

Eliminating Heavy-Metal Toxicity in Medical Marijuana, to Produce Patients' Medicine Safer Than Drinking Water...

... WHILE RAISING BUD WEIGHT, THC, AND CANNABINOIDS.

A Research White Paper.
Authored by Julian Karadjov, PhD
Bulgarian Academy of Sciences

How to Protect Medical Marijuana Patients from Heavy-Metal Toxicity While Raising Bud Weight, THC, and Cannabinoids

The cannabis growing community on the whole is still in its infancy. Consequently, there are many myths that still abound.

Hearsay and tradition are treated as dogma and the lack of attention from the scientific world still leaves many questions. We hope to share a few little-known facts in this report of which the growing community needs to be aware.

Specifically, we will explore the research and share our findings on ...

- **A little-known fact about the cannabis plant that most growers never consider (and this puts their plants and the consumers of their plants at great risk of harm).**
- **New scientific research demonstrating the importance of not just cannabis-specific, but pharmaceutical-grade cannabis-specific fertilizers for human safety as measured by leading third-party research labs.**
- **How Advanced Nutrients fertilizers increase overall yields, THC, and cannabinoids (as proven, among other, by research at the University of Mississippi—the only DEA-certified growing facility for cannabis research).**

The information, scientific research, and development that went into compiling this report have been in development since at least as early as 2003.

Our goal in releasing this white paper is to give the grower new scientific information and considerations so that he or she may make more informed decisions in choosing the correct fertilizer program for their cannabis plants.



In 2012, the author of this Special Report, Julian Karadjov, PhD, was invited by the organizers of the international cannabis conference Cannafest 2012 in the capital of the Czech Republic—Prague. He was asked to speak exclusively on the subject of heavy metals and their influence on overall plant health and resulting yields. He also discussed the effects of the final product on human health.

Advanced Nutrients employs over 23 PhDs who perform cannabis-specific research in our state-of-the-art Bulgarian laboratory. Plant tissue samples are tested with a 4-stage gas chromatograph which can measure with accuracy of parts per trillion (good for tracking hormonal pathways).



WARNING:

Cannabis is an accumulator plant. It takes up everything from the soil or the growing medium—the good and the bad. Cannabis is even used for soil remediation—to absorb toxic and radioactive elements from the soil. Because of this, cannabis grown as a medicine has to be fed with the safest plant nutrients available.

A Little-Known Fact about Cannabis

(and why it is dangerous not to know)

As you might know, the cannabis plant is known as one of the “accumulator plants”. This means it accumulates everything in its environment and these substances remain in the plant, influencing all future development of the sapling, the germ, and even the seed.

In fact, cannabis is so effective at accumulating contaminants, that it was even used after the Chernobyl accident to remove radioactive waste from the soil. While soil remediation sounds great, the fact is, the cannabis plants used became highly radioactive as a result, and had to be disposed of properly as well.

Can you imagine a patient treating themselves with radioactive medicine?

Scary thought, isn't it?

It's this unique property, among many other particularities of the cannabis plant, that demonstrates the need for cannabis-specific fertilizers.

Even generally speaking, when we talk about high yields and high quality, there is no such thing as standard fertilizers. Every plant species, and every variety, has its specific needs. Geranium flowers need much more phosphorus to produce their famous blossoms and aroma. Tomatoes reveal their full genetic potential (sweet taste, full color, juicy fruits) only when fed more

potassium than most other plants. Farmers enjoy a rich harvest of wheat or corn only when enough molybdenum is present in the soil.

In addition, even different varieties of one and the same plant may have specific needs, meaning the use of only one type of fertilizers is ill-advised.

This is even more true for cannabis not only because of the diverse strains and varieties of this plant but also because of its aforementioned status as an accumulator plant. That's why it's not enough to have “cannabis-specific” fertilizers. The grower also needs fertilizers whose effects have been scientifically tested and studied on many different strains.

In other words, endless experiments with different strains of this unique plant are needed for the creation of the ideal nutrients for medical marijuana. In order to maximize the levels of THC and other cannabinoids, while consistently increasing yields, extensive research must be undertaken and applied to the production of these highly specialized nutrients.

