MUSKMELON (*Cucumis melo* 'Superstar')
Powdery mildew; *Podosphaera xanthii* (formerly *Sphaerotheca fuliginea*)

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Efficacy of Bravo for powdery mildew control in muskmelon as affected by nozzle type and sprayer, 2001.

Growers presently rely on systemic fungicides for powdery mildew control because conventional nozzles and sprayers deliver little spray material to the underside of cucurbit leaves. Goals of this project were to identify equipment that maximizes spray coverage and to determine if powdery mildew can be controlled effectively with contact (nonsystemic) fungicides when coverage is maximized. A means to improve spray deposition on the leaf underside would improve resistance management, by increasing the proportion of the pathogen population exposed to the low-resistance-risk contact fungicide, and improve control in organic production for which there are no approved systemic fungicides. Novel nozzles for conventional booms reportedly improve coverage by delivering more spray to the leaf underside or reducing drift. The sprayer used in this study was a tractor-drawn unit equipped with an air assist boom and a separate hydraulic boom set-up with multiple nozzles on a single nozzle body. Two novel nozzles (twin jet and air induction) were compared to 3 traditional nozzles (flat fan, hollow cone, and cone jet). All are considered ideal for applying fungicides. Twin-jet nozzles use forward and rearward pointing flat fans, thus providing two chances to hit the plant. They apply the same total amount of liquid as a conventional flat fan. Air induction (air inclusion or venturi) nozzles are flat fan nozzles where an internal venturi creates negative pressure inside the nozzle body. Air is drawn in through two holes in the nozzle side, mixing with the spray liquid. The emitted spray contains large (450 micron) droplets filled with air bubbles and virtually no fine, drift-prone droplets. Normally droplets this large would bounce off their target. However, because of the air bubbles they explode on impact and spread over the leaf as the air absorbs the impact load. Coverage is similar to that of finer sprays produced by traditional nozzles. This experiment was conducted at the Long Island Horticultural Research and Extension Center in a field with Haven loam soil. Fertilizer (666 lb/A of 15-15-15) was broadcast and incorporated on 7 Jun. Transplants were seeded in the greenhouse on 17 May. On 19 Jun, seedlings were transplanted with starter fertilizer (15-30-15) into black plastic mulch at 24-in. within row plant spacing and 68-in. row spacing. Plants were watered using drip irrigation as needed based on irrometer readings. Weeds between rows were controlled by applying Gramoxone Extra EC (2 pt/treated A) on 3 Jul and hand-weeding. Cucumber beetles were managed with a soil drench of Admire 2F (0.02 ml/plant) on 21 Jun and a foliar application of Asana XL (9.6 oz/A) on 14 Jul. To manage Phytophthora fruit and crown rot (*Phytophthora capsici*), Ridomil Gold EC (1 pt/A) was broadcast over the entire field then incorporated on 8 Jun**,** and Acrobat 50WP (6.4 oz/A) was applied on 31 Aug and 7 Sep. Average monthly high and low temperatures (F) were 80/63 in Jun, 80/63 in Jul, 84/68 in Aug, and 75/59 in Sep. Rainfall (in.) was 6.08, 3.43, 4.86, and 2.98 for these months, respectively. A randomized complete block design with four replications was used. Plots contained 12 plants in three 4-plant rows. Upper and lower (under) surfaces of 5 to 50 leaves in each plot were examined for powdery mildew on 31 Jul; 7, 15, 22, and 28 Aug; and 6 Sep. Initially, 50 older leaves were examined in each plot. As disease progressed, leaves of other age classes and fewer total leaves were examined. Number of leaves examined was adjusted based on the incidence of affected leaves in a plot. Beginning on 22 Aug, mid-aged leaves were also examined. Young leaves were examined beginning on 28 Aug. Defoliation, predominantly due to powdery mildew, was assessed on 24 Aug and 4 Sep. Spray coverage was assessed on 29 Aug by attaching water sensitive paper cards in pairs to both leaf surfaces of 10 leaves for each nozzle type. Proportion of each card that changed color due to spray deposit was determined using a computer scanning program specifically designed for this purpose (Droplet Scan, WRK). Ripe, rotten and green fruit were counted on 4 and 11 Sep. Percentage of sucrose was determined using a hand refractometer for two ripe fruit per plot on 27 Aug and 4 Sep.

