tank in this example.



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How do we check for coverage?

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Water sensitive paper to check for coverage

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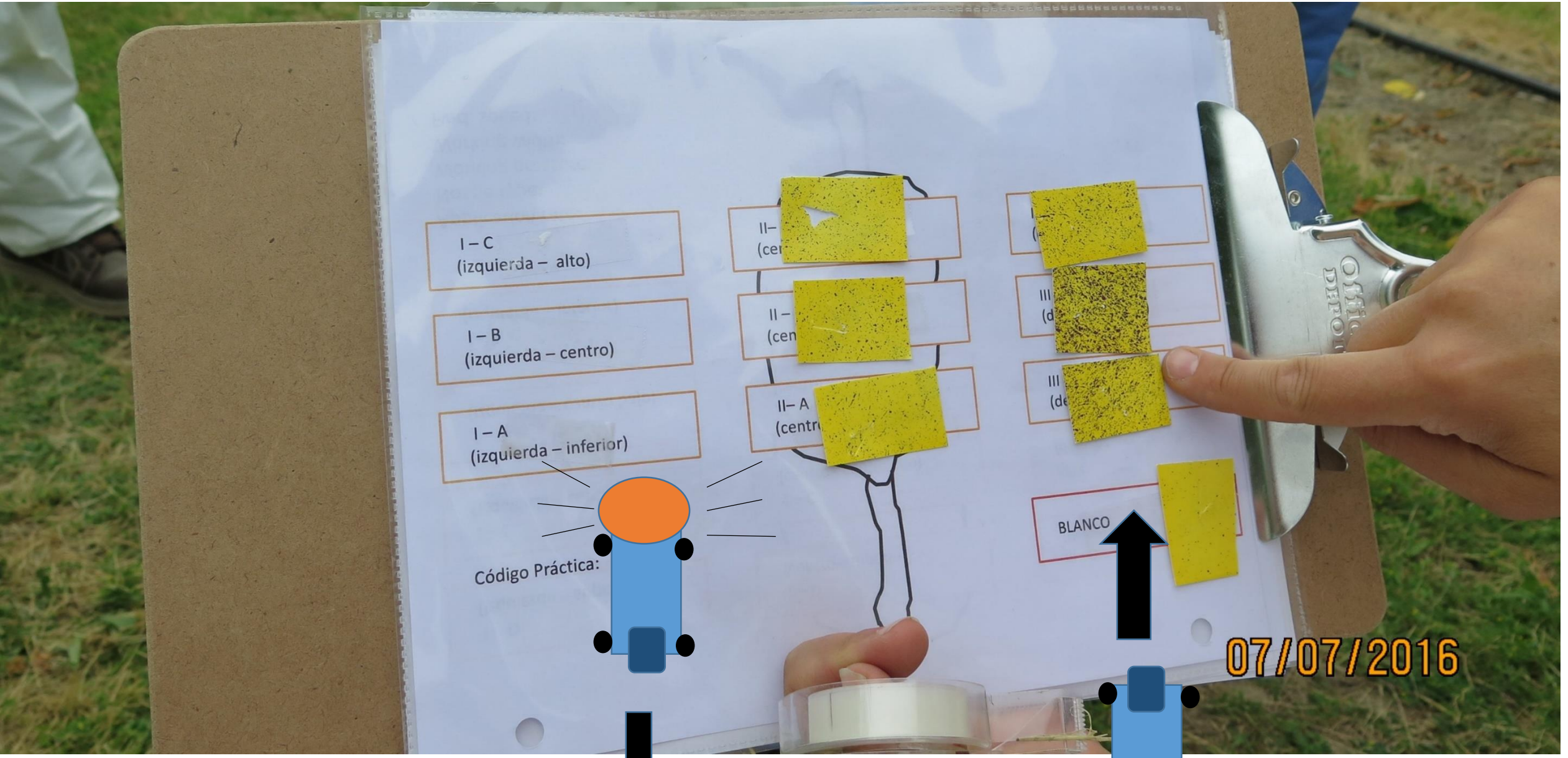
07/07/2016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(izquierda – alto)