And most importantly, the grower has a responsibility to always keep in mind the end user of the marijuana—and because of his plant's unique accumulator status—must do everything possible to ensure patient safety.

¹ In 1998, Phytotech, along with Consolidated Growers and Processors (CGP) and the Ukraine's Institute of Bast Crops, planted cannabis for the purpose of removing radioactive contaminants near the Chernobyl site.

Where Does Contamination Come From?

Let's take a look at different sources of contamination and how it's possible to keep plants safe—from the roots to the buds. This is especially important now that we've established that cannabis is an incredible accumulator plant and that human beings will ultimately consume it.

Humans can take in large amounts of heavy metals, either from polluted food or from toxic fumes. Plants are no different: their roots absorb heavy metals from the soil, the

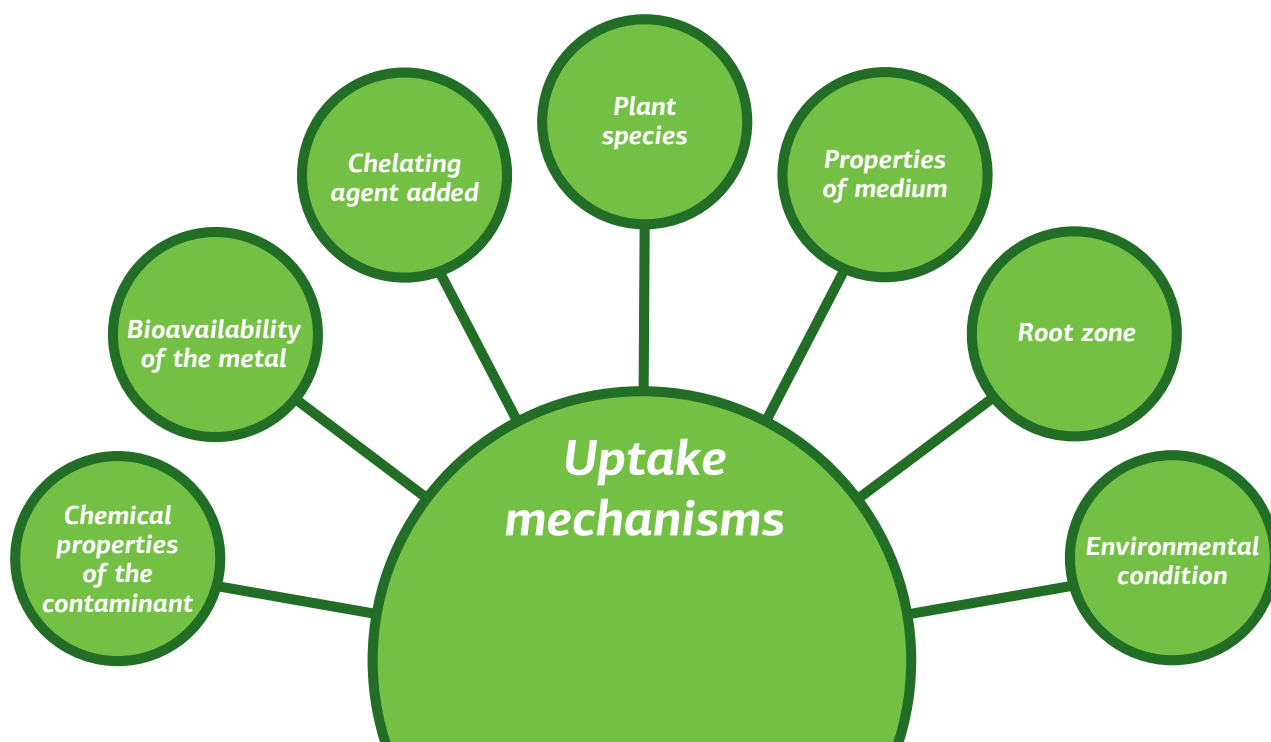
growing media and also the nutrients they're fed. It is a sad irony that some of the most valuable nutrients plants need to survive can serve as vehicles for delivering toxic heavy metals.

Phosphorus is notoriously problematic, as we will discuss. If it's too little, the dose won't help. On the other hand, if it's too much, the entire plant will be poisoned.

