GROWERTALKS

Features

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Cutting to the Chase

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Whiteflies are among the most persistent and costly pests of greenhouse ornamental plants. They reproduce quickly, hide on the undersides of leaves and can build noticeable adult populations in a short time, often becoming most apparent when they flutter up as the plants are handled.

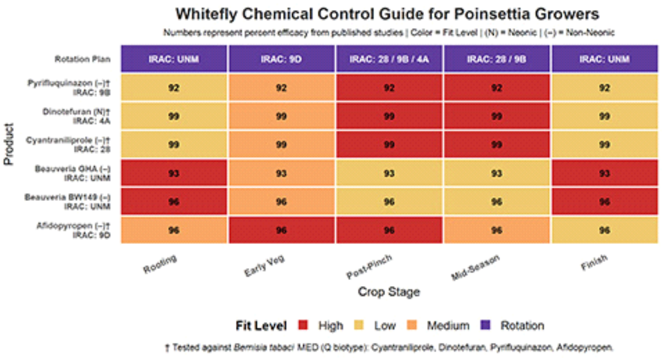
Across 15 years of available trial results spanning multiple crops, biotypes and chemistries, a consistent pattern emerges. Only a small group of products consistently deliver strong control and growers who rotate them at the right time see the best results.

This article summarizes those findings using the dataset in Table 1 and the new summary heatmap in Figure 1. Together, they provide a practical, evidence-based field guide for building a season-long whitefly management program across ornamental crops, including poinsettia.

How we analyzed the data

We synthesized efficacy data from 15 years of published greenhouse trials evaluating chemical and microbial products against *Bemisia tabaci*, drawing from both journal articles and Arthropod Management Tests. To allow meaningful comparison across crops, chemistries and biotypes, we included only studies that reported percent efficacy, used compatible sampling intervals, employed quantifiable endpoints and clearly described methods. Because we focused on comparable methods that met our criteria, not all published studies or IR-4 data could be included. Percent efficacy was used because it provides a common scale across studies and not all trials reported the raw counts or stage-specific data needed to calculate percent reduction consistently. Arthropod Management Tests were included when their greenhouse protocols and reporting formats aligned with these criteria, thereby broadening the range of chemistries represented.

Products achieving ≥90% efficacy in at least one trial were flagged as high performing and those showing this level of control across multiple independent trials were emphasized in the summary presented in Figure 1. The dataset is intentionally narrow, focusing on studies with methods that could be compared side by side rather than attempting to capture every trial conducted during this period. “Fit” in Figure 1 reflects the combination of reported efficacy, consistency across trials and how each product performed relative to typical whitefly pressure at each crop stage. These patterns represent performance under controlled greenhouse conditions similar to those used in commercial ornamental production.



Whitefly Chemical Control Guide for Poinsettia Growers

Numbers represent percent efficacy from published studies | Color = Fit Level | (N) = Neonic | (–) = Non-Neonic

Product	Rooting	Early Veg	Post-Pinch	Mid-Season	Finish
Rotation Plan	🟪 IRAC: UNM	🟪 IRAC: 9D	🟪 IRAC: 28 / 9B / 4A	🟪 IRAC: 28 / 9B	🟪 IRAC: UNM
Pyrifluquinazon (–)† IRAC: 9B	🟨 92	🟧 92	🟥 92	🟥 92	🟨 92
Dinotefuran (N)† IRAC: 4A	🟨 99	🟧 99	🟥 99	🟥 99	🟨 99
Cyantraniliprole (–)† IRAC: 28	🟨 99	🟧 99	🟥 99	🟥 99	🟨 99
Beauveria GHA (–) IRAC: UNM	🟥 93	🟧 93	🟨 93	🟨 93	🟥 93
Beauveria BW149 (–) IRAC: UNM	🟥 96	🟧 96	🟨 96	🟨 96	🟥 96
Afidopyropen (–)† IRAC: 9D	🟧 96	🟥 96	🟥 96	🟧 96	🟨 96

Fit Level 🟥 High 🟨 Low 🟧 Medium 🟪 Rotation

† Tested against *Bemisia tabaci* MED (Q biotype): Cyantraniliprole, Dinotefuran, Pyrifluquinazon, Afidopyropen.

