Soil Basics Program on Table Grapes in California

Research Summary for

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Background

As the highest value fruit crop in the United States, grapes contribute over $6.6 billion in to the national economy[1]. Grapes can be dried into raisins, processed for foods like jam, sold to the fresh market, or crushed for wine. California is by far the largest producer of table grapes in the nation. They are grown on 121,000 acres and constitute 14% of the state's total grape acreage. With average production near 11 ton/ac, table grapes contribute over $1.25 billion to California's economy.

Table grape vineyard establishment costs are substantial. Grapes are trellised onto wires in one of several systems, with the goals of increasing sunlight capture and minimizing disease pressure. Most vineyards are drip-irrigated. Broadcast or fertigated applications are standard for macronutrient fertilization, while micronutrients are often applied by foliar sprays. Weeds are controlled on the berms by mechanical or chemical means, and insecticides are applied for any economically threatening insect pressure. Fungicide applications are routinely made in-season to control disease, such as botrytis or powdery mildew. Labor expense is high; practices such as vine training, pruning, cluster tipping, hand thinning, leaf stripping, girdling, and hand harvest are ubiquitous. Gibberellic acid (GA), a plant growth regulator, is often applied both at bloom to thin and also during berry sizing to increase berry size.

Variety selection is important in both vineyard management and marketing success. Autumn Royal was released in 1996 from USDA in Parlier, California. It is a purple-black variety harvested late-season, with notably large berry size.

The objective of this trial was to evaluate a Soil Basics soil and foliar program on table grapes. Grape yield, color, and brix were the measured variables.

[1]National Agricultural Statistics Service. 2018. Noncitrus Fruits and Nuts. United States Department of Agriculture.

Materials and Methods

The trial was established in Selma, California, in a conventional Autumn Royal vineyard. The soil series is Delhi sandy loam, a fertile soil with granitic rock parent material. The vines are thirteen years old, planted 7' by 12'. Plots consisted of fifteen vines. Both untreated and Soil Basics treatments were replicated twice (table 1).

Soil Basics Treatment			
Application Date	*Method*	*Product*	*Rate*
June 24	Foliar	Oasis Micro	1 qt/ac
July 12	Soil	Kappa	5 gal/ac
		Brilliance	2 gal/ac
August 6 (late verasion)	Foliar	EXI	1 qt/ac
August 28	Soil	C-Four	3 gal/ac
September 13	Soil	C-Four K	3 gal/ac
	Foliar	EXI	1 qt/ac
		Helix Micro	1 qt/ac
		Helix Copper	5 fl oz/ac
		Helix Magnesium	10 fl oz/ac

Table 1. Product and rate for each treatment.

Soil applications were placed under each drip emitter with high water volume. Foliar applications were made with a Stihl SR 200 backpack mistblower at 150 gal/ac spray volume (figure 1).

All pest management and fertility additions were made by the collaborating grower in accordance with standard practices.

Harvest evaluations were conducted on September 21, September 28, October 4, and October 11. On September 21, the number of bunches on 10 vines in each plot were counted, and separated into marketable coloration versus immature. A subsample of bunches were weighed. Ten bunches per plot were measured for shoulder width and rachis length. Ten berry subsamples were juiced for brix content by digital refractometer. The percentage coloration and brix measurements were repeated at the subsequent harvests. *t*-tests ($\alpha = 0.10$) were performed for statistical analyses in RStudio.

Figure 1. Equipment used for foliar application.

Results and Discussion

The spring was unusually cold and wet, making early season grower operations logistically difficult (figure 2). Bud break occurred during early April, and bloom began in late May. A warm summer helped grape progression return to near-normal timelines after the relatively late start.