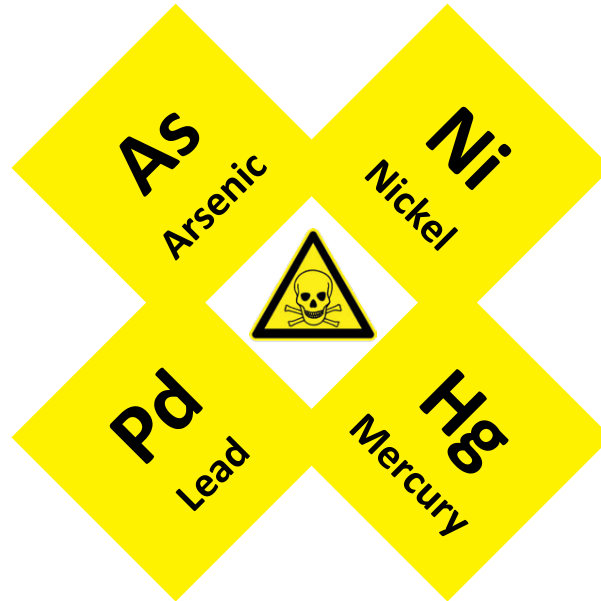
Each Component of the Growing Process Can Potentially Contaminate the Cannabis Plant...

Factors affecting the uptake:

- **The medium properties:** pH adjustment (the bioavailability of heavy metals decreases when outside the pH range of 5.5-6), addition of chelators and the right fertilizers are among the factors that enhance the uptake or remediation of heavy metals (see Chelators section).
- **The root zone:** the effect of plant enzymes and organic acids (such as citrate and oxalate), exuded from the roots, on the contaminant degradation.
- **The vegetative uptake:** it is affected by environmental conditions (temperature, chemical composition of the soil, organic matter contents).
- **The plant species:** it depends on the remediation properties of all species individually.



The Story Nobody Is Telling about Heavy Metals...



Are heavy metals beneficial nutrients or toxic elements that need to be eliminated?

Heavy metals are conventionally defined as elements with metallic or metalloid properties and an atomic number >20 (Tangahu et al., 2011). But that still doesn't help the grower.

Growers are scared of what they know from common knowledge, especially about the effects of arsenic. Unfortunately, arsenic is not the only concern, because the list of potentially toxic elements is much larger than is commonly assumed. Yet, not all heavy metals are toxic...

Some heavy metals are unconditionally toxic and/or carcinogenic: arsenic, nickel, lead, mercury. Others, such as iron, copper, zinc, when taken in low doses are valuable micronutrients for plants and humans, but can become toxic when taken in excess. (M. J. Ellenhorn, 1997). On the next page, you will see a summary of the effects of toxic heavy metals on the human body.

Metal pollution is harmful to all biological systems and does not undergo biodegradation. It has been repeatedly proven that toxic heavy metals can be accumulated in






living organisms (Tangahu et al., 2011). This may cause various diseases and disorders even in relatively low concentrations. This applies to both plants and humans who consume them.

As seen on TV ...

The problem is addressed even in popular culture. An episode of House M. D. TV series (Season 1, Episode 12—Sports Medicine) is based on a fictional case of heavy cadmium poisoning—a result of marijuana consumption. Since the scenario depicted in the TV show can be seen as a gross exaggeration, Drug-War style, such poisoning should be considered very rare (but not impossible). For example, the Canadian medical marijuana program was allegedly growing cannabis on the contaminated soil of an abandoned mine (A. Vasil, 2003).

In fact, it is well known that hemp grown on polluted soil can absorb large amounts of toxic heavy metals (L.O. Eboh, B.E. Thomas). Because of this, sophisticated hi-tech equipment is developed and offered on the market to check the level of toxic heavy metals in medical marijuana (Olympus Corp. Application Note).

Heavy Metals' Toxic Effects on Marijuana Patients...

