Soil Basics Products on Garlic in California

Research Summary for

Julie Sannar
Soil Basics Corporation

Prepared by

Megan Townsend
Crop Matters
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Background

California produces over 99% of the garlic (*Allium sativum*) in the United States[2]. California garlic increased by 13% from 2016-2017 in California, with Fresno and Kern county responsible for 96.9% of the garlic produced[2]. In 2018, 32,800 acres of garlic were harvested, which yielded 175 cwt/acre[1]. The corresponding value was just under $452.6 million; fresh market garlic accounted for $381.7 million of the total[1].

Garlic grows best in well-drained soil rich in organic matter with a pH of 6.0-6.5. Garlic is planted 1-1.5 inches deep in the fall on raised beds. Drip irrigation is often used to provide about one inch of water each week during critical periods. Diseases that commonly affect garlic include *Botrytis*, basal rot (*Fusarium*), white rot (*Sclerotium*), and downy mildew (*Peronospora*). Heavy fertilization is necessary; 125 lbs of nitrogen, 150 lbs of phosphorus, and 150 lbs of potassium per acre each growing season are required.

The objective of this trial was to evaluate several Soil Basics products on garlic in the Central Valley of California. Yield and quality were the measured parameters.

[1] NASS. 2018. State Agriculture Overview: California. USDA, Washington DC.
[2] California Agricultural Production Statistics. 2018. California Agricultural Statistics Review 2018 Report. CDFA, California.

Materials and Methods

The trial was placed within a conventional California Late garlic field, planted November 18. Four treatments were replicated four times each in a randomized complete block design (table 1). Plots were one bed wide and 20ft long, with one bed buffers. A soil application was made on April 12 by a high water volume poured over the drip tape. A foliar application was made on May 25 with a CO_2 powered backpack sprayer calibrated to deliver 15 gal/ac spray volume.

Trial Treatments		
Treatment	*Rate*	*Applications*
Oasis	2 qt/ac	Soil on April 12 Foliar on May 25
Oasis Micro	2 qt/ac	
Soil Basics Micro	2 qt/ac	
Untreated	n/a	n/a

Table 1. Product, rate, and applications for each treatment.

A 5' section in each plot was hand-harvested on June 20. Bulbs were counted and weighed, and number of rotted, undersize (<1.5 inches), and deformed bulbs was noted. Statistical analyses were performed in RStudio under ANOVA with Tukey-Kramer modification and an alpha of 0.10.

Figure 1. Crop stage on April 12.

Figure 2. Crop stage on May 25.

Results and Discussion

The trial area was flat and of uniform soil type (Panoche loam), and no blocking effect was significant. The site was a later-planted field, and the growing period was marked by rains and relatively moderate temperatures (figure 3).

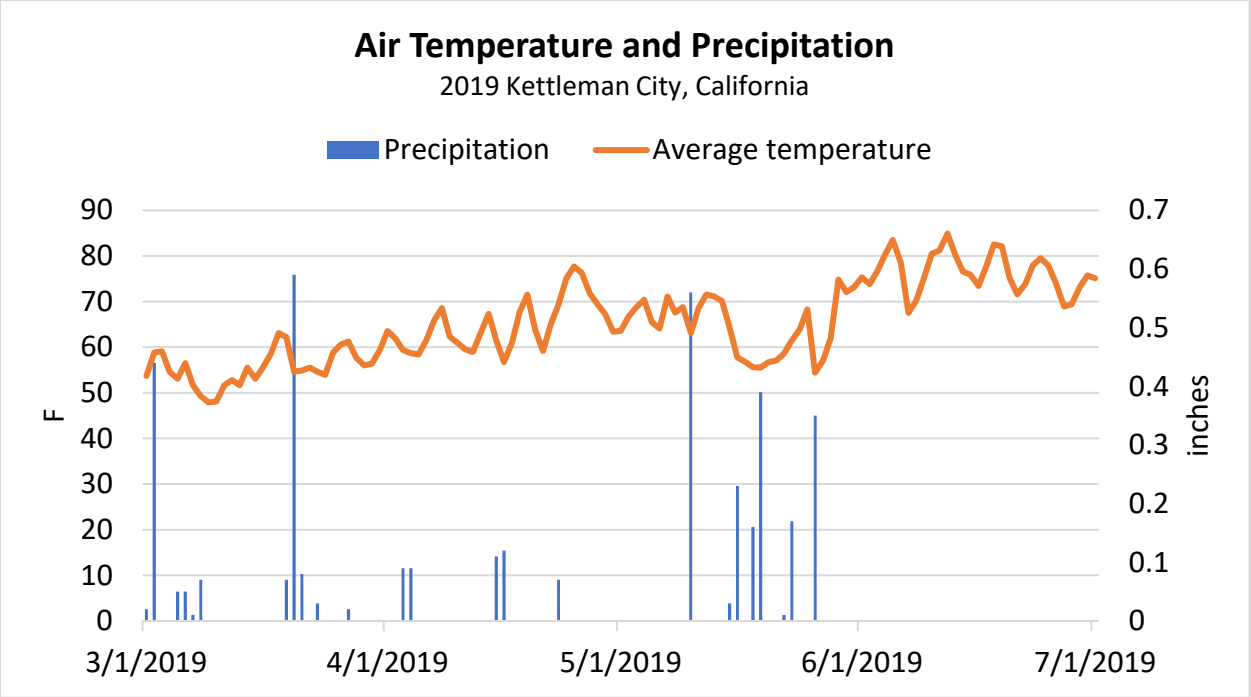

Figure 3. Average daily air temperature from March to July at the trial site is shown in orange and referenced on the left axis. Corresponding to the right axis is total daily precipitation for the same time period. Data from Cimis.

