

# Effectiveness of four synthetic fungicides in the control of postharvest gray mold of strawberry and analyses of residues on fruit

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Fungicides are usually applied in strawberry fruit to control gray mold caused by the fungal pathogen *Botrytis cinerea*. In this study, four reduced-risk fungicides were applied before harvest for the control of postharvest decay of strawberries.

## Field experimental trial



The trials were run in strawberry field cv 'Alba', located to "Pasquale Rosati" experimental farm of the Polytechnic University of Marche in (Agugliano; 43°31'60"N, 13°22'60"E), Italy.

### Treatments:

1. **cyprodinil (CYP) + fludioxonil (FLU)** (Switch, 37.5 + 25, Syngenta S.p.a., Milan, Italy), 110 g/hl.
2. **boscalid (BOS)** (Cantus, 50, BASF S.p.a., Cesano Maderno, Italy), 80 g/hl.
3. **pyrimethanil (PYR)** (Scala, 37.4, Bayer S.p.a., Leverkusen, Germany), 175 ml/hl.



The strawberries were sprayed with a volume equivalent to 500 l/ha using a motorized backpack sprayer (GX 25, 25 cm<sup>3</sup>, 0.81 kW; Honda, Tokyo, Japan) with commercial formulations and then collected at different times.

## Postharvest tests

Strawberry fruits were harvested at 0-, 4-, 8- and 12-days following treatment (dft) then:

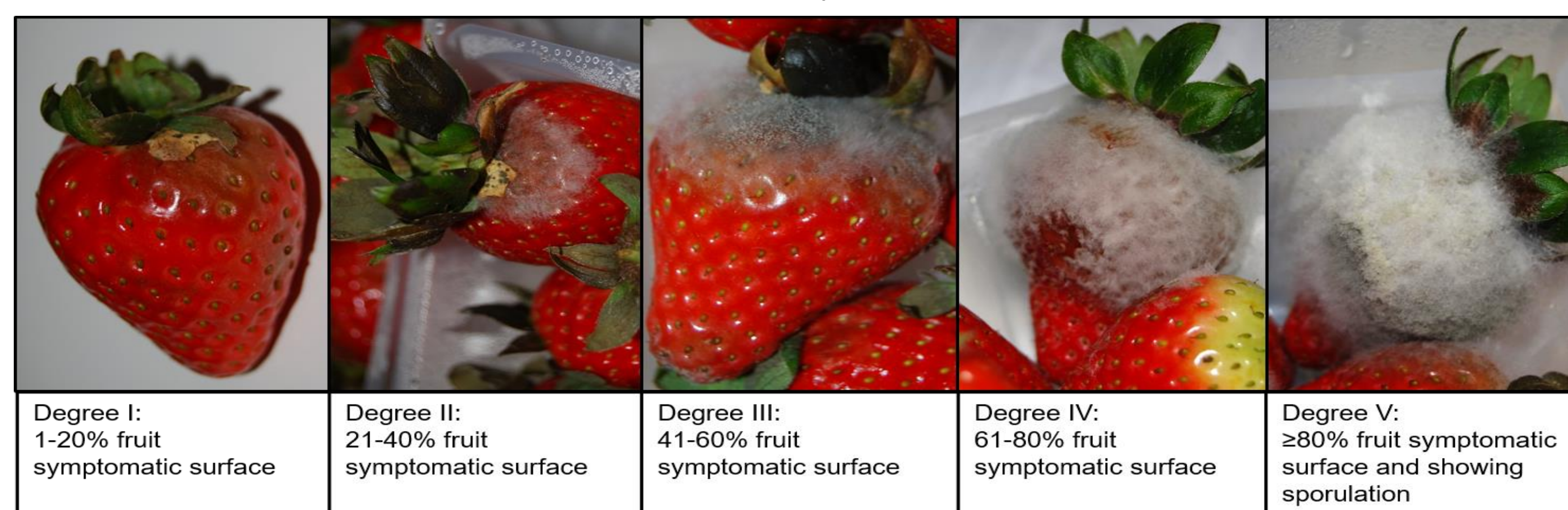
□ kept at 20 ± 1° C for 4 days

□ cold stored 7 days at 0.5 ± 1° C, followed by a 5 days shelf life at 20 ± 1° C.