 Cadmium	Cd^{48} 112.41	kidney damage human carcinogen osteomalacia bone fractures
 Mercury	Hg^{80} 200.59	lung damage neurological and psychological symptoms (tremor, changes in personality, restlessness, anxiety, sleep disturbance and depression) kidney damage coronary heart disease
 Lead	Pb^{82} 207.20	neurotoxicity (headache, irritability, abdominal pain and various symptoms related to the nervous system) lead encephalopathy (characterized by sleeplessness and restlessness) neuropathy anemia neurotoxicity carcinogen
 Arsenic	As^{33} 74.92	gastrointestinal symptoms central nervous system bone marrow depression haemolysis hepatomegaly melanosis polyneuropathy and encephalopathy hyperkeratosis pigmentation changes hypertension cardiovascular disease carcinogen
 Nickel	Ni^{28} 58.69	damage of lungs and kidneys gastrointestinal distress (nausea, vomiting, diarrhea) neurological effects dermatitis (carcinogenic)

The dangers of heavy-metal toxicity are well known. What is not so well known is that because cannabis is an “accumulator” plant, the potential for heavy-metal toxicity to the end user is high. If care is not taken to ensure the growing environment, the growing medium (whether soil or hydro), fertilizers and other raw materials used in the cultivation of cannabis are free from heavy metals—heavy metals will be accumulated by the plant and transmitted to the human consumer when cannabis is ingested.

The Hidden Dangers of Phosphorus...

Believe it or not, the main potential source of heavy-metal contamination is phosphorus.

Heavy metals are held within phosphorus. Phosphate ions form chelates with many toxic metals that carry them to the plant. Moreover, raw phosphates, mined in many parts of the world, contain substantial amounts of toxic contaminants captured by phosphate ions millions of years ago when the deposits were formed.

Here's the important part: When used in the production of fertilizers, such polluted phosphorus would deliver its toxicity to the plants and eventually, to the humans who consume these plants for medicine (F.H. Oosterhuis, F.M. Brouwer, H.J. Wijnants, 2002).

A controversial policy inspired by scientific research ...

One of the most controversial decisions taken by the Advanced Nutrients Research Team was to launch the company's new Low Phosphorus Policy. This was fueled by two main factors:

- **Phosphorus is crucial to the biosynthesis of medically valuable molecules within the cannabis**

plant. However, phosphorus is not wasted, but is recycled and reused by the plant again and again. The accepted dogma was that the plant needs more phosphorus for enhanced blooming. Now we know, through testing, exactly how much is "enough" and that plants don't need any more than this amount.

- **The dark side of phosphorus is that phosphate ions are the main carrier of toxic heavy-metal contamination. When growing a medicinal plant, safety is the most important concern. Hence, supplying the plant with less phosphorus would significantly minimize contamination.**

A solution to the controversy was offered by the Advanced Nutrients scientists—give the plants exactly as much phosphorus as they need for a rich harvest, and no more.

These are not just theories made-up by Advanced Nutrients. This has been proven repeatedly through the scientific method. Every product offered by Advanced Nutrients is extensively tested—first on several plant species, then on different cannabis varieties specifically. Experiments are first performed in Advanced Nutrients greenhouses and labs, then the results are confirmed by independent researchers and growers.

Advanced Nutrients has spent years studying various strains of cannabis, performing extensive tissue sampling to determine the optimal amounts and precise ratios of nutrients for optimum growth and bloom—using advanced testing tools such as our 4-stage gas chromatograph.