What Table 1 tells us

Table 1 summarizes 15 published trials across salvia, zinnia, basil, hibiscus and poinsettia. Reported efficacy ranged from –45% to 99%. Only four products—cyantraniliprole, dinotefuran, pyrifluquinazon and afidopyropen—consistently reached the ≥90% threshold. Most other chemistries fell between 20% and 70%, and several feeding disruptors, spinosyn combinations and products with unknown modes of action (MOA products are insecticides classified by how they kill or disable pests) showed moderate or inconsistent performance. In contrast, two microbial products (*Beauveria bassiana* strains GHA and BW149) exceeded 90% efficacy in hibiscus trials.

High-performing products (≥90% efficacy)

Across all studies in Table 1, only four products reached or exceeded the ≥90% threshold, and their trial results show how strongly they surpassed that mark: cyantraniliprole (IRAC 28, where IRAC refers to the Insecticide Resistance Action Committee’s mode of action classification system) at 99% and 93%, dinotefuran (IRAC 4A) at 99%, pyrifluquinazon (IRAC 9B) at 92%, and afidopyropen (IRAC 9D) at 96%. These materials form the core of the “top performer” group summarized in Figure 1. They repeatedly delivered strong control across crops, biotypes and growing conditions, including the MED/Q whitefly biotype.

Although MED/Q is resistant to several insecticide groups, it’s not resistant to all chemistries; the products listed here represent the few modes of action in this dataset that still provide reliable suppression. Even so, they’re not used throughout the entire crop cycle because poinsettias move through stages with very different sensitivity, residue concerns and whitefly pressure.

Trials on salvia and the MED/Q biotype produced the highest values because those studies used the strongest chemistries, while trials on basil, hibiscus and the MEAM1/B biotype used products with inherently lower performance. These differences in product selection—not crop or biotype alone—help explain why a product that looks excellent in one crop or biotype may appear weaker in another.

MOA patterns

High-efficacy products were concentrated in three MOA groups: 1) IRAC 28—ryanodine receptor modulators; 2) IRAC 4A—neonicotinoids; 3) IRAC 9B/9D—feeding disruptors. Other groups showed more variable performance, including 4) IRAC 29—chordotonal organ modulators (flonicamid); 5) NA (Not Assigned)—products with unknown modes of action; 6) IRAC 4D—butenolides (flupyradifurone); 7) IRAC 5 + 4C—spinosyns + sulfoximines (spinetoram + sulfoxaflor); 8) IRAC 9B—feeding disruptors (pymetrozine); and 9) UNM (Unclassified Microbials)—microbial products. IRAC groups 4 to 8 fall within the low-to-moderate efficacy MOA category, while microbial products (group 9) were the main exception because they performed strongly in hibiscus trials, unlike the other low-to-moderate groups.

Neonicotinoid vs. non neonicotinoid performance

When high-performing products were grouped by mode of action, the IRAC 4A neonicotinoid dinotefuran showed higher average efficacy than most non-neonic chemistries in this dataset. Even so, it was the only product that consistently reached the ≥90% threshold.

IRAC 4D (flupyradifurone) and IRAC 4C (sulfoxaflor, evaluated here in combination with spinetoram) aren’t classified as neonicotinoids, and their performance in these trials was moderate rather than high. It’s important to note that products within the same IRAC group don't always perform similarly. Whitefly populations that show reduced sensitivity to one neonicotinoid (such as imidacloprid) may still respond well to another (such as dinotefuran), even though both are classified as IRAC 4A. This reinforces the rationale that efficacy is determined by the specific active ingredient rather than the MOA group alone. This means efficacy is product-specific, not class-wide. In Figure 1, only the true neonicotinoid (IRAC 4A, dinotefuran) is labeled (N); all other products shown in the figure are labeled (–) because they're non-neonic.

A note for growers concerned about pollinators

Poinsettias do produce a small amount of sugary exudate in cyathia, but they're grown indoors and aren't visited by bees under commercial greenhouse conditions. As a result, neonicotinoids do not present a pollinator exposure pathway in poinsettia production. Even so, many large retailers require "non-neonic programs" for marketing reasons rather than biological necessity. Growers can meet those requirements by relying on pyrifluquinazon, afidopyropen and microbial products, while still keeping highly effective tools like dinotefuran available when permitted.

Crop & biotype context

Crop and biotype differences influence how products appear to perform in whiteflies and Table 1 shows that each crop–biotype combination was evaluated with a different set of chemistries. The efficacy values, therefore, reflect the interaction between the crop, the biotype present and the products used in that particular study.

For growers, the practical point is that a material may look stronger in one trial and more moderate in another because the crop, the biotype and the overall study conditions were different. Keeping these factors in mind helps align expectations with the performance patterns seen across the dataset.

