# Medical Marijuana Outdoor Trials 2017

**Purpose**

Establish an optimal fertility rate for outdoor cultivation of medical Cannabis in MI that uses Suståne's organic fertilizers with and without various supplements.

**Methods**

Multiple rates of Suståne products were tested as the primary source of fertility for an outdoor grow of medical marijuana. Transplants of *Cannabis sativa* cv. Grape Ape were grown outside in 65-gallon pots filled with ProMix M. Essential plant nutrients, biostimulatory humates, and beneficial microorganisms were provided using Suståne products at varying rates. Suståne's Organic programs were used varying amounts of dry granular 8-2-4 and/or 4-6-4 added to the potting mix every four to eight weeks. Hybrid programs used 12-12-12 added to the potting mix sometimes supplemented with 4-6-4 up to every 4 weeks during bloom. Both types of programs were sometimes supplemented with Suståne Compost Tea, an experimental biostimulant, or Hi-N water dispersible fertilizers once a week during bloom phase.

**Figure 1: Typical growth and maturation of Cannabis following addition of Suståne Natural Fertilizer. Plant A10 shown at time of initial transplant (left) and just prior to harvest (right).**

The experiment was set up as a replicated block design with three replicates and four rate regimes examined. Each plant received 1 to 5 applications of Suståne dry granular fertilizers delivering a total of 73 to 146 g of N per plant over the course of the growing cycle. When used, liquid supplements were added twice during bloom phase, adding just 1 to 10% more macro nutrients.

**Results**

**All plants responded well to added fertility regardless of program used.** Growing conditions were good in 2017 and yields ranged from 1.05 to 2.40 lbs. dry weight per plant. Variation in plant growth among pots was minimal, indicating that growing conditions were even across the test site. Specifically, the coefficient of variation for organic programs ranged from 7.1% to 8.5% and hybrid programs ranged from 5.3% to 24.4%.

**Increasing rates of Suståne's fertilizers were noted to improve plant growth and yields**. When fertility is limiting, increasing application rates will produce higher yields following the law of diminishing returns (Table 1). Organic programs using roughly 30% more nitrogen produced just 13% greater yields. Likewise, hybrid programs using about 50% more nitrogen produced 37% higher yields.

| Suståne Program | N applied g / plant | Yield g/plant | Nitrogen NUE | P2O5 NUE | K20 NUE |
|---|---|---|---|---|---|
| Organic High5 | 122 | 878 a | 7.3 | 14.5 a | 13.1 a |
| Organic Low5 | 95 | 779 b | 8.1 | 14.3 a | 12.9 a |
| Hybrid Med4 | 109 | 786 b | 7.2 | 6.2 b | 7.2 b |
| Hybrid Low4 | 73 | 573 c | 7.9 | 6.3 b | 7.9 b |

**Table 1: Effects of increasing rates of Suståne fertilizers on Cannabis yields and nutrient use efficiencies. NUE values are calculated as g dry weight yield per g of nutrient applied. Values in the same column followed by different letters differ significantly (P<0.1).**

Nitrogen use efficiencies decreased marginally in response to higher fertilizer rates, but were still above 4.9 g dry weight product per g of nutrient for all programs and rates tested. Organic programs outperformed hybrid programs which used Suståne's 12-12-12 as the primary source of nutrients producing higher yields at roughly comparable nitrogen use efficiencies. Such enhanced performance was possible

because organic programs were roughly twice as efficient at utilizing fertilizer phosphorus (P205) and potassium (K20) as the Hybrid programs (P<0.05).

**Sustâne's dry granular fertilizers are remarkably cost effective.** Overall, the cost of our test programs ranged from $2.01 to $3.34 per plant which translated to just $1.56 to $1.84 per lb. of dry product (Table 2). At wholesale prices of $1000/lb., plants receiving Sustâne's dry granular fertilizer programs produced well over $500 sellable product for every $1 of Sustâne fertilizer applied.

| Program | N applied g / plant | Cost per Plant | Cost per lb. DW |
|---|---|---|---|
| Organic High5 | 121 | $ 3.34 | $ 1.84 |
| Organic Low5 | 97 | $ 2.67 | $ 1.56 |
| Hybrid Med4 | 109 | $ 3.00 | $ 1.73 |
| Hybrid Low4 | 73 | $ 2.01 | $ 1.59 |

**Table 2: Input rates and costs of different Sustâne fertilizers programs.**

**Regular top-dressing can be used to improve production efficiency.** Specifically, adding just three top dressing applications significantly improved yields in both organic and hybrid Sustâne-based fertilizer programs (P<0.05; Table 3). Splitting applications of Sustâne's dry granular fertilizers increased yields by 15% to 20% in this study.

| Program | Apps | Yield g/plant | Nitrogen NUE | P2O5 NUE | K20 NUE |
|---|---|---|---|---|---|
| Organic High5 | 5 | 878 a | 7.3 | 14.5 a | 13.1 a |
| Organic High4 | 4 | 822 ab | 6.8 | 13.6 a | 11.3 a |
| Organic High2 | 2 | 766 b | 6.3 | 25.2 a | 12.6 a |
| Hybrid Med4 | 4 | 786 b | 7.2 | 6.2 b | 7.2 b |
| Hybrid Med1 | 1 | 655 c | 6.0 | 6.0 b | 6.0 b |

**Table 3: Effects of splitting fertilizer applications on yield and nutrient use efficiencies (NUE). NUE values are calculated as g dry weight yield per g of nutrient applied. Values in the same column followed by different letters differ significantly (P<0.1).**

Additionally, splitting applications tended to improve nutrient use efficiencies where the proportions of macronutrients applied were approximately the same. However, NUE of P and K varied more by type of fertilizer than by frequency of applications.

**Addition of liquid supplements to Sustâne's dry granular fertilizer programs during bloom can sometimes increase yields**. Such increases can depend on the amount of nutrients provided by the dry granular program, but this is not always the case (Table 4). In this study, both the experimental biostimulant (B) and Sustâne's compost tea (CT) significantly increased Cannabis yields overall(P<0.10). When applied during bloom, Sustâne's compost tea increased yields by 7% on average and the experimental increased yields by 20%.

| Liquid Supplement | Organic Low5 | Organic High5 | Organic High4 | Organic High2 | Avg. |
|---|---|---|---|---|---|
| B | 952 a | 1000 a | 1033 a | 946 a | 981 a |
| CT | 930 a | 937 ab | 820 b | 788 b | 868 b |
| WDF | 736 b | 752 c | 776 b | 816 b | 770 c |
| None | 779 b | 878 b | 822 b | 766 b | 811 c |

**Table 4: Increased Cannabis yields (g per plant) in response to liquid supplementation during the bloom phase. Yield values in the same column followed by different letters differ significantly (P<0.1).**

**The value of the Sustâne-based fertilizer programs examined in this trial was truly exceptional.** By providing slow release N, balanced nutrition, beneficial microorganisms, and natural humate biostimulants, Sustâne's dry granular fertilizers provide the most cost-effective way to produce organic Cannabis. Because the Sustâne-based program was simpler to implement, there is also a substantial savings in labor time and expertise required to complete a successful grow. With an optimized program in hand, our cooperating grower is now using Sustâne-based program for all their outdoor production!

**For more information on this project, contact us at help@Sustâne.com or our grower cooperator, Sam Kaca, at samantha.kaca@gmail.com**