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Tomato Quality Starts With the Soil

Quality in tomatoes means different things to different people. In production agriculture, quality often extends beyond flavor to appearance and nutritional quality. For example, the most important limitation to cost efficiency in production and processing of tomatoes intended for whole-peel and diced products are physiological disorders that affect the color of the fruit. Because the pigments that make tomato fruit red are pro-vitamin A and lycopene, poor color translates into a less nutritious fruit. Color disorders affect as much as 65% of the processing tomato crop and the potential cost to farmers and processors is therefore high.

The profiles for soils at risk for color disorders can be found in the table on page 2. Work over the last two years has suggested an important role for potassium, calcium, magnesium, organic matter and pH of the soil. Tomatoes grown on soils containing 3.4 % organic matter produce fruit with a low incidence of yellow shoulder disorder while tomatoes grown on soils with organic matter below 2.4% produce fruit with a high incidence of yellow shoulder disorder. Tomatoes produced on soil at a pH of 6.4 have a low incidence of yellow shoulder while tomatoes grown on soil in excess of 6.7 have a high incidence. More detailed information can be found using the links available under "Managing Color Disorders" at http://www.oardc.ohio-state.edu/tomato/.

Research sponsored by the USDA's Initiative for Future Agriculture and Food Systems is yielding results that will help manage risk related to color disorders. Tomato production in Indiana, Michigan, Ohio, Pennsylvania, and New Jersey occurs on soils that vary in texture, mineralogy, cation exchange capacity, and the availability of nutrients. Because soil conditions in the Great Lakes region are so diverse, there are not yet general recommendations in our region for amending high-risk fields (Table 2).

Table 1. Profiles for Soils that are at a Low Risk for producing tomatoes affected by color disorders.

	Great Lakes and Mid Atlantic		CA Soils
	Low Risk	High Risk	Low Risk
Extractable K	>0.4 cmol/Kg	<3.5 cmol/Kg	0.7 cmol/Kg
K as % CEC	> 4%	< 3%	> 2%
Hartz Ratio	> 0.35	< 0.30	> 0.25
Ca/Mg Ratio	3:1	nd	> 2:1
pH	6.4	6.7	nd
Organic Matter	3.50%	2.50%	nd

The most common color disorder, yellow shoulder, is characterized by discolored regions under the skin of ripe fruit. The severity of symptoms range from internal white tissue associated with vascular bundles to distinct yellow or green sectors. The diversity of symptoms has lead to a number of names including yellow eye, green shoulder, yellow tag, internal white tissue, yellow shoulder, all of which refer to a single disorder. Yellow shoulder is a disorder that involves modified development, not delayed ripening of fruit. These alterations are triggered very early in fruit development and are not reversed by delaying harvest. Understanding that color disorders involve altered fruit development rather than delayed fruit ripening is important to management strategies: we must treat the problem before we see it in the field.

Table 2. Summary of tomato fruit quality management principles.

1) **Management strategies must be aimed at prevention of color disorders.** The alterations in fruit are triggered very early in fruit development. It is too late to treat the problem once we see it in the field. Delaying harvest to let colored sectors catch up is ineffective and will reduce the quality of unaffected fruit
2) **Know your soils.** Pay close attention to exchangeable K^+, Mg^+, and Ca^{++}, K^+ fixation capacity, pH, and organic matter.
3) **Use varieties that are less susceptible to Yellow Shoulder Disorder.** Varieties with excellent color uniformity and low risk for yellow shoulder are TR12, OX23, and Heinz 9423.
4) **Uniform color requires more available K^+ than is necessary for maximum yield**. Adding more K^+ will not help if soil fixation capacity is high.
5) **Manage soil conditions to increase available K^+** and/or decrease available Mg^+. Maintaining a pH between 6.2 and 6.5 and high organic matter may be more effective than amendments.