

PENBOTEC™ 400 SC, A NEW POSTHARVEST FUNGICIDE

Dany Bylemans and Bill Goodwine

Janssen Pharmaceutica N.V

INTRODUCTION

PENBOTEC™ 400 SC is a new postharvest fungicide on the market for use in citrus and pome fruit. It contains pyrimethanil, a fungicide of the chemical class of aniline-pyrimidines. Its biochemical mode of action is the inhibition of fungal secretion of cell wall degradation enzymes like proteinases, cellulases, pectinases and laccase. Moreover, pyrimethanil inhibits the biosynthesis of methionine via the enzyme cystathione β -lyase. This biochemical mode of action is physiologically reflected by reduced spore germination, inhibition of germ tube extension and the prevention of lesion expansion. The latter is the result of the blockage of the lytic function of infection hyphae. As a consequence PENBOTEC™ 400 SC is a fungicide with preventive and curative action. This mode of action differs from existing fungicides in pre- or postharvest application on citrus or pome fruit: mitochondrial respiration (e.g., Abound), osmotic stability (e.g., Scholar), ergosterol biosynthesis (e.g., Fungaflor) or interference with nucleus or cell division (e.g., Mertect).

BIOLOGICAL ACTIVITY AND SPECTRUM ON POME FRUIT PATHOGENS

Trials in different institutes and universities in the United States demonstrated the excellent activity of PENBOTEC™ 400 SC on the major pome fruit pathogens: gray mold (*Botrytis cinerea*) and blue mold (*Penicillium expansum*) by dip, drenching, in-line spray and wax incorporation (Figures 1 and 2). These effects were proven on both apple and pear.

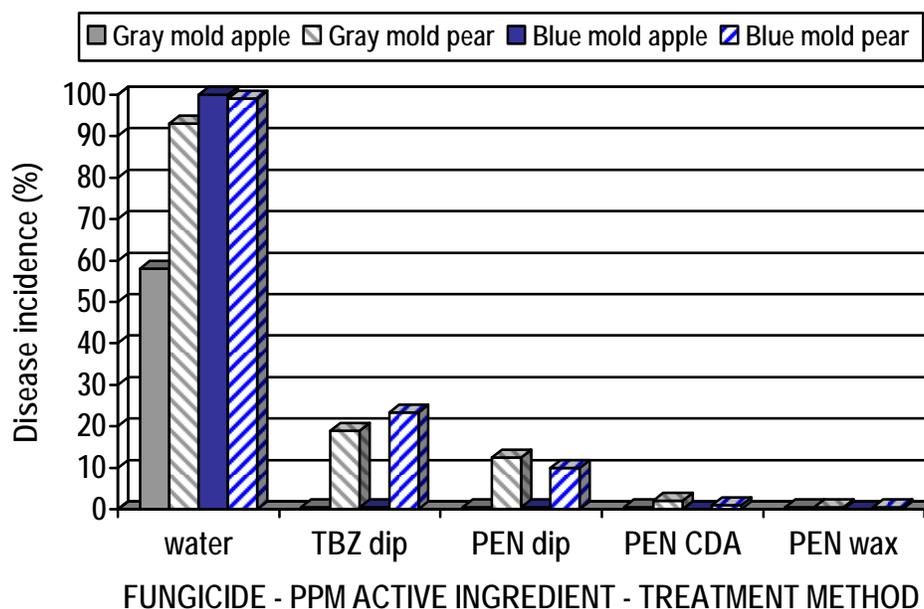


Figure 1. PENBOTEC™ for mold control on apple and pear. Art. infestation (Sanderson, WTFRC, 2002) TBZ : 526 ppm (dip); PEN: 500 (dip), 1000 (CDA), 2000 (wax) ppm a.i.

Dose rates of PENBOTEC™ 400 SC are 16 to 32, 32 and 64 fluid ounces per 100 gallons for dip or drench, line spray or controlled droplet applicator (CDA) and wax incorporation, respectively. A fruit residue above 1 ppm should be targeted.