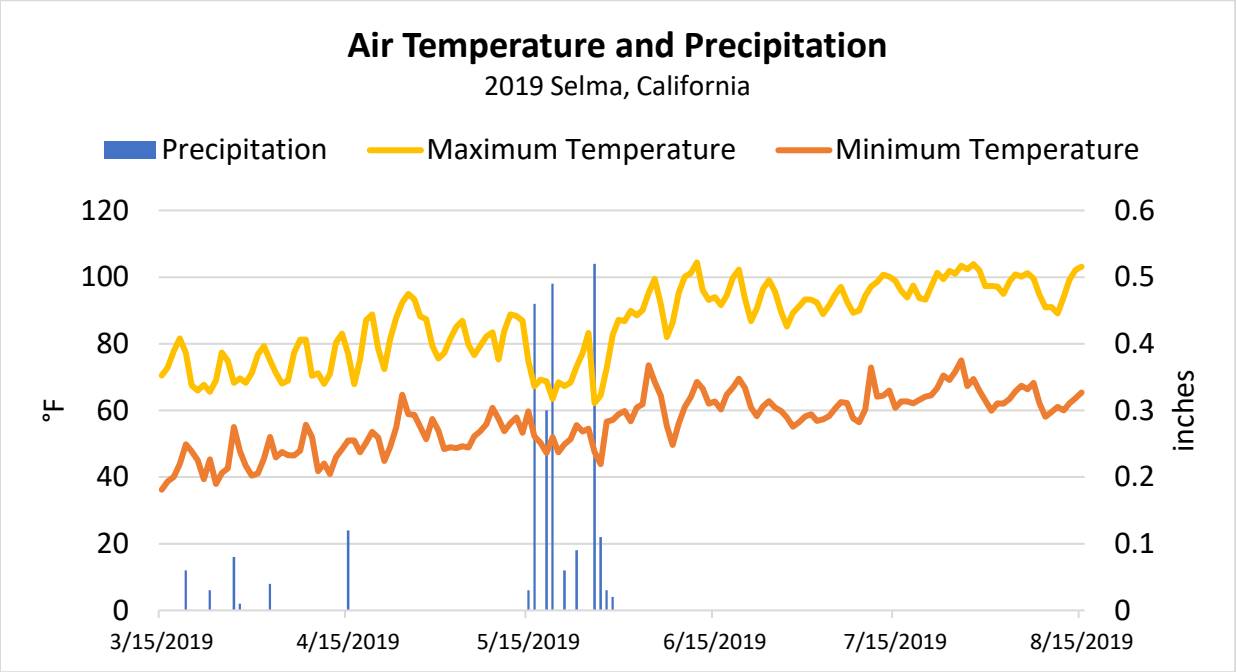

Figure 2. Minimum and maximum daily air temperatures and daily precipitation at the trial location.

Vine vigor was similar between treatments, but differences in bunch coloration were noted by late August. The treated clusters exhibited darker, better color relative to grower standard untreated.

The harvest evaluation was conducted 10 days prior to the grower's first pass (table 2). Cluster dimension was slightly but not statistically larger in the untreated areas, both in shoulder and rachis. Fruit set was statistically higher in the untreated areas, but had already been determined prior to any treatment applications. Individual bunch weight was numerically greater on Soil Basics-treated vines. Overall yield was 13% higher in untreated areas, but was not statistically verified.

Yield and Cluster Dimensions					
Treatment	*Shoulder Width (in)*	*Rachis Length (in)*	*Individual Bunch Weight (lb)*	*Bunches per Vine*	*Yield (ton/ac)*
Soil Basics	2.80a	7.13a	1.71a	40.4a	17.9a
Untreated	3.03a	7.44a	1.66a	47.4b	20.3a

Table 2. Average bunch weight, bunches per vine, yield, shoulder width, and rachis length for each treatment. Values followed by the same letter indicate no significant difference (*t*-test, $\alpha = 0.10$).

Brix content increased throughout the harvest period (table 3, figure 3). Soil Basics grapes were higher in soluble sugars at each sampling date –clearly statistically separated from untreated. Improvements ranged from 8-14% (figure 4).

Brix				
Treatment	*9/21*	*9/28*	*10/4*	*10/11*
Soil Basics	18.9a	21.5a	22.7a	22.4a
Untreated	17.5b	19.1b	19.9b	20.6b

Table 3. Average berry brix content for each treatment. Values followed by the same letter indicate no significant difference (*t*-test, α = 0.10).

