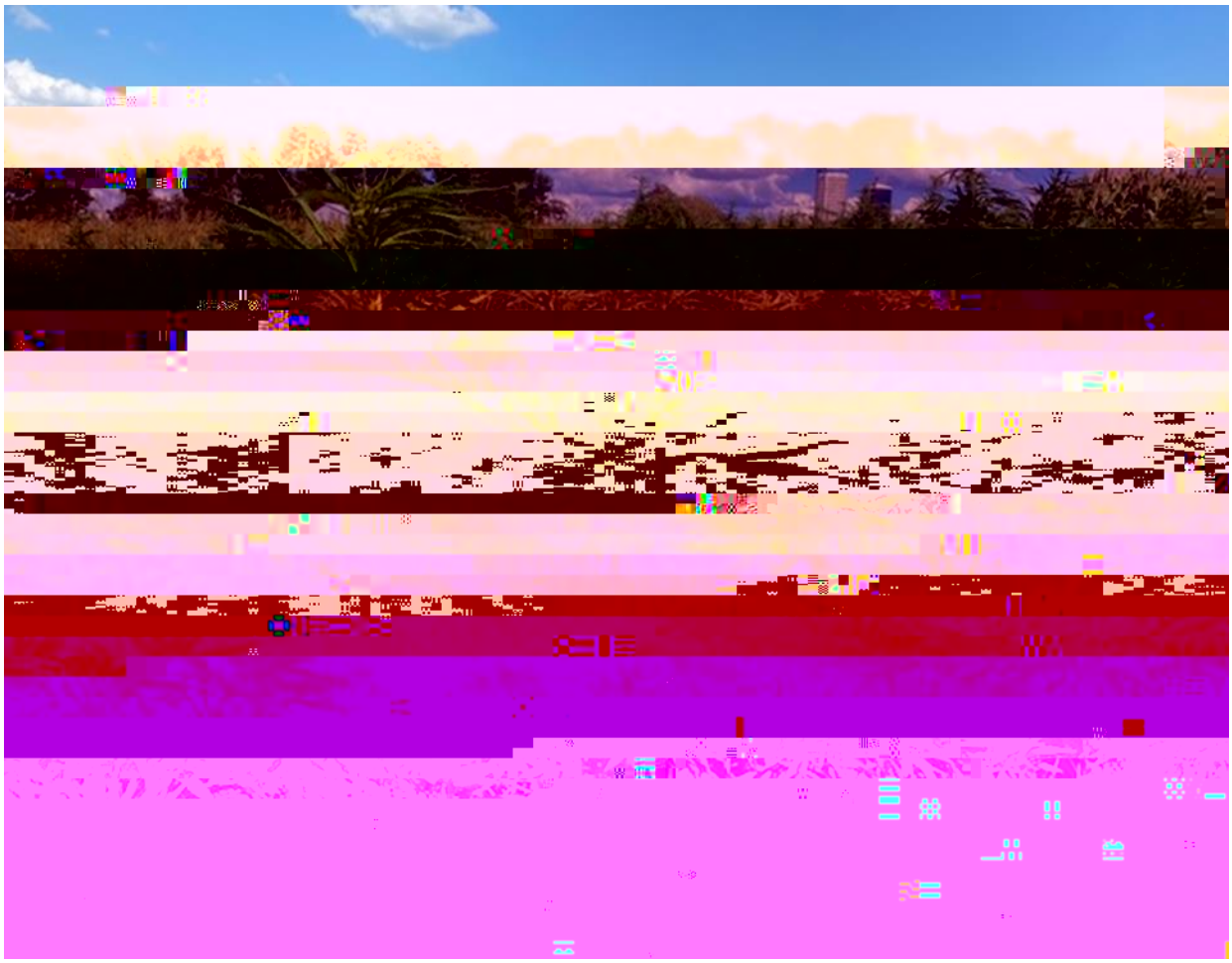
2022 Hemp Flower Nitrogen Fertility Trial



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THE UNIVERSITY OF VERMONT EXTENSION

2021 HEMP FLOWER NITROGEN FERTILITY TRIAL

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Hemp is a non-psychoactive variety of *Cannabis sativa* L. The crop is one of historical importance in the U.S. and re-emerging worldwide importance as medical providers and

MATERIALS AND METHODS

The trial was initiated at Borderview Research Farm in Alburgh, Vermont (Table 1) and the experimental design was a randomized complete block design with four replications. Plots consisted of five plants spaced ments consisted of five N application rates including a Control (0 lbs N ac^{-1}), 50, 100, 150, and 200 lbs N ac^{-1}.

Table 1. Agronomic information for the hemp nitrogen fertility trial, Alburgh, VT, 2021.