Where these products fit in poinsettia production

Poinsettias move through five predictable stages and product fit depends on both crop physiology and residue sensitivity.

1. Rooting/establishment—Rooting of unrooted cuttings or initial stabilization of newly received rooted plugs; many growers now start with rooted liners and cutting dips are often used to reduce early whitefly establishment
2. Transplanting—Moving rooted plugs into their final pot size (when plugs are purchased prerooted)
3. Early vegetative—Active growth before pinch
4. Post-pinch—Regrowth and canopy shaping
5. Mid-season—Bulk vegetative growth
6. Finish—Bract development and coloration, when phytotoxicity and residue concerns are highest

The strongest chemistries—such as cyantraniliprole, dinotefuran and pyrifluquinazon—generally fit best in post-pinch and mid-season when whitefly pressure can rise if early suppression was incomplete. However, early intervention is often the most effective point of control because populations are still low, localized and more easily suppressed.

Systemic products—particularly dinotefuran—are frequently applied shortly after transplanting, once plants are in their final pot size, to support uptake and provide extended systemic activity before populations expand. Microbials and softer chemistries remain the better fit in rooting and finish because plant sensitivity and bract safety, rather than whitefly biology, drive product choice during these stages. However, microbial formulations differ in how they behave on poinsettia foliage: some wettable powder products can leave visible residues on bracts, while certain emulsifiable suspension formulations may increase the likelihood of phytotoxicity during coloration. These formulation-specific considerations are important when selecting products for the finish stage.

What Figure 1 shows

Figure 1 presents 15 years of trial results in a single visual summary and shows how each product aligns with the different stages of poinsettia production. Because the figure combines efficacy values with crop-stage considerations, it helps readers see not only how strongly a product performed in trials, but also where it's typically positioned in the crop.

In this context, "fit" refers to how well a product's reported performance and crop-stage needs match one another, which is why the strongest chemistries are concentrated in the middle of the crop. Products such as pyrifluquinazon, dinotefuran and cyantraniliprole all achieved more than 90% reduction in trials, yet they aren't rated as high-fit in rooting or finish because those stages involve more sensitive tissues.

Microbial products such as *Beauveria bassiana* appear to be a good fit in the early and late stages because they're commonly used when protection of cuttings and bracts is a priority, although formulation-limited. The figure makes these stage-specific patterns visible at a glance and highlights that only a small group of chemistries—and two microbial agents—repeatedly reached the highest efficacy values in the trials summarized in Table 1.