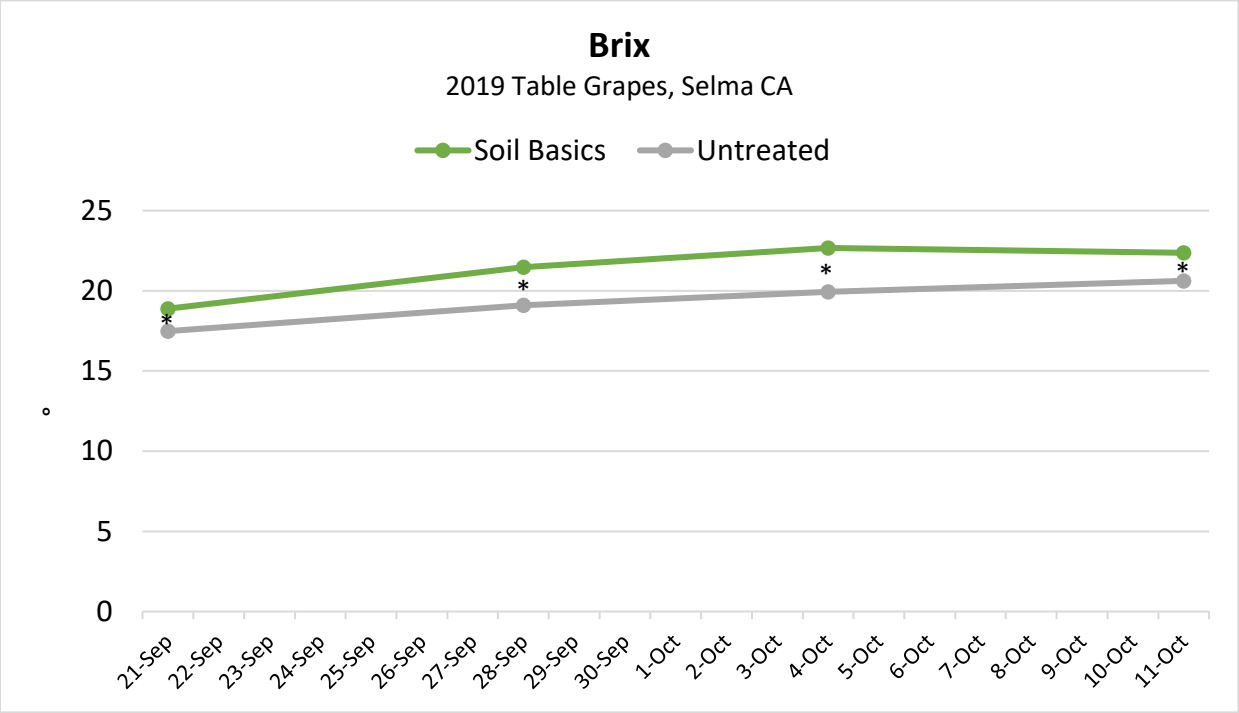

Figure 3. Average berry brix content for each treatment. Asterisks denote significant difference (*t*-test, α = 0.10).