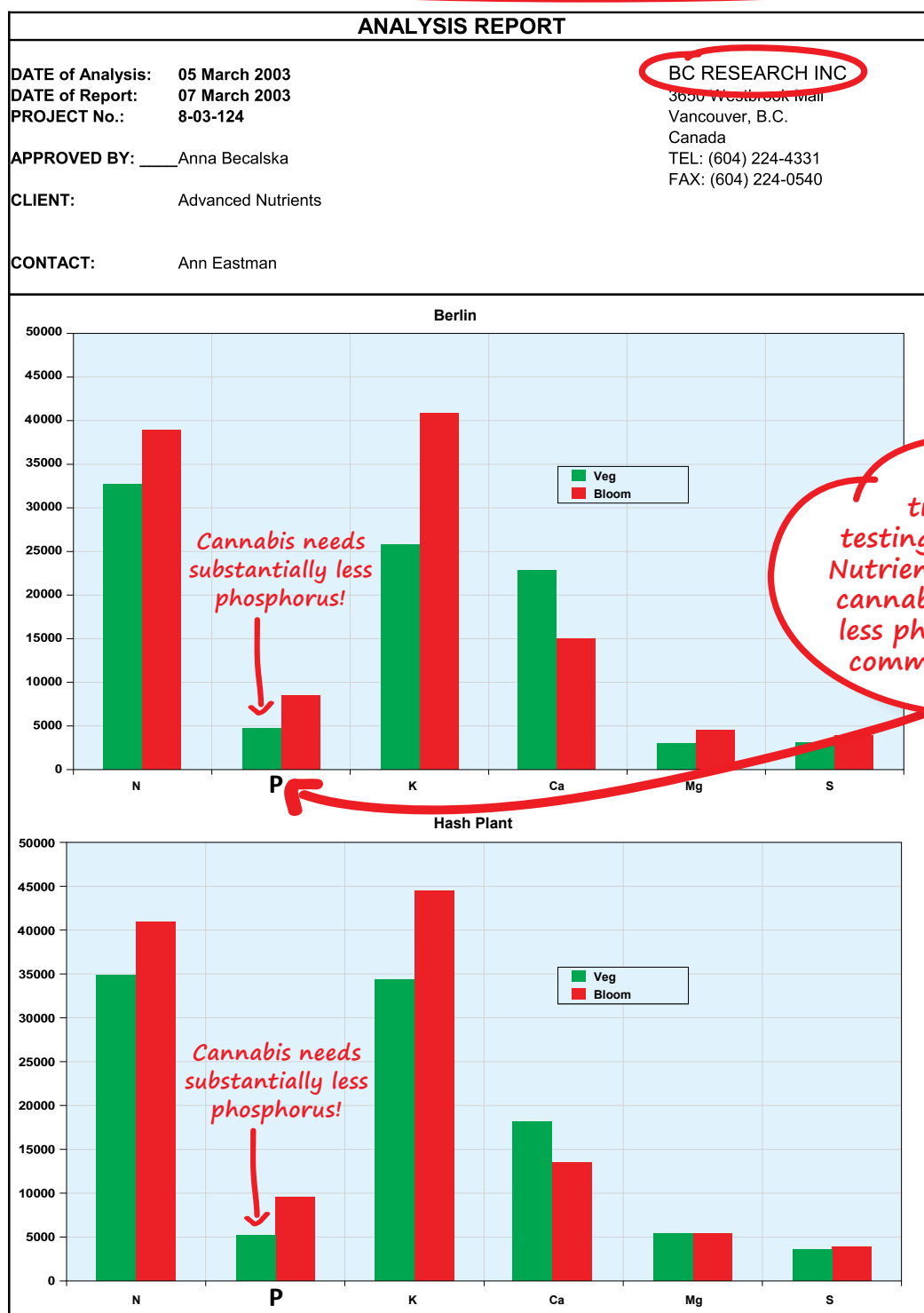
As you can see in the following tissue sample research on three strains of cannabis, phosphorus was needed in much lower amounts than most growers assume. It's extensive, real data like these which are at the base of our "proper-amount-of-phosphorus" claims.

NOTE: We have an entire white paper, The Phosphorus Myth, made up of tissue sample research like this.

Actual research on the next page!

Extensive Tissue Sample Testing Cannabis Needs Much Less

BC Research Tissue Sample Analysis of Berlin, Hash Plant, and White Rhino



by Advanced Nutrients Has Revealed Phosphorus Than Commonly Thought

ANALYSIS REPORT

DATE of Analysis: 05 March 2003
DATE of Report: 07 March 2003
PROJECT No.: 8-03-124