Yield was over 6 ton/acre, but there were no statistical differences between treatments (table 2). The top performer was Soil Basics Micro, followed by Oasis (figure 4). Untreated numerically produced higher tonnage than Oasis Micro. Bulb number echoed the yield trend, with Soil Basics Micro containing statistically more bulbs. Individual bulb weight was lowest in the Soil Basics Micro plots, and highest in Oasis and untreated plots.

Yield			
Treatment	*Yield (ton/ac)*	*Bulb Number (per 25 ft^2)*	*Individual Bulb Weight (oz)*
Oasis	6.77a	81.0a	12.3a
Oasis Micro	6.30a	77.3a	12.0a
Soil Basics Micro	7.07a	89.0b	11.7a
Untreated	6.67a	80.8a	12.3a

Table 2. For each treatment, yield, bulb number, and individual bulb weight. Values followed by the same letter indicate no significant differences (α=0.10).

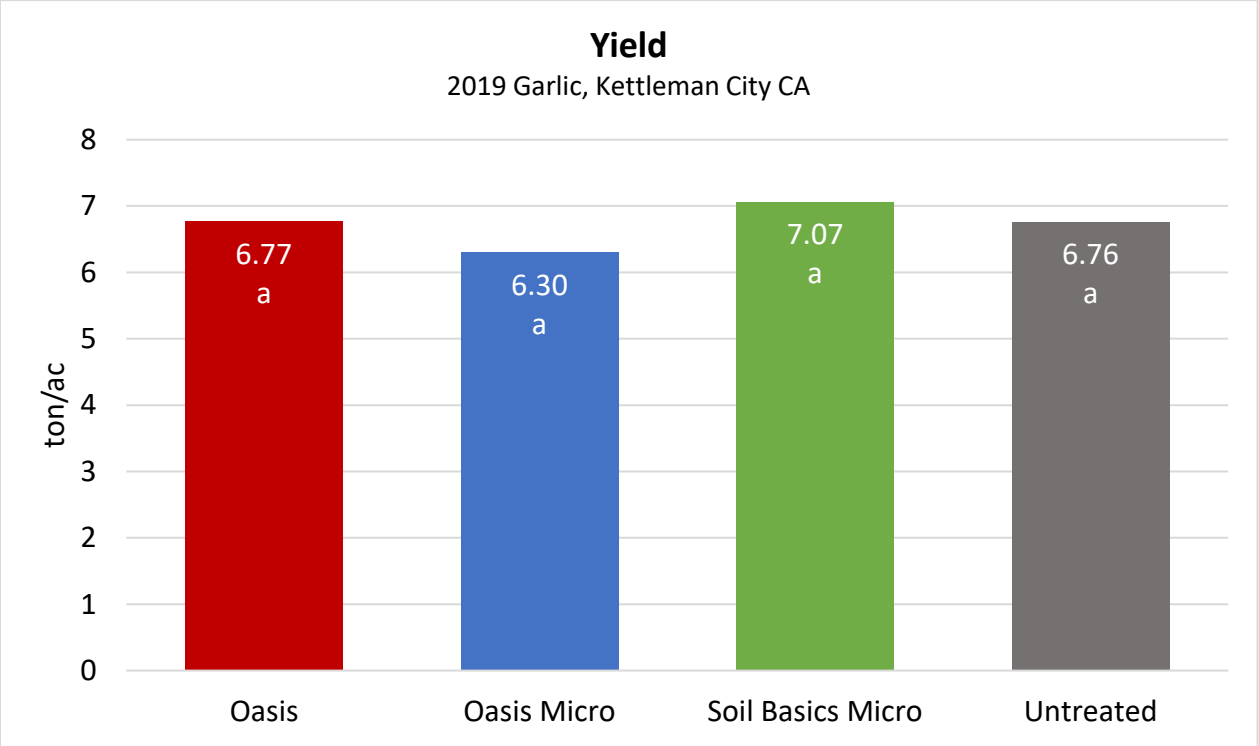

Figure 4. Tons per acre for each treatment. Values followed by the same letter indicate no significant differences (α=0.10).

Rot levels were low; none was found in Soil Basics Micro plots, statistically less than the 1.2% in Oasis and untreated plots. Bulbs under 1.5" diameter comprised a larger proportion. Oasis-treated areas had over 17% undersize, while Oasis Micro undersize levels were numerically lowest, at 14%. Deformities were about 20% in all treatments. No difference in total cull amount between treatments was statistically verified.