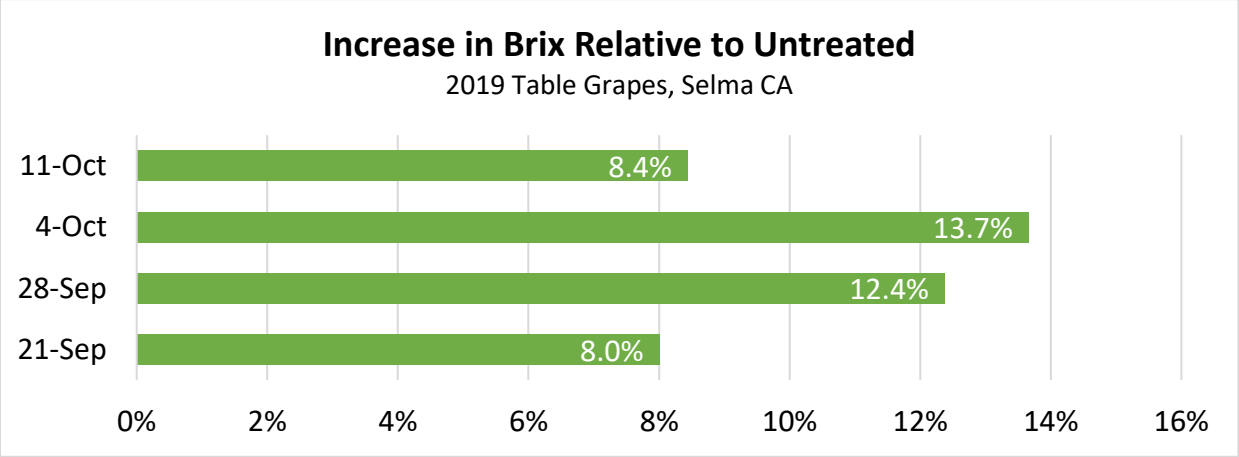

Figure 4. Increase in Soil Basics berry brix content relative to untreated.

During the sampling period, marketable color increased steadily in the Soil Basics-treated plots and followed more of sigmoidal curve in the untreated areas (table 4, figure 5). Through September, coloration was significantly better in Soil Basics plots – over 20% improvement relative to untreated (figure 6). By early October, untreated bunches had caught up and there was no longer a statistical difference in percent marketable.

Marketable Color				
Treatment	*9/21*	*9/28*	*10/4*	*10/11*
Soil Basics	78.8%a	85.3%a	90.1%a	97.0%a
Untreated	64.8%b	71.0%b	89.5%a	91.3%a

Table 4. Average percent of bunches with marketable color for each treatment. Values followed by the same letter indicate no significant difference (*t*-test, α = 0.10).