Neither the air assist boom nor the novel nozzles improved control achieved with Bravo applied with conventional nozzles on a hydraulic boom. Control was improved on the lower leaf surface only when systemic fungicides were also used. The last application was delayed due to 2 days of windy conditions; however, it is unlikely this affected results. Defoliation was significantly lower in fungicide-treated plots than nontreated plots on all assessment dates. There were no significant differences among treatments on 24 Aug when defoliation was 1-5% versus 45% for nontreated. On 17 Sep, defoliation was lower for the Quadris alternated with Bravo + Nova treatment (21%) than for the Bravo treatments (42 to 61%). Nontreated fruit had the lowest sucrose concentration; however, there were no significant differences among treatments (data not presented). Spray deposit on water sensitive paper corresponded to powdery mildew control results except that significantly less material was deposited on upper leaf surfaces with the air assist boom than with any nozzles on the hydraulic boom. In conclusion, it was not apparent that the novel spray application technologies improved powdery mildew control with Bravo. This experiment has demonstrated that it is challenging to improve spray coverage on the lower surface of muskmelon leaves by changing spray equipment. Similar results were obtained in a parallel experiment with pumpkin.

Fungicide and rate/A [a]	Powdery mildew severity (% leaf coverage) [b]						Defol-		
Sprayer type	upper leaf surface			lower leaf surface			iation	Spray deposit	
Nozzle (pressure, gallonage)	28 Aug	6 Sep	AUDPC	28 Aug	6 Sep	AUDPC	4 Sep	upper	lower
Nontreated ……………………………..…	69.52 a[c]	73.0 a	912 a	73 a	87 a	961 a	88 a		
Bravo Ultrex 82.5WG 2.7 lb									
Hydraulic boom									
Flat fan (65 psi, 53 gpa) ……………..	0.06 b	3.5 b	18 b	49 b	61 bc	654 bc	21 bc	80 a	5
D3-45 hollow cone (65 psi, 76 gpa) …	0.00 b	5.2 b	23 b	38 b	69 abc	601 c	9 bc	80 a	5
Conejet (80 psi, 42 gpa) ……………...	0.10 b	0.6 b	4 b	45 b	59 c	617 bc	13 bc	70 a	14
Twin-jet flat fan (65 psi, 68 gpa) …….	0.34 b	3.5 b	21 b	40 b	65 abc	627 bc	20 bc	76 a	6
Air inclusion (72 psi, 74 gpa) ……….	0.17 b	2.1 b	15 b	53 b	83 ab	780 b	6 c	75 a	6
Air assist boom									
Yellow albuz (50 psi, 26 gpa) ………..	0.38 b	11.4 b	58 b	36 b	60 bc	549 c	28 b	35 b	8
Quadris F 15.4 oz alt Bravo+Nova 40W 5 oz									
Hydraulic boom									
Flat fan (65 psi, 53 gpa) ………..……	0.00 b	0.2 b	1 b	2 b	49 c	239 d	9 bc		
P-value	0.0001	0.0001	0.0001	0.0001	0.0322	0.0001	0.0001	0.0016	0.571

[a] Applications were made on 1, 8, 16, and 23 Aug and 2 Sep.

[b] Powdery mildew colonies were counted and converted to severity using the conversion factor of 10 colonies/leaf = 1%. When colonies could not be counted accurately because they had coalesced and/or were too numerous, severity was estimated. Average severity for the entire canopy was calculated from the individual leaf assessments. A square root transformation was used when needed to stabilize variance. The table contains de-transformed values.

[c] Numbers in a column with a letter in common are not significantly different according to Fisher's Protected LSD ($P = 0.05$).