

Role of Silicon and Calcium in Managing Quality of Strawberries



ABSTRACT

Calcium and silicon are plant nutrients that can increase plant strength and improve a plant's ability to fight environmental oxidative stress. Both calcium and silicon play critical roles in cell wall structure. Calcium and silicon have been linked to fruit quality in crops including apples, pears, citrus and berries. The utility of Mainstay Si, a reacted plant nutrient product containing calcium and silicon, was assessed in strawberry production for improving yield and quality. Mainstay Si treated plots produced on average 11% higher marketable yield across the season. Mainstay Si treated plots also had a lower total cullage by 2.5%. Mainstay Si treated plots showed no fruit bronzing and 27% lower incidence of albino fruit.

INTRODUCTION

Silicon is a beneficial plant nutrient that can increase plant strength and improve a crop's ability to fight environmental oxidative stress. Silicon is an element like calcium, potassium, or zinc that is used by the plant to complete physiological processes. Similar to calcium, silicon plays a critical role in cell wall structure. Silicon is also linked to phenolic compound synthesis pathways. This means when silicon is deficient we do not necessarily see discolored leaves or odd plant structure. We do, however, see a more tender plant that does not withstand stress. Silicon and calcium deficiencies can be a major concern in crops where fruit quality and storability are key such as in berries. Silicon deficiencies can also be a major concern in crops grown in artificial media such as in greenhouse

production. In these crops we see soft fruit issues and more tender leaves. Not all crops show an obvious issue like these mentioned, but we do see that under stressful growing conditions crops with silicon considered in their fertility plans better withstand environmental oxidative stress.

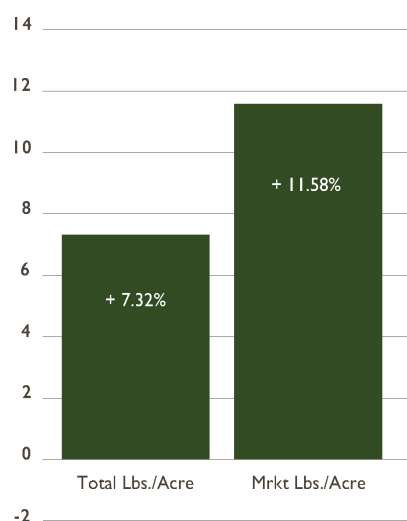
Mainstay Si (10% Ca, 22% SiO₂, Redox Chemicals LLC., Burley, ID) is a reacted plant nutrient high in silicon and calcium. In these studies, we assessed the economic affect of applying Mainstay Si to field grown strawberries, specifically regarding yield and cull rate. Tank mix compatibility with common miticides was also assessed.

METHODS AND RESULTS

Cull and Yield Study Mainstay Si was applied at a rate of 0.5 gallons per acre to strawberries starting fall 2016. Applications were made via injection irrigation into drip tape on a 14-day interval as weather permitted. There were 5 replicates. Applications were made in addition to grower standard fertility practices. Total and marketable yield were tracked throughout the production cycle (26 weeks). Cull fruit were tracked to assess affect on an assortment of cull reasons. Trials were conducted by the cooperating grower's in-house research team.

Mainstay Si improved total yield by 7.32% with marketable fruit weight increasing by 11.58% respectively over the grower standard (Fig. 1). This indicates a lower cull rate for Mainstay Si treated blocks. Considering the culled fruit, Mainstay Si treated blocks had a higher proportion of small fruit. Mainstay Si proportionally had fewer malformed fruit, less fruit rot and less rain damage. There was a

FIGURE 1
PERCENT CHANGE IN YIELD
WITH MAINSTAY SI



marked decrease in albino fruit and very low fruit bronzing in Mainstay Si treated blocks (fig. 2).

Tank Mix Compatibility The tank mix compatibility of Mainstay Si with common acaricides, Epi-Mek® (abamectin, Syngenta) and Agri-Mek® EC (abamectin, Syngenta) was assessed for two-spotted spider mite (*Tetranychus urticae*). Treatments were applied in field to strawberry plants having spider mite numbers above the economic injury level. The trial was a randomized block design with 4 replicates. Mite populations were monitored for 27 days following treatment. The trial was conducted by Holden Research (Camarillo, CA). Epi-Mek® and Agri-Mek® EC alone controlled both mobile and egg stages. The addition of Mainstay Si to the tank mix did not affect acaricide efficacy. Data presented in Figure 3 is from 27 days after treatment. The trial was repeated twice with similar results.

