Nutrient Recovery Efficiency Is Cultivar-related in Strawberry (*Fragaria ananassa* Duch.)

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Field studies were conducted in Tucuman, Argentina, with the objective of assessing the influence of genotype on nutrient recovery efficiency (NRE). Strawberry cultivars 'Camarosa', 'Camino Real', 'Candonga' (Sabrosa), and 'Ventana' were subjected to three fertilization levels, keeping constant the ratio of nutrients to nitrogen: 1(N):0.58(P_2O_5):1.8(K_2O):0.3(CaO):0.17(MgO). Treatments (in kg/ha) were: "control (C)" (120 N, 70 P_2O_5, 220 K_2O, 40 CaO and 20 MgO; "1.5 × C" and "2 × C". The experimental design was a split-plot design with 3 replicates. Nutrient concentration and biomass were measured for fruits, leaves, crown and root. Yields were +20% in 'Camarosa', +13% in 'Ventana', +6% in 'Camino Real' and –3% in 'Candonga' with treatment "1.5 × C", where NRE (%) were 47 N, 21 P_2O_5, 40 K_2O, 82 CaO and 33 MgO for 'Camarosa'; 24 N, 14 P_2O_5, 24 K_2O, 37 CaO and 9 MgO for 'Ventana'; 10 N, 2 P_2O_5, 7 K_2O, 18 CaO and 4 MgO for 'Camino Real'; and –3 N, 0.7 P_2O_5, –10 K_2O, –40 CaO and –25 MgO for 'Candonga'. Responses to "2 × C" treatment were null or negative. Fruit quality parameters, such as fruit size, firmness, total soluble solids and color, were affected by cultivar and harvesting date but not by fertilizer treatment. These results suggest that plant response to fertilization levels is cultivar-related and that each cultivar has its particular NRE rate. There are also environmental implications since fertilizers that are not incorporated into plant biomass might contaminate the soil. Growers could reduce costs and improve yields by knowing the particular fertilization program for each cultivar.

The Strawberry Breeding Program at EMBRAPA

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The Ministry of Agriculture of Brazil holds more than 60 years of research on genetic improvement of strawberry in Pelotas, Rio Grande do Sul, and some other parts of Brazil. The work started with strawberry breeding was in the extinct Agronomic Institute of the South ("UEPAE – Cascata") in 1950 and continued at Embrapa after its creation in the 1970s. The beginning of the strawberry breeding program was based on the introduction of plants and seedlings of cultivars developed in other breeding programs outside of Brazil. After crosses were performed and made the selections of superior clones with a focus on plants adaptation with better quality fruits. The program registered 12 cultivars: 'Konvoy', 'Princesa', 'Cascata' (1962); 'Konvoy-cascata' and 'BR-1' (1981); the introductions (1981): 'Lassen', 'Tioga', 'Leiko', and 'Alemanha'. In the 1990s, 'Santa Clara' (dual purpose industry and fresh market); 'Vila Nova', 'Bürkley' (for industry). The program was discontinued in the late 1990 and reactivated in 2008. Currently crosses are being made through a scheme that seeks complementary characteristics. The main objective is to develop new adapted cultivars, with perfect flowers, with high productivity and stability, good balance between vegetative growth and fruit production, and finally with low susceptibility or resistance to biotic or abiotic stresses.

Strawberry Cultivar Response to the Four Genotypes of *Colletotrichum* spp. Associated with Strawberry Crown Rot in Australia

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Crown rot, caused by *Colletotrichum gleosporioides*, is a serious disease of strawberry (*Fragaria ×ananassa* Duchesne) in southeastern Queensland, Australia. Recently, 20 isolates from our collection gathered over the last 25 years from a range of strawberry cultivars, fruit farms and runner nurseries were classified into four different genotypes, i.e., *Cg*8, *Gc*2, *Cf*1 and *Cf*2. The genotypes were associated with geographical areas. Two glasshouse experiments evaluated inoculation techniques and pathogenicity. In the first experiment, 'Festival', 'Galexia', 'Rubygem', 'Redlands Joy', and 'Fortuna' were susceptible to the *Cg*8 isolate N12030.2 using both spray inoculated and spore injection techniques. Seventy-five percent of the plants wilted within 2–4 weeks, with 83% dead 6 weeks after inoculation. Response of cultivar differed with inoculation technique. Fifty percent of 'Kabarla' survived following spray inoculation and 75% survived following spore injection. All 'Treasure' plants survived following spray inoculation, but were susceptible when inoculated by spore injection. In the second experiment, 'Camarosa', 'Festival', and 'Tioga' were susceptible after inoculated with the *Cg*8 isolate by spore injection, with 89% of the plants dead within 2–4 weeks. All plants were dead 6 weeks after inoculation. Only a small percentage of plants inoculated with *Gc*2 isolates, N16592.1 and N15359.8, wilted 7-9 weeks after inoculation. Spray inoculation allowed pathogenicity differences in 'Treasure' and 'Kabarla' to be expressed, whereas spore injection masked differences in pathogenicity. The *Cg*8 isolate was more aggressive than the *Gc*2 isolates. This study encourages further work to explore genotype by pathogenicity interactions associated with strawberry cultivars and breeding lines in Australia.

A Microtiter Assay Shows Effectiveness of a Natural Fungicide for Control of *Colletotrichum* spp. from Strawberry

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Fruit rot diseases are serious problems for strawberry producers world-wide. In the southeastern US, anthracnose fruit rot is particularly severe, and chemical control has become more difficult as several effective fungicides are no longer sold in the US or have lost their registration for use on strawberries. In addition the pathogens *Colletotrichum acutatum*, *C. gloeosporioides,* and *C. fragariae* have developed resistance to some of the more commonly used fungicides. A micro-dilution broth assay was used to test for in vitro activity of 16 agrochemicals against nine *Colletotrichum* spp. isolates collected from strawberry, and one isolate of *C. acutatum* obtained from apple fruit. Each isolate was grown on half-strength potato-dextrose agar and conidia were harvested from 7–10 day old cultures. Conidial concentrations were determined photometrically and suspensions were adjusted to a concentration of 1.0×10^6 conidia/mL. Each microtiter test well contained RPMI 1640 media, buffered broth, conidia and the test antifungal solution. Each fungus was challenged in a dose-response format using test compounds where the final treatment concentrations were 0.3, 3.0, and 30.0 µM. Microtiter plates were incubated in a growth chamber at ~24 °C and 12-hour photoperiod. Growth was evaluated at 48 and 72 hours by measuring absorbance of each well at 620 nm using a microplate photometer. At 72 hours the 30 µM concentration of captan, thiram, cyprodinil, chlorothalonil, azoxystrobin, and kelthane provided 74% to 100% growth inhibition of all 10 *Colletotrichum* isolates while dodine and quinomethionate inhibited growth of 9 of the 10 isolates. Butrizol and pentac inhibited growth of all isolates by 21% to 87%. Iprodione, vinclozolin, metalaxyl, and fosetyl-Al did not inhibit growth of any isolate. Benomyl and thiobendazole provided near 90% growth inhibition of the two *C. fragariae* isolates and one of the two *C. gloeosporioides* isolates. However, all six *C. acutatum* isolates were slightly sensitive to insensitive to these two fungicides. The natural fungicide, azoxystrobin, was one of the most effective fungicides at the lowest concentration tested, 0.3 µM. Our microtiter assay provides a method to rapidly obtain fungicide resistance and sensitivity information that growers can quickly incorporate into their chemical disease management strategy when they need it. The conidial based assay is especially useful for evaluating new fungicides such as strobilurins that de-couple electron transport used to produce energy need for spore germination or infection.