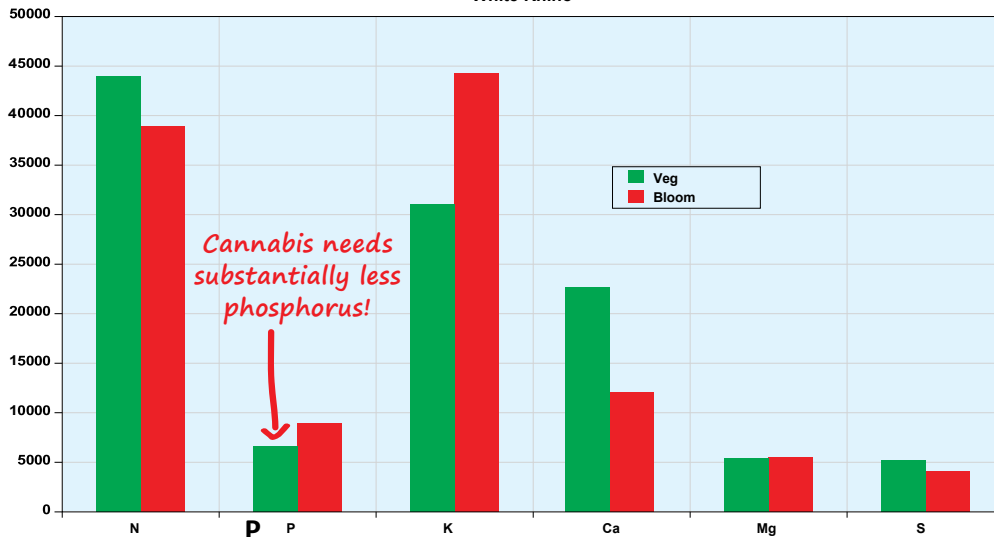
BC RESEARCH INC
3650 Westbrook Mall
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TEL: (604) 224-4331
FAX: (604) 224-0540

APPROVED BY: _____ Anna Becalska

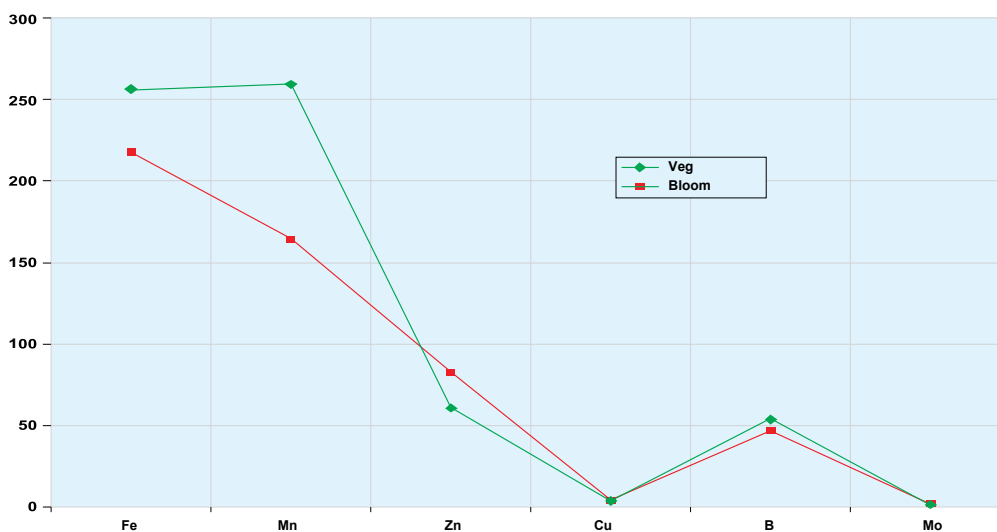
CLIENT: Advanced Nutrients

CONTACT: Ann Eastman

White Rhino



Micronutrient Analysis



The Truth about “Pharmaceutical-Grade” Salts and Chelates

We should never forget that cannabis is grown primarily to be consumed by humans. Whether ingested or inhaled, almost all cannabis plants will find their way into the human body. What's more, many of the people ingesting cannabis are using it as medicine because it's an integral part of their treatment therapy. Many of these patients face life-threatening diseases such as cancer. That's why it is of vital importance that cannabis be grown as pure and toxic-free as scientifically possible.

Toxic metals can be eliminated only by regularly checking all raw materials used in fertilizer production. As a result of these tests, producers may find that ordinary-grade, fertilizer-grade, and even analytical-grade chemicals are too risky due to contamination, and that despite the higher price they have to use pharmaceutical-grade raw materials so that perfectly safe products reach the clients.

