



Medical Marijuana Rate Trial 2016

Purpose

Establish an optimal rate for Sustane's organic and natural fertilizer products to reduce costs and simplify outdoor growing of medical marijuana in Michigan.

Methods

Different Sustane products were tested as sources of fertility for an outdoor grow of medical marijuana in Michigan during the summer of 2016. Transplants of *Cannabis sativa* were grown outside in 65 gallon pots filled with ProMix M. Supplemental fertility was provided using Sustane Natural fertilizer products at varying rates. The experiment was set up as a replicated block design with 4 blocks of 12 plants each. Within blocks, sub experiments were conducted using organic or blended natural products applied at various rates. Crop assessments included visual scoring for growth and color as well as yield assessments at harvest. Flowers and buds were harvested in late September and air dried prior to assessment.

Results

All plants responded well to added fertility, regardless of rate applied. While about 10% of plants initially showed signs of transplant shock (e.g. yellowing whitening of leaves upon outside placement), all signs of stress were relieved by four weeks post-transplant. Rainfall was above normal and adequate supplemental irrigation was provided.



Figure 1: Typical growth and maturation of Cannabis following addition of Sustane Natural Fertilizer. Plant 2.2 shown at time of initial transplant (left), top dress treatment (center), and just prior to harvest (right).

Variation in plant growth throughout the experiment was substantial (Figure 1). Transplants varied in height and fullness, with initial height and leaf area differing by up to a factor of two. Nonetheless, all fertility treatments supported vigorous growth through the vegetative stage.

Increasing rates of Sustane's fertilizers were noted to improve plant growth and yields. The relationship between crop yield and fertilizer rate was positive. Here, the dry bud yield increased by 5 g for every cup of Sustane-based starter fertilizer applied at transplanting (Figure 2). Because the yields did not taper off at the higher application rates used in this study, higher yields are clearly obtainable. Overall, plants receiving the highest rate of Sustane fertilizers (0.50 lbs. N / pot) produced 9.7% more yield on a dry weight basis than those receiving the lowest rates (0.17 lbs. N / pot).

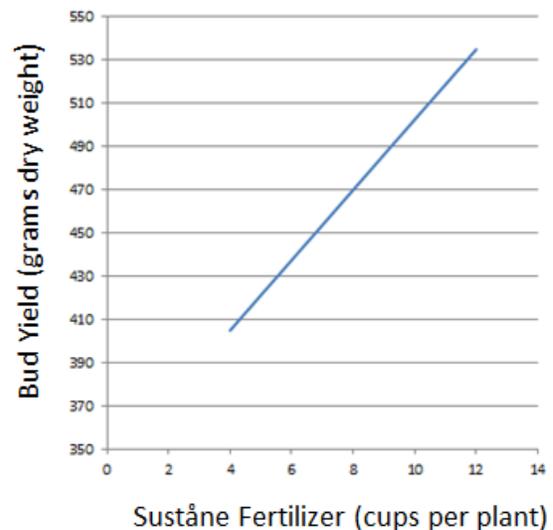


Figure 2: Relationship between Sustane fertilizer additions to potting mix and yield of Cannabis plants.

Across the trial, yields were acceptable but varied substantially by plant regardless of rate of fertility applied. Harvested dry weights ranged from 237 to 905 g dry weight per plant. Average and median yields were just less than one pound per plant, i.e. 426 and

422 g dry weight, respectively. Significant differences in yield were observed by cultivar, with Grape Ape yielding about 50% more than Tangerine Power and about 25% more than Blueberry when grown under similar fertility regimens.

Cannabinoid profiles were largely unaffected by fertilizer type and rate. The harvested material in this trial averaged 18.5% cannabinoids by weight, with individual plants yielding 14.5 to 20.3% cannabinoids on a dry weight basis. Average cannabinoid decreased marginally (i.e. <0.8%) with increasing fertility rate in all three paired comparisons (P < 0.2). The relative concentration of THC harvested did not vary with Sustane fertilizer rate, biomass yield or irrigation block ranging from 90 to 92% of total cannabinoid content across all test samples. Because biomass yield increased by about 10% for each step up in fertilizer rate, total cannabinoid and THC yield are expected to increase in concert with biomass production when plants are fertilized with Sustane materials.

Increasing the rate and frequency of nutrient availability increased vegetative growth rates and bud yields. Specifically, changes in vegetative growth scores were highest for split vs single fertilizer applications at the same overall rate of addition.

| Rate | Apps | ΔVegScore | Yield/Plant |
|------|------|-----------|-------------|
| Low | 2 | 2.4 ab | 377 |
| Med | 2 | 2.4 ab | 419 |
| Med | 1 | 1.9 b | 390 |
| High | 1 | 2.7 a | 420 |

Table 1: Growth enhancement of Cannabis due to Sustane fertilizers. Values in the same column followed by different letters differ significantly (P<0.1).

For single application treatments, there was a significant increase in vegetative growth rate with a step up in the amount of fertilizer applied. Average yields increased by around 10% for each step up in application rate as well as by splitting fertilizer applications of Sustane’s organic granules.

Split applications of fertilizer can provide greater nutrient use efficiency by Cannabis plants and reduce costs for growers. In this trial, it took 3 cups of Sustane 4-4-4+Bolster at transplanting to give rise to comparable yield increase of two 1 cup applications. The difference was likely due to nitrogen loss over

time. Significantly, the average yield potential of plants treated with Sustane’s blended fertilizers (SRN+CRF) was higher than the organic (SRN only) fertilizers used in this study (475 vs 402 g d.w. per plant, respectively). Furthermore, plants treated with the blended fertilizers yielded more than 1 lb. (d.w.) per plant more frequently than plants treated with the organic only program. These data suggest that Cannabis growers could optimize their fertility programs using a single application of Sustane’s blended fertilizers or just two to four applications of Sustane’s organic fertilizers.

The value of the Sustane-based fertilizer programs examined in this trial was exceptional. The highest rate tested cost less than 10% of the cooperator’s standard program for fertilizing their plants! That translated into over \$2400 in savings on fertilizer alone. Furthermore, getting a single step up in yield of 10% by increasing fertilizer rates could translate into around \$14,000 more income per growth cycle.

Because the Sustane-based program was simpler to implement, there is also a substantial savings in labor time and expertise required to complete a successful grow.

Follow up research is planned with this cooperator. The most important questions will be how different rates affect the quality as well as yields of the crop. In addition to examining different combinations of dry granular products and rates, the grower will examine how Sustane’s compost tea might most profitably be used to further enhance grower yield and crop quality.



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