**Targeted Fungicides for Cucurbit Powdery Mildew**

This table includes information on when these fungicides received U.S. federal registration for use, when resistance was confirmed, and the current status and use recommendation based on occurrence of resistance in pathogen. Fungicides are listed by FRAC Code. PCR = partial cross resistance.

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| --- | --- | --- | --- | --- | --- |
| **Trade name**  | **Active ingredient** | **FRAC Code** | **When labeled in U.S.** | **Resistance confirmed** | **Status or current use recommendation** |
| Benlate z | benomyl | 1 | 1972 | 1967 | discontinued |
| Topsin M z | thiophanate-methyl | 1 | after Benlate | cross resistance | not recommended |
| Bayleton | triadimefon | 3 | 1984 (April) | 1990 (1986 suspected) | discontinued |
| Nova, Rally y | myclobutanil | 3 | 2000 | PCR | not recommended |
| Procure y | triflumizole | 3 | 2002 | PCR | recommended |
| Proline y | prothioconazole | 3 | after Procure | PCR | recommended |
| *other DMIs* y | *multiple* | 3 | after Procure | PCR | some recommended |
| Pristine, Endura | boscalid | 7 | 2003 (July) | 2008 | not recommended |
| Fontelis w, Merivon w, etc. | penthiopyrad, fluxapyroxad | 7 | after Pristine | cross resistant w/boscalid | not recommended |
| Luna Exper-ience x, w | fluopyram, tebuconazole | 7, 3 | 2012 | PCR | recommended. Use sparingly |
| Quadris z | azoxystrobin | 11 | 1999 (spring) | 2002 | not recommended |
| *other QoIs* z | *multiple* | 11 | after Quadris | cross resistance | not recommended |
| Quintec t, v | quinoxyfen | 13 | 2007 | 2015 | not recommended |
| Torino t, u | cyflufenamid | U6 | 2012 (July) | 2017 | not recommended |
| Vivando | metrafenone | 50 | 2014 (spring) |  | recommended |
| Prolivo s | pyriofenone | 50 | 2017 |  | recommended |
| Gatten w, s | flutianil | U13 | 2018 |  | not top choice s |

**Key**

PCR = partial cross resistance.

z Resistance to FRAC code 1 and 11 active ingredients is qualitative, thus pathogen strains are either resistant or sensitive. Cross resistance is complete and renders all products in the group ineffective. Resistance to these chemistries have remained common in the pathogen population.

y Resistance to FRAC code 3 active ingredients is quantitative, thus cross resistance is partial (PCR). Products registered after Bayleton have higher inherent activity. Their efficacy varies.

x Luna fungicides contain fluopyram plus another active ingredient in a different chemical group (FRAC 3 or 11). PCR was documented with other succinate dehydrogenase inhibitor (SDHI) fungicides (FRAC 7), thus Luna fungicides can effectively control boscalid-resistant strains whereas Merivon and Fontelis cannot. However, control with Luna Sensation was poor in 2017 at LIHREC.

w Not permitted used on Long Island, New York. Fontelis not labeled for use on cucurbits in NY.

v Labeled in 2007 for use only on melons; 2009 for pumpkin and winter squash. Isolates resistant to Quintec and typically also to Torino and Endura have been found commonly in crops where Quintec was used.

u Poor control in fungicide evaluation at LIHREC in 2017. Resistance confirmed.

t Torino and Quintec are not recommended because control failure has been associated with pathogen isolates resistant to these fungicides in a research planting and powdery mildew can be effectively managed with other fungicides (ex FRAC 3 fungicides alternated with Vivando). An application of either Quintec or Torino may contribute to control if resistance frequency is low in a planting, which recent research findings suggest often to be the case until these fungicides are applied. While results from prior year testing of pathogen isolates provide some indication of expected resistance occurrence, the pathogen population changes yearly reflecting ability of the pathogen’s wind-dispersed spores to be spread widely. See results from testing powdery mildew isolates for more information.

s Apply Prolivo with a nonionic surfactant. Prolivo and Gatten in some university fungicide evaluations have exhibited moderate control of powdery mildew on the lower surface of leaves, where control achieved with targeted fungicides is most important. In experiments conducted with susceptible pumpkin varieties, control based on AUDPC values was 66% with Prolivo and 52% with Gatten versus 97% with Procure in OH in 2021 (PDMR16:V079), and 25% with Prolivo, 56% with Gatten, and 92% with alternation of Vivando, Quintec, and Torino in PA in 2021 (PDMR16:V091). However, control was 87% with Prolivo applied with a nonionic surfactant, as recommended by the manufacturer, in the 2022 fungicide evaluation conducted at LIHREC with applications made on a preventive schedule to an intermediate resistant pumpkin variety (PDMR17:V061). Prolivo is less expensive to apply than Vivando which is in the same FRAC group.

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