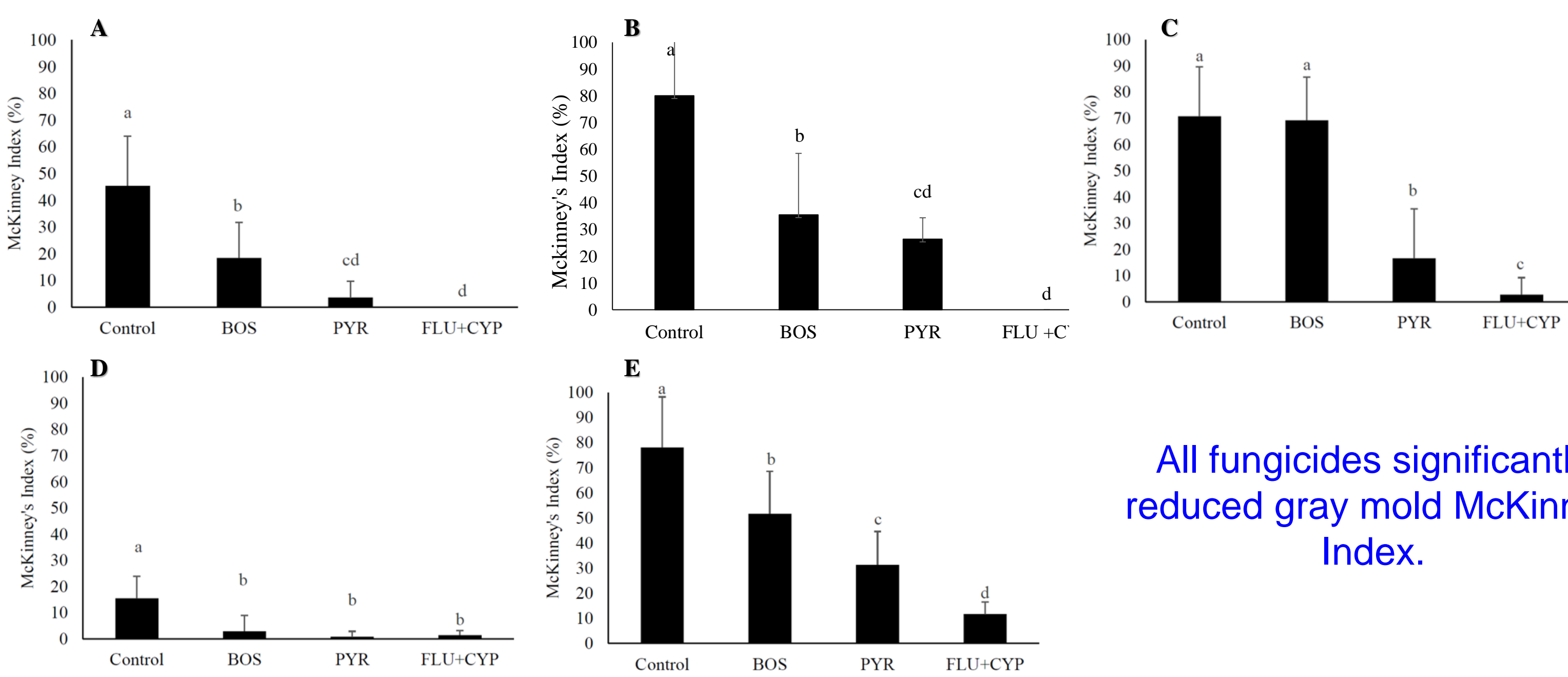


## Decay evaluation

Disease severity was recorded according to an empirical scale with six degrees including 0 for healthy fruit.



Strawberries with the 5 degrees of gray mold disease severity.