DISCUSSION

Mainstay Si treated plots produced on average 11% higher marketable fruit yield across the season. This effect is larger than the impact of the 2.5% lower total cull rate in treated plots. This points to an improvement in other fruiting characteristics such as fruit size and number of fruit pieces. This program showed an economically favorable return on investment with monthly product cost slightly less than \$60 per acre.

FIGURE 3
TWO SPOTTED MITE & EGG COUNT

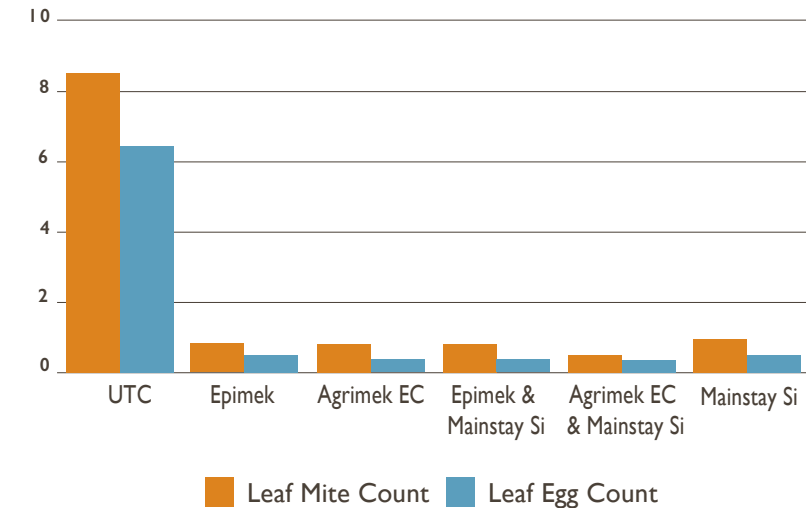
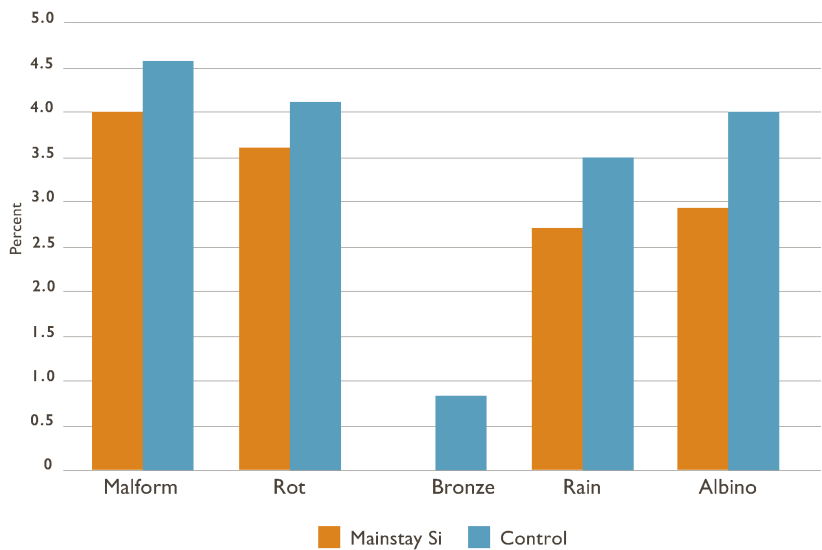


FIGURE 2
MINOR REASONS FOR FRUIT CULL



Mainstay Si treated plots had functionally zero incidence of fruit bronzing and reduced incidence of albino fruit by more than 27%. Additionally, other cull categories showed lower numbers in Mainstay Si treated plots. It is well documented that silicon and calcium are critical structural components of cell walls. Stronger cell walls in fruit produce firmer, more damage resistant fruit. Other studies reported the addition of Mainstay Si improved shelf life of strawberries and potatoes, and reduced bitter pit incidence in apples and pears. All of these data support that Mainstay Si is helping plants produce stronger cells and improved fruit quality.

Tank mix compatibility of Mainstay Si showed no measurable effect on efficacy of the acaricides tested. Field observations demonstrate Mainstay Si to be a favorable tank mix companion with common insecticides, fungicides and acaricides for foliar application. Mixing compatability is attributed to the unique formulation of the product that stabilizes calcium and silicon preventing reactions in the spray tank.

The use of Mainstay Si in fruiting crops will help to improve fruit quality, reduce cull rates, and increase plant strength.