Zinc compounds are a typical example because zinc is a valuable micronutrient for plants and animals. Commercially available zinc salts are extensively used as supplements in agriculture and medicine. However, all natural sources of zinc are, more often than not, strongly contaminated with lead, cadmium and mercury. From a chemical point of view, these toxic metals are very similar to zinc and it is not surprising that they deposit together. Most zinc ores are in fact zinc-lead ores; the separation of toxic lead from zinc is a demanding task. Hence, zinc salts for general use are often contaminated with cadmium, mercury, and lead.

Even expensive analytical-grade zinc salts may be unsuitable for human or agricultural use. This is because contaminants are controlled just for the specific requirements of their intended use: in production or in the lab. Zinc salts for human and agricultural use should be isolated in order to remove other toxic heavy metals, such as mercury, to protect patients who are intending to ingest the medicine.

Thus, the statement that pharmaceutical-grade metal salts, proteinates, alaninates, etc., are used in Advanced Nutrients micronutrient fertilizer products is not just a marketing trick. Several other nutrient manufacturers are not capable of this type of compound isolation, and that is a primary difference in Advanced Nutrients products, and yet another justification for their premium price points.

The key here is not the salt or the chelator but the metal itself. “Pharmaceutical grade” means that the metals used in the preparation of these products are pure enough for human use. Although their concentration in the product may be relatively low, the use of pharmaceutical-grade metal salts or chelates is perfectly justified as a means to decrease the concentration of toxic metals often found in less expensive fertilizers.

Why most regulations do NOT cover hydroponics fertilizers ...

Every developed country has regulations that limit the concentration of toxic metals in solid and liquid fertilizer products. No product should make an exception. Unfortunately, liquid fertilizers intended to be diluted before use—the exact type of fertilizers we are discussing here—have a small market share and are often not covered by these regulations. For example, the EU has a list of toxic metals but does not state their maximum permitted concentrations. Fortunately, a list of toxic elements with their maximum concentrations can be found in French regulations (French Norm NF U 42-004).

In the following chart you can see 18 different Advanced Nutrients products that were tested by an NPPS-authorized lab. Because of Advanced Nutrients commitment to using only pharmaceutical-grade raw materials, in every product tested the concentration of toxic metals was so low that it could not be measured (below DL—detection limit), and consequently—much below the maximum concentration defined by the regulation.

18 Advanced Nutrients Products Tested to Have Less Than Detectable Levels of Regulated Toxic Elements

Toxic element	As	Cd	Cr	Hg	Ni	Pb
Maximum permitted concentration in fertilizers, according to NF U 42-004 (ppm)	< 1	< 1	< 10	< 0.1	< 15	< 5
Detection limit of NPPS lab, Sofia (ppm)	0.5	0.3	1	0.05	5	5
Concentration of metal in Advanced Nutrients products (ppm)	< 0.5	< 0.3	< 1	< 0.05	< 5	< 5

The NPPS-authorized lab has tested eighteen Advanced Nutrients products. In every product the concentration of toxic metals was so low that it could not be measured —below DL— and, indeed, much below the maximum concentrations defined by the regulation.

- Arsenic (As), cadmium (Cd), and mercury (Hg) are widely known as dangerous toxins. Nickel (Ni) and lead (Pb) are not much safer.
- Chromium is less dangerous, but it should be controlled too.
- Selenium (Se) is included in the EU list, not because it is especially harmful to humans, but because it is toxic for plants.

The Role of Chelators in Heavy-Metal Toxicity...

Among growers, there are many myths about the role of chelators in toxic metal absorption. Let us look at them carefully...

- **Myth 1. Natural (“good”) chelators help the plant to take up the good metal micronutrients:** Not true! We have just shown above that even natural chelators, such as fulvic and humic acids, can be dangerous without the right contamination control.
- **Myth 2. Synthetic (“evil”) chelators help the plant to uptake toxic heavy metals. By using synthetic chelators in formulations, Big Hydro companies are poisoning medical marijuana patients.** Not true! We will demonstrate to you that synthetic chelators do not selectively increase heavy-metal uptake.