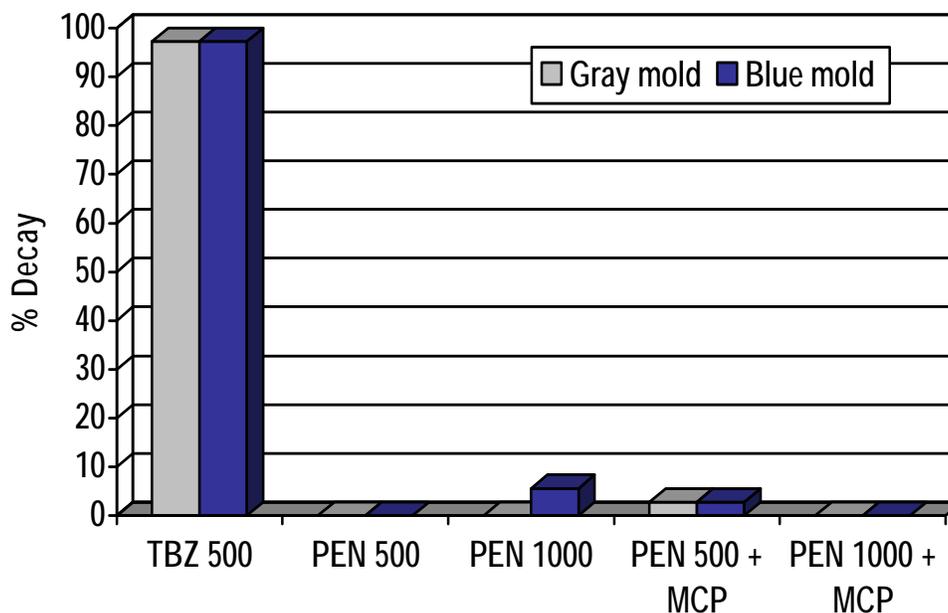


Figure 2. PENBOTEC™ and 1-MCP Dr. Errampali, AAFC Canada, 2004 art inf. TBZ-R strains, 1ppm 1-MCP, apple cv. Empire, 126 cold + 7 d RT

Besides the above mentioned activity of blue and gray mold, good activity was obtained on secondary diseases as *Pezicula alba* (*Phlyctaena vagabunda*), lenticel rot which is very much related to bull's eye rot (*Pezicula malicortitis*), *Phacidiopycnis pyri*, and *Phialophora malorum* (side rot). Field trials for label extension are ongoing.

Optimal efficacy was obtained if the treatment was executed up to 16 hours after artificial inoculation. Because fruit might be wounded during picking or transport, it is recommended to treat the fruit as soon as possible after harvest. A second application is possible before packing.

COMPATIBILITY

PENBOTEC™ 400 SC was shown to be compatible with the antioxidants used for scald control [ethoxyquin and diphenylamine (DPA)], the fungicide thiabendazole (TBZ), calcium chloride and 1-MCP (SmartFresh™).

No adverse phytotoxic effects or visible spray residue was observed on the following varieties of apple when PENBOTEC™ 400 SC was used according the recommendations: Boskoop, Braeburn, Bramley's Seedling, Cox O.P., Elstar, Empire, Fuji, Gala, Golden Delicious, Granny Smith, Honeycrisp, Import, Jonagold, Jonagored, McIntosh, Pink Lady® brand, Redcort, Red Delicious and Stark. None of the following pear varieties were adversely affected by treatment

with PENBOTEC™ 400 SC: Anjou, Bartlett, Bosc, Concorde, Conference, Doyennée du Comice, Durendeau, Packhams, Blanquilla and Kaiser.

SENSITIVITY MONITORING AND ANTI-RESISTANCE STRATEGY

Extensive research has indicated that strains of *B. cinerea* or *P. expansum*, were equally sensitive for PENBOTEC™ 400 SC, independent from their sensitivity for TBZ. As a consequence, no cross resistance between PENBOTEC™ 400 SC and TBZ is to be expected. More than 60 strains of both pathogens, which were collected in the United States, showed a similar sensitivity for PENBOTEC™ 400 SC, with a small 10 fold-variability, whereas the sensitivity for TBZ differed more than 1000-fold. These data indicate that PENBOTEC™ 400 SC is an excellent tool for postharvest control in the case of TBZ resistance. In the absence of TBZ resistance, the combination or alternation of TBZ and PENBOTEC™ 400 SC is advised to avoid the building up of resistance formation for either of the active ingredients.

LABEL CLAIM EXPANSION PLANS

Additional investigations are planned to expand the spectrum of disease control claims. Trials are planned to evaluate activity of PENBOTEC™ 400 SC against Phacidiopycnis rot, Philophora side rot, Sphaeropsis rot, brown rot, bull's eye rot, lenticel rot and alternaria rot.

MAXIMUM RESIDUE LIMITS

PENBOTEC™ 400 SC is labeled for a maximum of two applications for postharvest pome fruit treatment. These may range from drench treatment followed by aqueous or wax line spray to aqueous and wax line sprays. Residues on fruit from the different application scenarios ranged from 0.49 ppm for aqueous application to 1.44 ppm for a 1000 ppm drench plus 2000 ppm shipping wax when sampled just prior to packing into cartons.

Current maximum residue limits (MRLs) in many countries appear adequate in many cases for residues within this range. The major export markets for apples, representing 80% of the export volume, are Mexico, Canada, Taiwan, Indonesia, Hong Kong, Malaysia, the United Kingdom and the United Arab Emirates. For pears, Mexico, Canada, Brazil, the Netherlands, Sweden, Taiwan, and Colombia represent 98% of the export volume.

Tolerances are accepted in the United States and Mexico at 3 ppm. Import tolerances have been requested for PENBOTEC in Canada. CODEX review of PENBOTEC pyrimethanil as a priority action is proceeding. Of the priority countries, the United Arab Emirates, Malaysia, Indonesia, Hong Kong, Brazil and Colombia appear to rely on CODEX MRLs. Taiwan and Singapore set their own national standard MRLs, as do the European Union (EU) countries. In 2006 pyrimethanil MRLs will be harmonized at levels supporting PENBOTEC postharvest applications among all 25 EU countries.

JANSSEN DISPOSAL TECHNOLOGY

Janssen is developing a treatment system for eliminating PENBOTEC from treating solutions (e.g., drench tank solutions). The process is a batch process that is accomplished within 4 to 6 hours. The process has been certified to be effective by competent authorities in Spain with formulations containing PENBOTEC. The process is being optimized for use conditions common to pome fruit packers here in the United States.