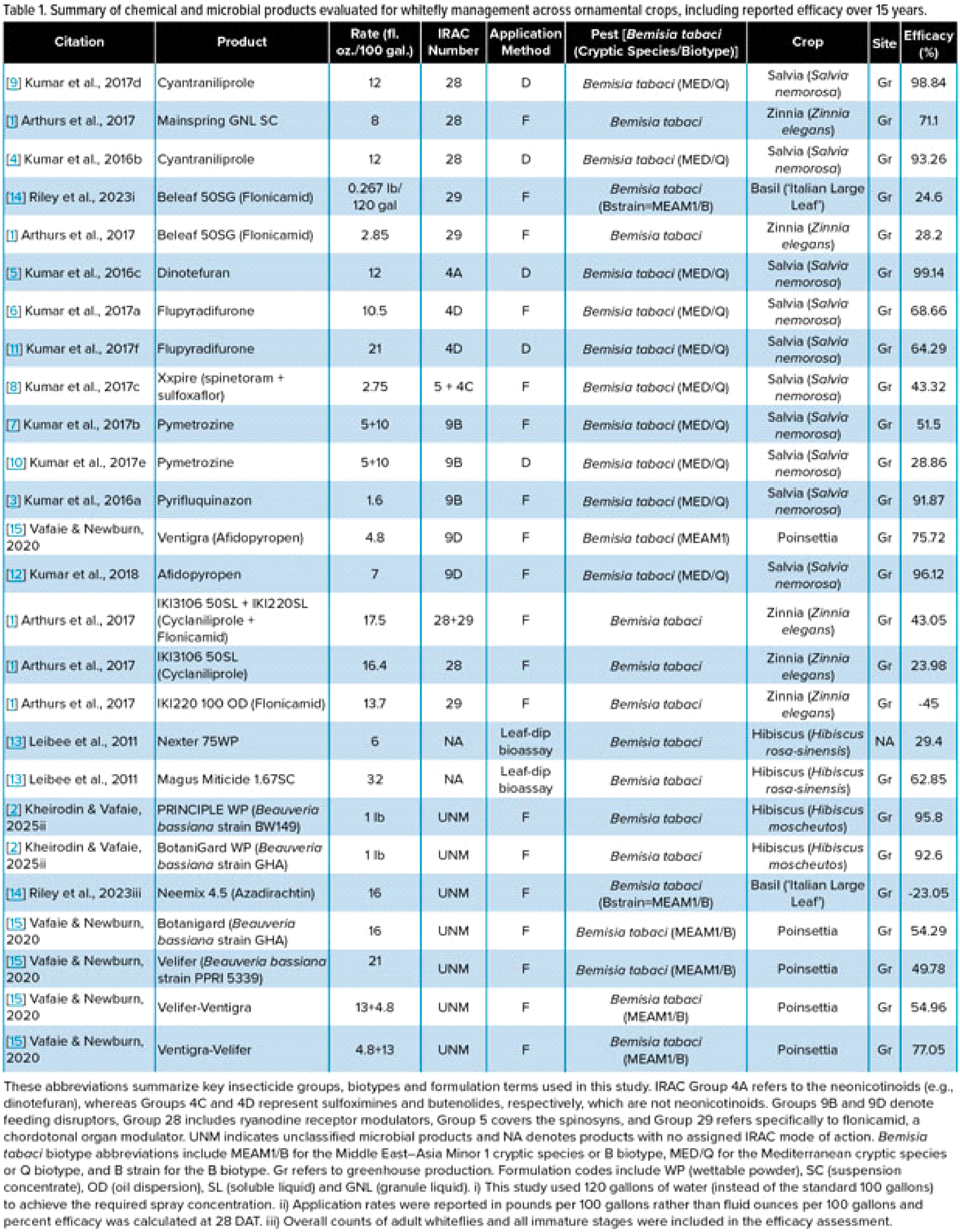


Table 1. Summary of chemical and microbial products evaluated for whitefly management across ornamental crops, including reported efficacy over 15 years.