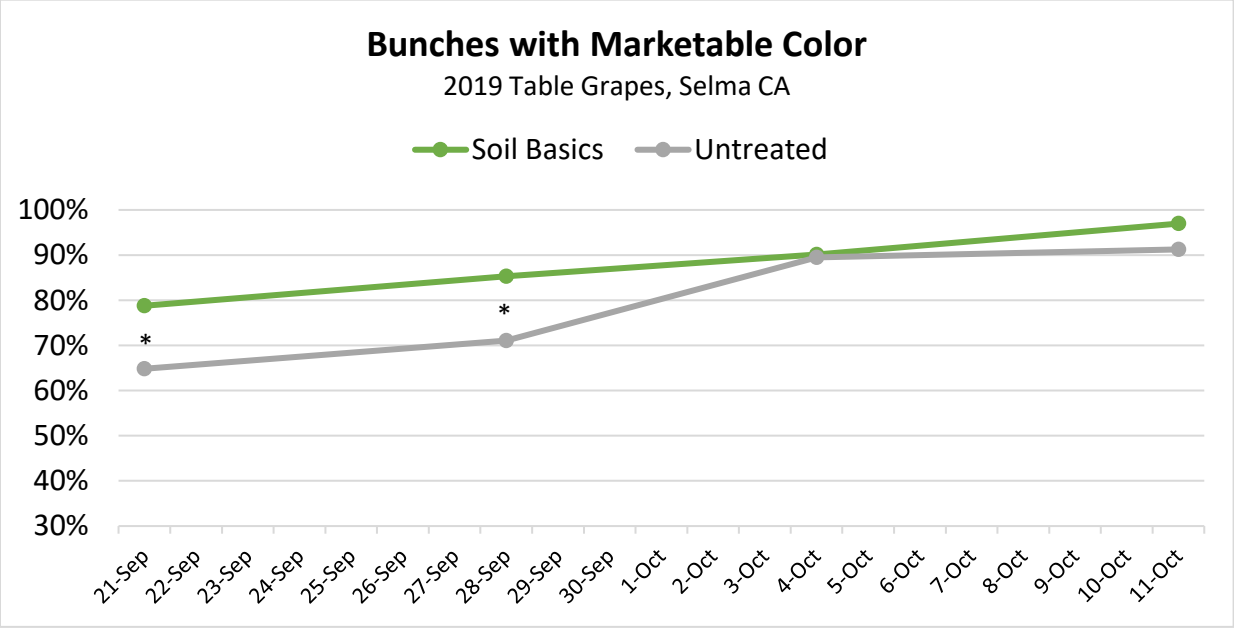

Figure 5. Average percent of bunches with marketable color for each treatment. Asterisks denote significant difference (*t*-test, α = 0.10).

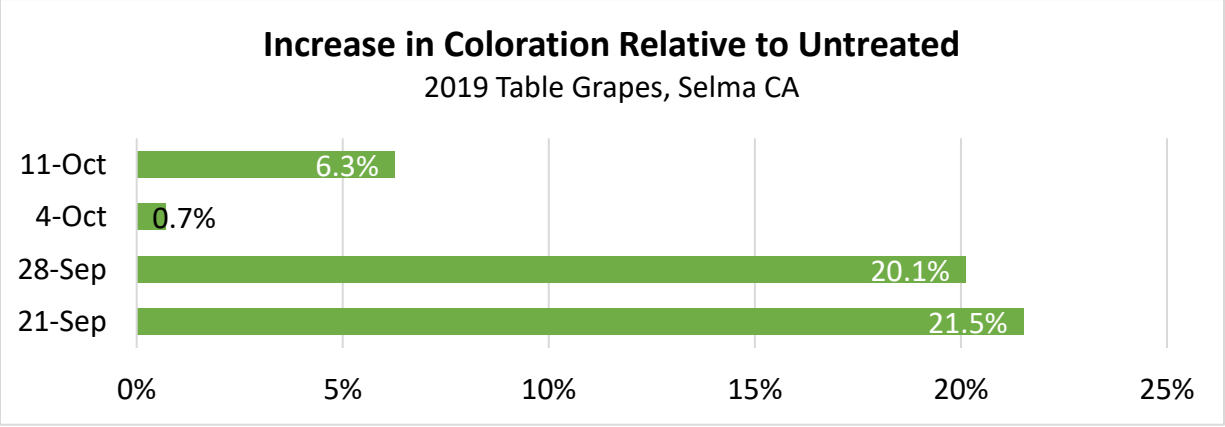

Figure 6. Increase in Soil Basics percent marketable clusters relative to untreated.

Based on an average price of $978 per ton for 2018 table grapes, gross return was very high: over $18,100 for untreated and $17,000 for Soil Basics (table 5, figure 7). Total gross return was greater in the untreated area due to higher yield. However, the earlier maturity in the Soil Basics' plots led to $1,000/acre improvement on the September 21 harvest pass. A sizable portion of untreated grapes were not marketable until the October 4 picking, while an additional 5-7% of remaining grapes were ready at each successive pass under Soil Basics.

Gross Return				
Treatment	*9/21*	*9/28*	*10/4*	*10/11*
Soil Basics	$13,809	$1,150	$843	$1,196
Untreated	$12,889	$1,236	$3,672	$345

Table 5. Gross return per acre for each treatment at each harvest date.

