Summary

Citrus spp. (Rutaceae) are the most widely produced fruits and they are grown in over a hundred countries. During postharvest, major losses are caused by fungal diseases, that for decades have been controlled by treatments with synthetic fungicides. However, their use is continuously more restricted by distributors and supermarket chains, which lower the Maximum Residue Level (MRL) to one third of the authorized or even ban the use of certain fungicides. This has loss of efficacy of treatments and development of resistant strains of pathogens. Alternatives are necessary to substitute or combine the use of synthetic fungicides. The objective of the present work was to evaluate alternative treatments against green and blue molds, caused by *Penicillium digitatum* (Pers.: Fr.) Sacc. and *Penicillium italicum* Wehmer, respectively. Food additives and GRAS substances were tested in *in vivo* preliminary tests against green and blue molds. Potassium sorbate (PS) (Chapter 2) and sodium benzoate (SB) (Chapter 1) were the most effective. 60-s dips in 3% (w/v) SB above 50°C reduced by 90% green and blue mold incidence on 'Valencia' oranges after 7 days at 20°C. This treatment was also effective on 'Lanelate' oranges, 'Fino' lemons and 'Ortanique' mandarins, but not on 'Clemenules' mandarins. Heated solutions combining SB with low doses of imazalil (IMZ) were synergistic. In semi-commercial trials with 'Marisol' Clementine mandarins, the combination PS+IMZ at 20°C allowed a significant reduction of the IMZ doses still controlling green mold. A new colorimetric method that employed extraction of PS from macerated fruit, followed by reaction with 2-thiobarbituric acid (Chapter 3) showed that in oranges treated with PS and stored at 15°C, residues declined initially rapidly and later more slowly, until residues stopped declining after 6 d. A brief double-dip rinse in tap water, immediately after immersion of lemons in a 2% (w/v) PS, removed more than 90% of PS residue. Exposure at 33ºC with 15 kPa CO_2 for 24 h or 30 kPa O_2 for 48 h effectively controlled both green and blue molds after 7 days of incubation at 20ºC, but control of both diseases lowered after 15 days (Chapter 4). Combining PS dip treatments with gas exposure showed a synergistic effect, that maintained the efficacy of combined treatments during 15 days. In cold storage, after 14, 28, and 42 days, green mold incidence on 'Clemenules' and 'Ortanique' mandarins treated with PS dips and 30kPa O_2 for 48h was reduced by 100, 96 and 68%, and 100, 97 and 79%, respectively. Again, a synergistic effect between treatments was observed (Chapter 5). Postharvest green mold and blue molds were effectively controlled by fumigation of lemons and oranges for 6 h at 22ºC with two applied dosages of 3000 µL L^{-1} of ammonia that was injected initially and again 2 h later (Chapter 6). Ammonia fumigation controlled an IMZ-resistant isolate of *P. digitatum*. When fruit were first immersed in 10 or 30 mg L^{-1} IMZ (about 10% of typical commercial rates) before ammonia fumigation, a single fumigation with 1500 µL L^{-1} of ammonia was adequate to control both diseases and the increase in effectiveness was additive or synergistic. All these treatments, at different degrees, could replace synthetic fungicides or augment IMZ performance in citrus postharvest decay management. The development of green and blue molds on the most commercially important citrus species and cultivars was assessed for four consecutive harvest seasons and associated with fruit quality parameters (Chapter 7). Fruit susceptibility of the cultivars to green mold in increasing order was Nova, Sanguinelli, Ortanique, Lanelate, Navelate, Fortune, Clemenules, Valencia, W. Navel, Oronules, Clemenpons, Marisol, Salustiana, Hernandina, and Nadorcott. Peel characteristics were the most influencing quality parameters on the susceptibility of citrus fruit to green and blue molds.