Location	**Borderview Research Farm Alburgh, VT**
Soil type	Benson rocky silt loam, 8-15% slope
Previous crop	Spring Grains
Plot size	2
Plant spacing (ft)	
Variety	Elektra
Plant material	Seedling
Planting date	6-Jun
Harvest date	27-Sep, 28-Sep

Individual seeds were sown one seed per cell in Deep 50 cell plug trays on 1

Variations in yield and quality can occur because of variations in genetics, soil, weather, and other growing conditions. Statistical analysis makes it possible to determine whether a difference among treatments is real or whether it might have occurred due to other variations in the field. At the bottom of each table a p-value is presented for each variable that showed statistical significance (p-
difference between two treatments within a column is equal to or greater than the least significant difference (LSD) value and you can be sure that for 9 out of 10 times, there is a real difference between the two treatments. In this example, treatment C is significantly different from treatment A but not from treatment B. Treatment B and treatment C
results are statistically similar. The difference between treatment C and treatment B is equal to 1.5, which is less than the LSD value of 2.0. This means that these treatments did not differ in yield. The difference between treatment C and treatment A is equal to 3.0, which is greater than the LSD value of 2.0. This means that the yields of these treatments were significantly different
yield value shows
that this value is significantly different from treatment B and treatment C

RESULTS

highest observed widths were seen at the 200 lbs N ac^{-1} treatment at 117 cm and was statistically similar to the 50 lbs N ac^{-1} treatment. Whole plant weights showed highest values in the highest three nitrogen rates within the trial. The 150 lbs N ac^{-1} treatment had the highest overall whole plant weight at 13.0 lbs and was statistically similar to the 150 and 100 lbs N ac^{-1} treatments at 12.4 and 12.2 lbs per plant respectively.

Table 4. Hemp whole plant weight, height, and width, Alburgh, VT, 2022.

Treatment lbs N ac^{-1}	Plant height cm	Plant width cm	Plant weight lbs $plant^{-1}$
0	135 b	86.0 c	3.10 b
50	**163 a**	114 ab	6.10 b
100	138 b	85.0 c	12.2 a
150	144 b	89.0 bc	**13.0 a**
200	148 ab	**117 a**	12.4 a
LSD (0.10)	16.3	26.6	3.05
Trial Mean	145	98.0	9.40

LSD Least significant dDIHU

[redacted]

Figure 1. Hemp flower yields Alburgh, VT, 2022.

At harvest, a composite subsample of flower material was collected from each plot and dried down to determin

Table 6. Hemp flower bud yield, Alburgh, VT, 2022.

Treatment	Flower dry matter		Unmarketable wet flower yield		Dry matter	
lbs N ac^{-1}	%		lbs ac^{-1}		lbs ac^{-1}	
0	25.0	b	**10.6**	**a**	700	c
50	26.3	b	22.1	a	1223	b
100	22.4	ab	10.8	a	1655	a
150	23.4	ab	104.1	b	**1731**	**a**
200	**19.6**	**a**	29.8	ab	1413	ab
LSD (0.10)	3.95		77.1		398	
Trial Mean	23.3		35.5		1345	

Within a column, treatments with the same letter are not significantly different from each other.
LSD Least significant difference at p=0.10.
Dry matter yield is reported at 0% moisture.

Whole plants were chipped and analyzed for primary and secondary plant nutrients (Table 7). There were significant differences across treatments for potassium, phosphorus, calcium, magnesium, sulfur, manganese, boron, and zinc. Nitrogen management of soil is closely linked to the plant uptake of a wide number of nutrients. Differences in primary and secondary nutrient uptake could have been impacted by changes in soil pH as a result of increased nitrogen application rates or weather conditions.

Table 7. Hemp whole plant nutrient analysis, Alburgh, VT, 2022.

Treatment	Nitrogen	Potassium		Phosphorus		Calcium		Magnesium		Sulfur		Carbon
lbs N ac^{-1}	%	%		%		%		%		%		%
0	2.32	1.79	b	0.761	ab	2.17	ab	0.260	ab	0.225	ab	21.8

Table 7 cont. Hemp whole plant nutrient analysis, Alburgh, VT, 2022.

DISCUSSION

As we continue to investigate nitrogen response in high cannabinoid hemp, some similarities can be observed between past research done in grain and fiber. However, through three years of study in flower hemp, there appears to be greater variability in nitrogen uptake for flower production. Some grain and fiber hemp research have shown that the majority of nitrogen uptake occurs during the first month of growth during vegetative periods. This ends up being a critical growth period for high cannabinoid hemp as well with the rapid uptake of nitrogen occurring during the vegetative production period. Additionally, a positive yield and biomass response in grain and fiber varieties is seen with increased nitrogen application rates up to approximately 130 lbs N ac^{-1}. Past this point, additional nitrogen appears to have no major impact on grain yields. In the 2020 hemp flower nitrogen fertility trial, those treatments that received the highest three nitrogen application rates resulted in greatest whole plant biomass, showing some similarities to past research results in grain and fiber hemp. In 2021, there appeared to be little influence on hemp growth and development as a result of nitrogen fertility treatments. However, greater treatment impacts were noted in the 2022 growing season as noted earlier. These were largely seen in flower yields and concentrations of flower and stem material for plants in each treatment.

This trial was also conducted with University of Maine at The Rogers Farm in Stillwater, Maine to capture seasonal differences in the Northeast. The impacts of varying weather conditions became more apparent through comparisons across research sites. While 2021 was hot and dry in Vermont and 2022 was comparatively cool and wet, Maine saw opposite weather conditions in each year and similar trending for gathered metrics in flower dry matter and flower yields.

whole plant nitrogen concentrations were extrapolated to a crop removal rate per acre over the past few years to gain a clearer picture of

Given the maturation rate of the selected variety for this trial and potentially as a result of disease resistance, there appeared to be little to no observable pest issues in this trial, whereas adjacent trials suffered from powdery mildew and Septoria leaf spot issues.

Cannabinoid concentrations in this year of study did not appear to be impacted by nitrogen application rate. In past years of studies there were similar responses, or lack thereof, for several cannabinoids however some differences were observed in other years with different hemp varieties. In past years, increased nitrogen application rates have led to depressions in cannabinoid concentrations with a nearly 4% difference between 150 lbs N ac^{-1}