Citation	Product	Rate (fl. oz./100 gal.)	IRAC Number	Application Method	Pest [*Bemisia tabaci* (Cryptic Species/Biotype)]	Crop	Site	Efficacy (%)
[9] Kumar et al., 2017d	Cyantraniliprole	12	28	D	*Bemisia tabaci* (MED/Q)	Salvia (*Salvia nemorosa*)	Gr	98.84
[1] Arthurs et al., 2017	Mainspring GNL SC	8	28	F	*Bemisia tabaci*	Zinnia (*Zinnia elegans*)	Gr	71.1
[4] Kumar et al., 2016b	Cyantraniliprole	12	28	D	*Bemisia tabaci* (MED/Q)	Salvia (*Salvia nemorosa*)	Gr	93.26
[14] Riley et al., 2023i	Beleaf 50SG (Flonicamid)	0.267 lb/ 120 gal	29	F	*Bemisia tabaci* (Bstrain=MEAM1/B)	Basil ('Italian Large Leaf')	Gr	24.6
[1] Arthurs et al., 2017	Beleaf 50SG (Flonicamid)	2.85	29	F	*Bemisia tabaci*	Zinnia (*Zinnia elegans*)	Gr	28.2
[5] Kumar et al., 2016c	Dinotefuran	12	4A	D	*Bemisia tabaci* (MED/Q)	Salvia (*Salvia nemorosa*)	Gr	99.14
[6] Kumar et al., 2017a	Flupyradifurone	10.5	4D	F	*Bemisia tabaci* (MED/Q)	Salvia (*Salvia nemorosa*)	Gr	68.66
[11] Kumar et al., 2017f	Flupyradifurone	21	4D	D	*Bemisia tabaci* (MED/Q)	Salvia (*Salvia nemorosa*)	Gr	64.29
[8] Kumar et al., 2017c	Xxpire (spinetoram + sulfoxaflor)	2.75	5 + 4C	F	*Bemisia tabaci* (MED/Q)	Salvia (*Salvia nemorosa*)	Gr	43.32
[7] Kumar et al., 2017b	Pymetrozine	5+10	9B	F	*Bemisia tabaci* (MED/Q)	Salvia (*Salvia nemorosa*)	Gr	51.5
[10] Kumar et al., 2017e	Pymetrozine	5+10	9B	D	*Bemisia tabaci* (MED/Q)	Salvia (*Salvia nemorosa*)	Gr	28.86
[3] Kumar et al., 2016a	Pyrifluquinazon	1.6	9B	F	*Bemisia tabaci* (MED/Q)	Salvia (*Salvia nemorosa*)	Gr	91.87
[15] Vafaie & Newburn, 2020	Ventigra (Afidopyropen)	4.8	9D	F	*Bemisia tabaci* (MEAM1)	Poinsettia	Gr	75.72
[12] Kumar et al., 2018	Afidopyropen	7	9D	F	*Bemisia tabaci* (MED/Q)	Salvia (*Salvia nemorosa*)	Gr	96.12
[1] Arthurs et al., 2017	IKI3106 50SL + IKI220SL (Cyclaniliprole + Flonicamid)	17.5	28+29	F	*Bemisia tabaci*	Zinnia (*Zinnia elegans*)	Gr	43.05
[1] Arthurs et al., 2017	IKI3106 50SL (Cyclaniliprole)	16.4	28	F	*Bemisia tabaci*	Zinnia (*Zinnia elegans*)	Gr	23.98
[1] Arthurs et al., 2017	IKI220 100 OD (Flonicamid)	13.7	29	F	*Bemisia tabaci*	Zinnia (*Zinnia elegans*)	Gr	-45
[13] Leibee et al., 2011	Nexter 75WP	6	NA	Leaf-dip bioassay	*Bemisia tabaci*	Hibiscus (*Hibiscus rosa-sinensis*)	NA	29.4
[13] Leibee et al., 2011	Magus Miticide 1.67SC	32	NA	Leaf-dip bioassay	*Bemisia tabaci*	Hibiscus (*Hibiscus rosa-sinensis*)	Gr	62.85
[2] Kheirodin & Vafaie, 2025ii	PRINCIPLE WP (*Beauveria bassiana* strain BW149)	1 lb	UNM	F	*Bemisia tabaci*	Hibiscus (*Hibiscus moscheutos*)	Gr	95.8
[2] Kheirodin & Vafaie, 2025ii	BotaniGard WP (*Beauveria bassiana* strain GHA)	1 lb	UNM	F	*Bemisia tabaci*	Hibiscus (*Hibiscus moscheutos*)	Gr	92.6
[14] Riley et al., 2023iii	Neemix 4.5 (Azadirachtin)	16	UNM	F	*Bemisia tabaci* (Bstrain=MEAM1/B)	Basil ('Italian Large Leaf')	Gr	-23.05
[15] Vafaie & Newburn, 2020	Botanigard (*Beauveria bassiana* strain GHA)	16	UNM	F	*Bemisia tabaci* (MEAM1/B)	Poinsettia	Gr	54.29
[15] Vafaie & Newburn, 2020	Velifer (*Beauveria bassiana* strain PPRI 5339)	21	UNM	F	*Bemisia tabaci* (MEAM1/B)	Poinsettia	Gr	49.78
[15] Vafaie & Newburn, 2020	Velifer-Ventigra	13+4.8	UNM	F	*Bemisia tabaci* (MEAM1/B)	Poinsettia	Gr	54.96
[15] Vafaie & Newburn, 2020	Ventigra-Velifer	4.8+13	UNM	F	*Bemisia tabaci* (MEAM1/B)	Poinsettia	Gr	77.05

These abbreviations summarize key insecticide groups, biotypes and formulation terms used in this study. IRAC Group 4A refers to the neonicotinoids (e.g., dinotefuran), whereas Groups 4C and 4D represent sulfoximines and butenolides, respectively, which are not neonicotinoids. Groups 9B and 9D denote feeding disruptors, Group 28 includes ryanodine receptor modulators, Group 5 covers the spinosyns, and Group 29 refers specifically to flonicamid, a chordotonal organ modulator. UNM indicates unclassified microbial products and NA denotes products with no assigned IRAC mode of action. *Bemisia tabaci* biotype abbreviations include MEAM1/B for the Middle East–Asia Minor 1 cryptic species or B biotype, MED/Q for the Mediterranean cryptic species or Q biotype, and B strain for the B biotype. Gr refers to greenhouse production. Formulation codes include WP (wettable powder), SC (suspension concentrate), OD (oil dispersion), SL (soluble liquid) and GNL (granule liquid). i) This study used 120 gallons of water (instead of the standard 100 gallons) to achieve the required spray concentration. ii) Application rates were reported in pounds per 100 gallons rather than fluid ounces per 100 gallons and percent efficacy was calculated at 28 DAT. iii) Overall counts of adult whiteflies and all immature stages were included in the efficacy assessment.