Quality				
Treatment	*Rot*	*Undersize*	*Deformed*	*Total Cull*
	percent			
Oasis	1.2a	17.7a	20.2a	39.1a
Oasis Micro	0.6ab	14.0a	21.4a	36.0a
Soil Basics Micro	0.0b	16.8a	18.3a	35.1a
Untreated	1.2a	16.6a	19.0a	36.7a

Table 3. For each treatment, rot, undersize, and deformed percentages. Values followed by the same letter indicate no significant differences (α=0.10).

Based on an average price of $78.9 per cwt for 2018 garlic, gross return was high (figure 5). Soil Basics Micro areas produced the highest return, a 5% increase over untreated.

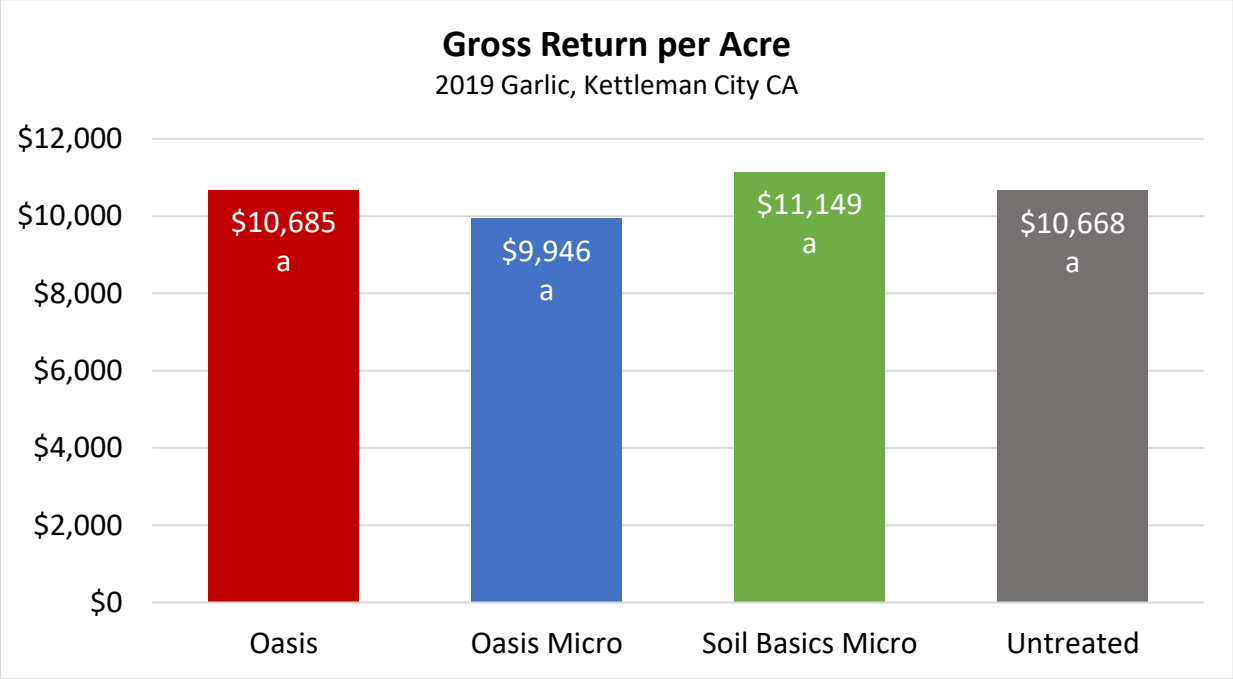

Figure 5. Average gross return per acre for each treatment. Values followed by the same letter indicate no significant difference (ANOVA, $\alpha = 0.10$).

Conclusions

There were no visual distinctions between treatments during the growing season. Soil Basics Micro plots produced the greatest yield with statistically more bulbs, but the smallest bulbs. Oasis and untreated followed in yield, with numerically heavier bulbs. Oasis Micro had fewer bulbs and accordingly lower production. Cull percent was lowest in Soil Basics Micro plots, while Oasis contained the largest percentages of rot, undersize, and deformity.

It was not clear whether micronutrients or Oasis provided benefit: Soil Basics Micro was the top performer overall, and Oasis followed – while the combination (Oasis Micro) appeared poorer than untreated. Yield results were not statistically verified, so field variability may have produced the observed differences.

Raw Data

Treatment	*Replicate*	*Weight (lb/25ft^2)*	*Bulb Number*	*Rot (#)*	*<1.5" (#)*	*Deformed (#)*
Oasis	1	7.86	86	2	22	19
	2	7.81	85	1	13	15
	3	7.11	79	0	13	11
	4	8.31	74	1	10	20
Oasis Micro	1	6.81	74	0	9	20
	2	7.11	84	1	14	13
	3	7.36	72	0	6	21
	4	7.66	79	1	15	11
Soil Basics Micro	1	8.81	88	0	11	22
	2	8.61	94	0	16	17
	3	7.86	93	0	19	13
	4	7.16	81	0	14	13
Untreated	1	8.06	79	1	11	20
	2	7.86	88	2	19	14
	3	7.16	78	0	11	14
	4	7.96	78	1	13	13