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BLANCO
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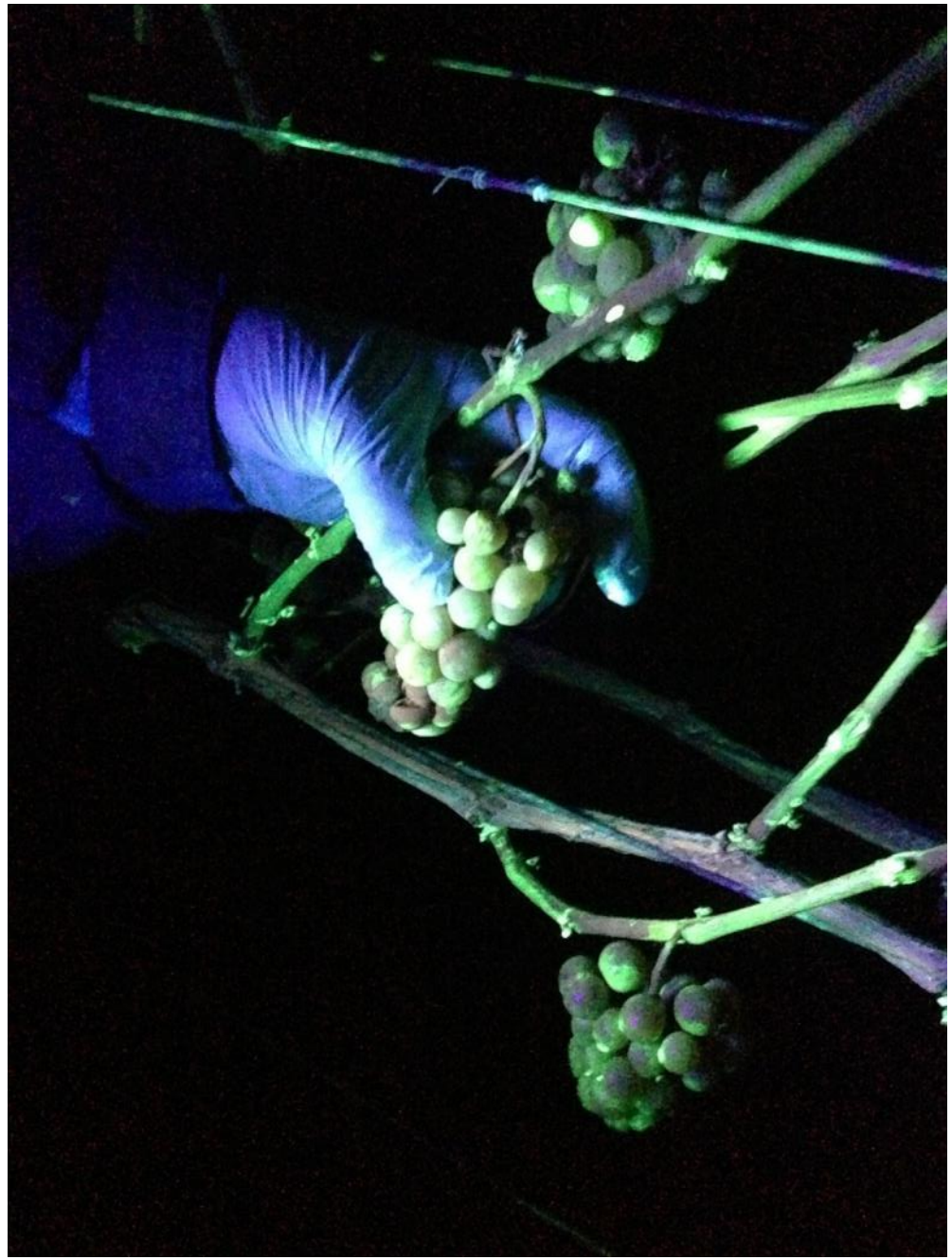


Photo courtesy
of Matt
Strmiska,
ADAPTIV

Visual check for coverage

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The best gauge? $ saved; product premium

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Thank you!
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