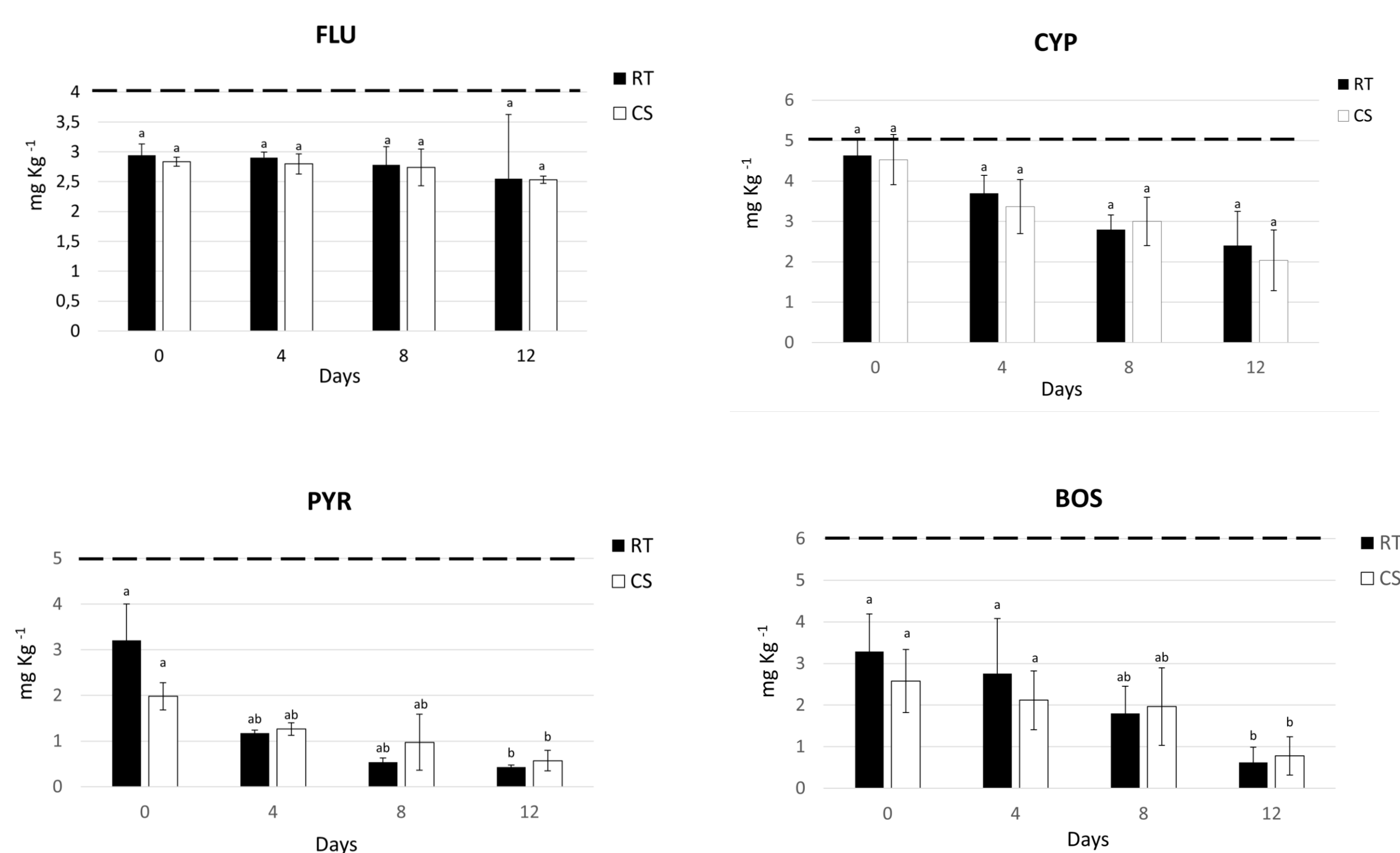


All fungicides significantly reduced gray mold McKinney Index.

McKinney Index of gray mold of 'Alba' strawberry fruit treated with fungicides, then collected at different dft and exposed to different days shelf life: collected soon after (0 dft), stored for 7 days at 0.5 ± 1 °C, and then exposed to 3 (A) and 4 (B) and 5 (C) days shelf life; collected 4 dft, stored for 7 days at 0.5 ± 1 °C, and then exposed to 3 days shelf life (D); collected 8 dft, stored for 7 days at 0.5 ± 1 °C, and then exposed to 4 days shelf life (E). BOS, boscalid; PYR, pyrimethanil; FLU+CYP, flu-dioxonil + cyprodinil. According to Fisher LSD test, treatments with different lowercase letters were significantly different at p<0.05. Bars above columns represent the Standard deviation.

## Fungicide extraction and analyses

Fungicides from strawberry samples were extracted using a kit supplied by Phenomenex (KSO-8910 Phenomenex RoQ-QuEChERS) combined with UNI EN 15662 purification method and analyzed by HPLC using a Perkin Elmer 200 Series chromatograph, equipped with a UV detector at 205 nm and Supelcosil C18 column (25 cm × 4.6 mm, i.d.).



Fungicide residues to meet MRLs of strawberry in Europe. Dotter lines indicate MRL values. RT (room temperature); CS (cold storage); (a) FLU, fludioxonil; (b) CYP, cyprodinil; (c) PYR, pyrimethanil; (d) BOS, boscalid. Lower case letters refer to statistical differences within each fungicide. According to HSD test, treatments with different lowercase letters were significantly different at p<0.05. Bars above columns represent the Standard deviation.

For the duration of experiment, fungicide residues were always below the maximum residue levels, and FLU was the most degraded, thanks to the enzymatic pool of the strawberries.

Monitoring fungicide residues in strawberries is essential to provide the consumer information on the safety of this widely consumed fruit. The present study pointed out the safety of the strawberry fruits for consumers, even if the treatment strategy implies the use of fungicide mixtures before the consumption, being fungicide levels always below the MRL.