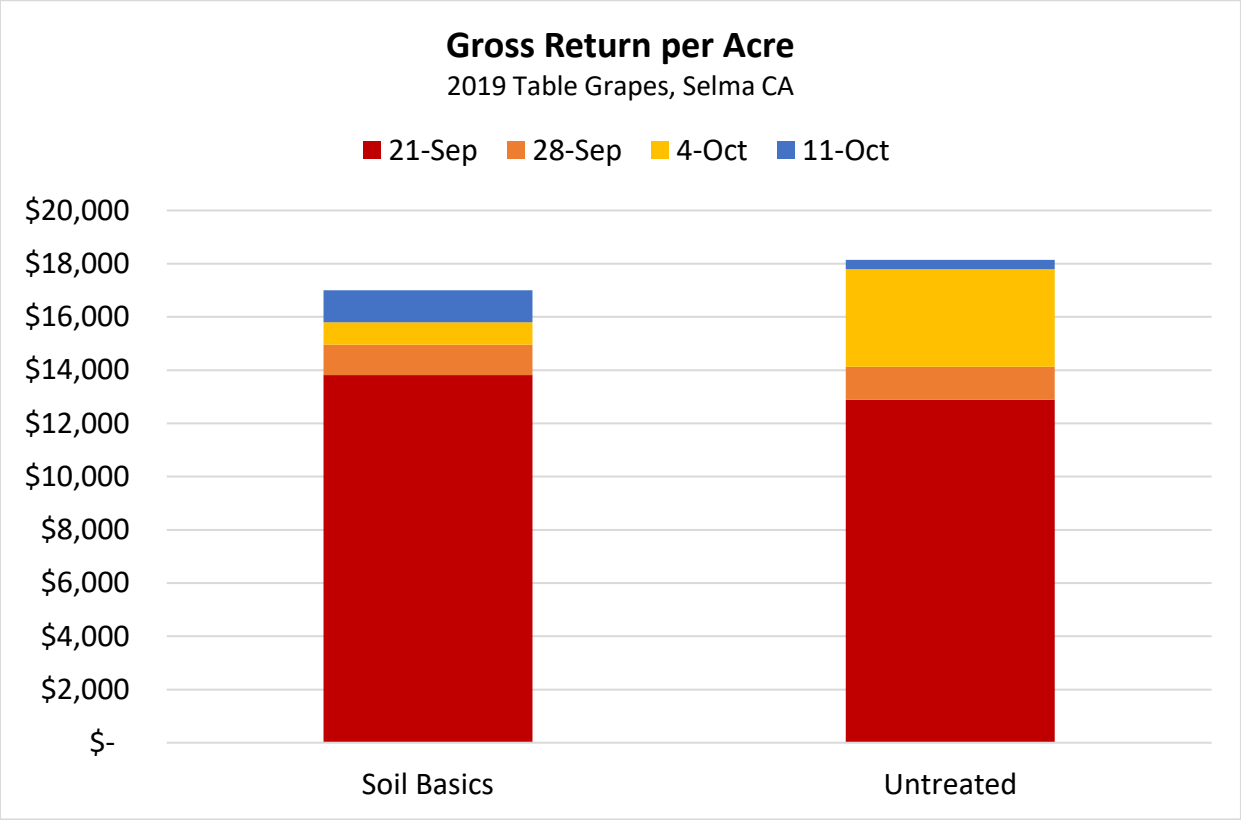

Figure 7. Average gross return per acre for each treatment, broken in each harvest pass.

Conclusions

Although individual cluster weight was slightly heavier in Soil Basics plots, the statistically greater cluster number in untreated led to numerically higher yield. Cluster dimensions were similar between treatments.

Brix was statistically higher under Soil Basics at all four sampling times. 8% - 13% improvement in soluble solids over untreated was achieved. Percent of bunches with marketable color was also numerically higher in Soil Basics treated plots at each harvest pass. The increase was statistically verified during September, with over 20% improvements.

Treatment yield and cluster size metrics were not statistically separated. Rather, significant differences were found in grape quality. The Soil Basics program clearly and statistically produced higher berry brix contents. Additionally, faster maturity was achieved; at the first trial harvest pass, only 65% of untreated clusters were marketable, while nearly 80% of treated clusters were acceptable in color. The Soil Basics plots continued a steady increase in percent colored, while untreated plots had a large jump in marketability between September 27 and October 4.

The brix and color improvements produced by the Soil Basics program can have significant ramifications for grower return. With labor cost and availability difficulties, reducing the number of harvest passes is a top priority.

Photographs

September 21

Soil Basics

Untreated


Soil Basics


Untreated

September 27

Soil Basics

Untreated


Soil Basics


Untreated

October 4

Soil Basics

Untreated

Soil Basics

Untreated