FLA Wind Tunnel Characterization of Spray Systems For Mosquito Control



Dukes et.al.



LD₅₀ vs Droplet Diameter

D. Haile, G. Mount & N. Pierce (1982)



Statistic	Flat Fan	High Pressure
	(8002)	(M1)
Dv ₍₁₀₎ (<i>u</i> m)	23	3
Dv ₍₅₀₎ (<i>u</i> m)	78	25
Dv ₍₉₀₎ (<i>u</i> m)	227	78
% Volume > 7 < 22 (<i>u</i> m)	5	20

Spray Cloud Spectra

Flat Fan vs High Pressure



% of Total Volume

Summary

Droplets between 7 and 22 um are the only ones effective in controlling adult mosquitoes.

FF and HP spray systems are capable of producing droplets effective in controlling mosquitoes.

Drift of effective droplets is the same for both **FF** and **HP**.

HP will provide at least a 4 fold increase in effective application rate over **FF** when applied at the same technical rate.

There is a range of droplets between 7 and 22 *u*m which will control mosquitoes and will not appreciably deposit on the ground.

FLA Wind Tunnel for Mosquito Control Contributors

Florida Department of Consumer Services Grant Florida A&M University	\$120,000
Public Health Entomology Research and Education Center	
Pasco Co. Mosquito Control District, Odessa, FL	\$25,000
Collier Co. Mosquito District, Naples	\$25,000
Manatee Co. Mosquito Control District, Palmetto, FL Florida Mosquito Control Association, FL	\$5,000
Lee Co. Mosquito Control District, Ft. Myers, FL	\$194,000











Wind Tunnel Components



Material Delivery Components



Control Room Components









ASAE Reference Nozzles Measured at NMSU, CPAS and FLA Wind Tunnels



NMSU = New Mexico State University CPAS = Center for Pesticide Application Safety FLA = Florida Wind Tunnel

Flat Fan



Two Fluid



High Pressure





Best Case Scenario for Flat Fan Nozzles

135⁰, 140 mph, 80 psi

Droplet Diameter

7 < % Vol. < 22 *u*m

"EFFICIENCY"

Baytex

5

4

4

Dibrom

9

6

6

Permanone

: Orchex 1:1

9

6

6

CALL REAL		·	
	Dv ₍₅₀)) (MMD)	,VMD)
	Permanone	Baytex	Dibrom
	Orchex 1:1		
8001	58	70	56
8002	68	78	64
8003	72	84	71

	(Spraying Systems, 23412-20)						
	Dv (50	D) (MMC	0,VMD)	Droplet Diameter 7 < % Vol. < 22 <i>u</i> m "EFFICIENCY"			
Liquid / Air (psi)	Permanon e : Orchex 1:1	Baytex	Dibrom	Permanone : Orchex 1:1	Baytex	Dibrom	
35 / 30	14	20	14	36	31	32	
40 / 30	16	14	12	30	35	34	
40 / 20	30	32	32	16	26	18	

Air Flow =
$$1.6$$
 to 2.0 scfm

High Pressure Nozzle

(Spraying Systems)

a Tar		Dv ₍₅₀)) (MMD)	,VMD)	Droplet Diameter 7 < % Vol. < 22 <i>u</i> m "EFFICIENCY"		
	Press. (psi)	Permanone : Orchex	Baytex	Dibrom	Permanone : Orchex	Baytex	Dibrom
		1:1			1:1		
M1	1500	28	35	39	18	14	9
	2000	33	30	35	24	17	11
	3000	28	25	27	29	20	18

High Pressure Impinger Nozzle (Bete)



PJ

PJ

1		Dv ₍₅₀)) (MMD)	,VMD)	Droplet Diameter 7 < % Vol. < 22 <i>u</i> m "EFFICIENCY"		eter <i>u</i> m ("
	Press. (psi)	Permanone : Orchex 1:1	Baytex	Dibrom	Permanone : Orchex 1:1	Baytex	Dibrom
10	1500	14	17	16	48	39	38
	2000	12	13	14	56	46	42
	3000	12	13	13	56	49	45
15	1500	17	22	23	42	28	26
	2000	15	19	21	47	32	29
	3000	14	17	17	52	33	37

Summary

•The FLA Wind Tunnel correlates well with other wind tunnels that use the Malvern laser for droplet sizing.

•Flat Fan Low Pressure (40-80 psi) Hydraulic Nozzles.

The nozzles of this type most commonly used in mosquito control were < 10% efficient.

 A 5 fold increase in efficiency of producing droplets in the range of 7 to 22 microns can be achieved through several different nozzle types.

•A 10 fold increase in efficiency of producing droplets in the range of 7 to 22 microns can be achieved with some nozzle types.

Benefits of LCMCD Contributions to FLA Wind Tunnel for Mosquito Control 2002

	ACTIVITY			BENEFITS	
Completion nozzle chai	of first phas racterization	e of DACS grant (inert oil).	1.	Scientifically defined the level or improvement provided by spray system upgrade.	f
			2.	Provided mosquito control distri specific data for improving environmental stewardship.	ct
			3.	Stimulation of independent applicators to upgrade their systems resulting in improved environmental stewardship.	
			4.	Focused mosquito control distrion on improving their systems which are now known to highly inefficient	icts ch ent.

Benefits of LCMCD Contributions to FLA Wind Tunnel for Mosquito Control 2003						
	ACTIVITY		00	BENEFITS		
Completion nozzle cha ingredient)	n of 2nd pha aracterization).	se of DACS grant (active	 Provided El labeling. Finalized ef 	PA with concis	se data for nozzles	
			used in r	nosquito cont	rol.	
Completion nozzle cha novel to m	n of 3rd phas tracterization osquito cont	se of DACS grant (nozzles rol).	unknown			
Publication	n of results o	f DACS grant.	unknown			

Benefits of LCMCD Contributions to FLA Wind Tunnel for Mosquito Control 200?

Effect of temperature on aerosol cloud composition.

Additives for improved nozzle efficiency.

Evaluation of nozzle ware.

Field evaluation of spray systems identified as candidates for enhanced environmental stewardship.

Investigation of new application strategies based on new highly efficient nozzles.

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