Microbials: *Beauveria bassiana* GHA & BW149

Microbials are best suited to rooting and finish, where they provide steady suppression without stressing young plants. They're especially valuable when crops are sensitive or when bract safety is a priority, and they offer dependable early knockdowns, as well as effective late-season cleanup, although formulation differences can influence residue and phytotoxicity risk during bract development. They're also compatible with parasitoids, predatory mites and predatory beetles, supporting growers who integrate biological control early in the crop.

Afidopyropen (IRAC 9D)
Afidopyropen is a flexible tool because it performs reliably across multiple crop stages and helps bridge the transition from early biological inputs to the stronger mid-season chemistries. The dataset summarized here shows its strongest fit during the early vegetative and post-pinch stages, where it consistently reduces adult whitefly populations without stressing young plants. Its performance is more moderate in rooting and mid-season, reflecting both the sensitivity of young cuttings early on and the higher whitefly pressure later in the crop. This stage dependent pattern makes afidopyropen a useful option for growers who prefer to avoid neonicotinoids while still maintaining steady suppression as the canopy develops.

Cyantraniliprole, Dinotefuran & Pyrifluquinazon
Cyantraniliprole, dinotefuran and pyrifluquinazon were the strongest overall performers in the trials summarized here, with reported efficacy values ranging from 92% to 99% across multiple crops and biotypes. In these studies, their best fit occurred during the post-pinch and mid-season stages, when whitefly pressure was highest and when products with consistently high trial performance were most useful for maintaining low populations. The trials also showed clear reductions in adult whiteflies over the evaluation periods. All three were tested against the MED/Q biotype, which is noteworthy because this lineage has documented resistance to several insecticide groups.

Why this matters
The stage-based fit patterns in Figure 1 support a simple, intuitive rotation that growers can follow without overthinking MOA codes or product lists. Our rotation plan—Early, Bridge, Peak, Clean (E–B–P–C)—aligns directly with crop development and the biology of whiteflies.

In the Early period (rooting to early vegetative), the goal is to establish clean plants without stressing young tissues, beginning with *Beauveria bassiana* to keep pressure low and introducing afidopyropen as the canopy expands. The Bridge period (early vegetative to post-pinch) maintains suppression through the transition, with afidopyropen holding populations down until stronger chemistries are appropriate.

The Peak period (post-pinch to mid-season) is when whitefly pressure is highest, and cyantraniliprole, dinotefuran and pyrifluquinazon provide the most value. The Clean period (finish) returns to *Beauveria bassiana* to protect bracts while minimizing residue. This sequence reduces early establishment, prevents mid-season population spikes and avoids late-season residue issues.

The Rotational Plan for Growers provides the operational details that correspond directly to the IRAC rotation row in Figure 1.

1. Rooting (Weeks 0 to 4-plus) represents the early treatment window, even though full rooting may take four to six weeks depending on region, temperature and cultivar; use Beauveria bassiana (GHA or BW149) and softer chemistries as needed.
2. Early vegetative (Weeks 2 to 4) uses afidopyropen (IRAC 9D) with microbials as needed.
3. Post-pinch (Weeks 4 to 6) uses cyantraniliprole (IRAC 28), pyrifluquinazon (IRAC 9B)* and dinotefuran (IRAC 4A). If pyrifluquinazon (IRAC 9B) is used here, it should be omitted from mid-season to avoid consecutive use of the same mode of action.
4. Mid-season (Weeks 6 to 9) uses cyantraniliprole (IRAC 28) and pyrifluquinazon (IRAC 9B).
5. Finish (Weeks 9 to 14) returns to Beauveria bassiana (GHA or BW149) and softer chemistries. This rotation distributes selection pressure across multiple MOA groups and helps preserve the long term

effectiveness of the strongest tools.

The story these trials tell

Fifteen years of greenhouse trials show a clear pattern. Only a small group of products delivers reliable whitefly control and they come from just a few MOA groups. When growers place these tools at the right points in the crop, whitefly populations remain manageable. A simple rotation works: microbials early, the strongest chemistries mid-season and softer tools at finish. This approach keeps pressure low, slows resistance and helps growers finish with clean, market-ready plants.

Top takeaways for growers
The lessons from these trials are direct and practical.

1. Only a few products consistently reach high control.
2. Rotating MOA groups protects the strongest tools.
3. Products work best when matched to the crop stage, not just the pest.
4. Neonics remain effective and poinsettias are not pollinator-relevant crops.
5. Clean finishes depend on reducing pressure early, not trying to fix problems late.

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