Effect of Humate Products on Chile Pepper Yield and Yield Components

Dan Smeal

Abstract

This study was implemented to evaluate the effect of soil applied humate products on the yield and yield components of drip irrigated chile pepper (Capsicum annuum).

Introduction

Humic substances (humate, humic acid, etc.) basically refer to extracts from well-decomposed organic material such as coal, compost, peat, etc. Claimed benefits of soil applied humate to soil quality and plant growth are numerous but the results from scientific research studies have not always substantiated these claimed benefits (Mikkelsen, 2005). The addition of organic matter to soil has been shown to improve soil physical properties such as tilth, water retention, and nutrient reserve, especially when continuously applied over many growing seasons. Benefits to soil chemical properties including improvements in cation (e.g. Zn and Fe) availability, reduction in toxic metal levels, and enhancing availability of P in both acid and calcareous soils have also been reported by the addition of humic materials to soil (Lee and Bartlett, 1976; Adani, et al., 2008). Improved growth and yield of tomato has also been observed by foliar and soil applications of humic acid (Yildirim, 2007).

Due to the great variability between the physical and chemical properties of different soils and humate products, the effects of applying humate to soil are unpredictable and optimum application rates are difficult to quantify. This pilot study was conducted to evaluate the effect of soil applied humate products on yield and yield components of drip-irrigated chile peppers.

Objectives

- Evaluate the effects of a single rate of four different humate products on the yield and yield components of chile peppers.

Materials and methods

Chile pepper (*Capsicum annuum* Mirasol type) seedlings were transplanted by hand at an in-row spacing of 12 inches in 8, 90 foot long rows on four (pre-irrigated) beds during the week of June 2, 2013. Beds spacing was 36 inches and row spacing on beds was 24 inches. A single line-source drip tape with an emitter spacing of 8 inches was lateralled next to each tomato row. Specified flow rate of the drip tape was 46 gph per 100 feet (0.31 gph per emitter) but measured flow rate was only 0.16 gph per emitter (24 gph/100 feet). Chemical analysis of preplant soil samples taken on March 6, 2013 are shown in Table 1. Requested analyses of N and organic matter were not provided. The first drip irrigation (1-hour) was applied on June 12. Irrigations were subsequently scheduled for every day to every-other day for 1 to 2 hours (0.16 to 0.32 gals/day per emitter) from June through mid-July then for 4.5 hours per day (twice per day at 2.25 hours per set) for a total of 0.7 gals/emitter/day from mid-July through August. Three solid humate products milled at different particle sizes and one liquid humic acid product were applied to the soil near the base of plants on July 12, 2013 when plants were flowering. Rates were 5 grams per plant for the three solid materials; dry standard AG ¼" (DSG), dry greens grade 1-2 mm (DGG), and dry high grade pulverized < 30 mesh (DHG) and 15 ml/plant for the liquid product. Plots were 5 feet (5 plants) of row and included two replicates (in which treatments were randomly distributed) within each of four rows. An untreated (control) plot was also included in each replicate.

Table 1. Chemical analysis of pre-plant soil samples taken at the site of proposed chile humate study. NMSU Agricultural Science Center at Farmington, NM. 2013.

pH	P	K	Zn	Fe	Mn	Cu	Ca	Mg	Na
	ppm								
8.2	7.6	175	2.35	4.56	1.55	0.90	4300	208	25.1

Fertilization

Micronutrients (Miller Nutrient Express, 18-18-18) consisting of 18% N, 18% P_2O_5, 18% K_2O, 0.50% Mg, 0.02% B, 0.05% Cu, 0.10% Fe, 0.05% Mn, 0.001% Mo, and 0.05% Zn was injected into the drip irrigation water on June 25 and July 18 at an estimated rate of 7 lbs of product per acre.

Pest Management

No herbicides or insecticides were used in the study plot. Weeds were controlled by hoeing or hand pulling and no significant damage by insects or diseases was noted.

Harvests

Mature green (or red) chile pods were harvested from all plants within each plot on three dates (August 20, September 3, and September 24, 2013). An early freeze on September 28 damaged the remaining (non-mature) pods so addition harvests were not conducted. Marketable pods were counted and weighed fresh immediately after harvest. Pod weight from each plot was converted to yield in tons/acre and components of yield (number of pods and average weight per pod) were calculated.

Treatment means were compared using an analysis of variance (ANOVA) procedure in CoStat Version 6.311, a statistical analysis software package published by CoHort Software.

Results and discussion

The only significant difference noted between yields or components of yield (pods per plant or weight per pod) from the different treatments occurred with marketable green chile where the mean yield of 17.9 tons/acre produced from the plots treated with the liquid humic product was significantly greater than the mean 14.4 tons/acre produced from the plots treated with the coarse-milled DSG material (Table 2). Total marketable yield ranged from a high of 20.5 tons/acre from the plots treated with the liquid to a low of 17.3 tons/acre from the plots treated with the DSG material but these yields were not significantly different (Table 2). Slight yield differences between treatments appeared to be related more to the number of fruits (pods) produced per plant (about 42 in plots yielding near 20 tons/acre and only 37.5 in plots yielding 17.4 tons/acre) rather than weight of individual fruits (Table 2).

Table 2. Yield and yield components of Mirasol type chile peppers treated with four different humate products; Agricultural Science Center at Farmington, NM. 2013.

Yield or Yield Component	Humate Product				
	Liquid	DHG	DGG	DSG	Untreated
Marketable Green Pod Yield (tons/acre)	17.9 a	17.2 ab	16.9 ab	14.4 b	15.4 ab
Marketable Red Pod Yield (tons/acre)	2.5	2.7	3.0	2.9	2.1
Total Marketable Yield (tons/acre)	20.5	19.9	19.9	17.3	17.5
No. Fruits per Plant	41.8	41.9	44.2	37.5	37.5
Weight per Fruit (oz)	0.90	0.87	0.83	0.85	0.87

‡Values represent the average of 4 replications with each replication being the mean data from two 5-foot plots within a single row. Treatment means followed by the same letter within a row are not significantly different at the 5% level of confidence based on Anova and Tukey's HSD means comparison. The absence of letters signifies no significant difference.

Averaged over all treatments, 56% of the total yield of 19.3 tons/acre was picked on the first harvest of August 20-21 (Table 3). The remaining 18 and 26% were harvested on 9/3-4 and 9/24-25, respectively. Most chile was picked at the mature green stage so only 14% of the total marketable yield (2.7 tons/ac) was red (Table 3). Total number of marketable pods produced per plant from all three harvests averaged 39.9 and the average weight per pod was 0.89 ounces.

Table 3. Average yield and yield components for three harvests of Mirasol type chile peppers; NMSU Agricultural Science Center at Farmington, NM. 2013.

Component	Harvest Date			
	8/20-21	9/3-4	9/24-25	Total
Marketable Green Pod Yield (tons/acre)	9.31	2.39	4.85	16.6
Marketable Red Pod Yield (tons/acre)	1.52	1.04	0.18	2.7
Total Marketable Yield (tons/acre)	10.83	3.43	5.03	19.3
No. Marketable Pods per Plant	18.8	7.71	10.55	39.9
Fresh Weight per Pod (oz)	1.06	0.82	0.88	0.89
Percent Red (by weight)	14.1	30.3	3.6	14.0

Summary and conclusions

Average chile yield from untreated plots of this study was not significantly different than average yields produced from humate-treated plots. Chile growing in soil treated with a liquid humate product at a rate of 15 ml per plant did produce a greater average yield than chile growing in soil treated with all other treatments but the yield was not significantly different than that from the control plot. A more rigorous