The truth is that both natural and synthetic chelators bind to both good and bad metals without differentiating between them. Let's look at EDTA—a synthetic chelator—and how it binds to different metals. The table shows how tightly EDTA sticks to metals. The higher the number (known as the formation constant), the better EDTA binds to the metal.

Please note that the formation constants of EDTA with zinc (an important micronutrient) and cadmium (a very toxic metal for both plants and humans) are virtually equal. It would be wrong to believe that EDTA supplies only the bad cadmium to roots, and not the good zinc.

It's important to note ...

Research has shown that EDTA increases the absorption of every metal ion to which it can bind. Natural chelators do exactly the same.

Hence, since zinc is present in a much higher concentration than cadmium, the plant will absorb much more zinc than cadmium. Zinc in this case can compete, very successfully, with cadmium and be absorbed by the roots. **Hence the importance of starting with pharmaceutical-grade raw materials so as to lower the amounts of toxic metals from the beginning.**

Let us remember that the City of Picher, Oklahoma, was evacuated in 2009 and closed by the federal government due to zinc and lead poisoning. The contaminated mine tailings were so toxically saturated with zinc, cadmium, and lead that 34% of school children were found to be suffering from a range of diseases due to the high concentration of those metals in the environment.

A good micronutrient fertilizer, produced with high-quality micronutrient salts and chelates, will protect the plant from excessive uptake of toxic heavy metals. The presence of a synthetic or natural chelator does not change this fact. On the other hand, the presence of different chelating agents, with their different formation constants toward different metal ions, improves the optimal availability of the metals in the feeding solution. Synthetic chelators (EDTA, DTPA, EDDHA) and natural chelators (fulvic and humic acids, amino acids) in combination help make a better and more flexible nutrient solution for the multiple metal ions present.

The aim of chelators is not to keep bad metals out, because they cannot do that. Chelators should be non-toxic and free from toxic metal contamination. And the grower should be using fertilizers manufactured with pharmaceutical-grade ingredients that are also free from toxic metal contamination. It all comes down to purity. That's all a grower needs. This is why a quality fertilizer producer regularly checks chelators, both natural and synthetic, before using them.

How EDTA (a synthetic chelator) binds to both good and bad heavy metals equally:

Metal Ion	Formation Constants log ₁₀ K _f
Fe ³⁺	25.10
Hg ²⁺	21.70
Cu ²⁺	18.80
Pb ²⁺	18.04
Zn ²⁺	16.50
Cd ²⁺	16.40
Al ³⁺	16.30
Fe ²⁺	14.32
Ca ²⁺	10.69
Mg ²⁺	8.79
Na ⁺	1.66
K ⁺	0.80

The “formation constant” number indicates how well EDTA binds to the metal. Note the numbers for **Zn²⁺** and **Cd²⁺** are virtually the same because chelators by definition bind to all metals and do not discriminate between “good” and “bad” ones.

² While working with plants in the Advanced Nutrients laboratories, the author of this document has seen what happens to living cells in the presence of only a couple of ppm cadmium—they feel very sick and this can be seen with the simplest microscope. Whole living organisms, plants and animals, are not so sensitive to its toxic effects since they have protection systems. Nevertheless, this metal is really scary. No surprise that the plot of the marijuana episode of House M.D. TV series was based on this nasty metal.

Advanced Nutrients Purity Tested and Confirmed

Advanced Nutrients is serious about testing their product's purity. A fresh batch of products intended for the European market was first analyzed by the National Plant Protection Service, based in Sofia, Bulgaria (EU). This lab is certified by the relevant EU authorities and all data issued are considered legitimate in the EU and beyond. The lab's standards of detection limits (DL) are equivalent to the limits defined by the French regulations.

Yet, Advanced Nutrients searched for an even more comprehensive and better equipped lab than just a good fertilizer lab to test their products. The following analysis data are provided by the respected Vancouver lab BC Research Inc. and the research method used was the same as the method used to examine drinking-water quality. In short, BC Research Inc.'s methods are 10 times more sensitive than those of standard fertilizer labs in both the European Union and North America.

BC Research Inc.'s protocols test for dozens of potentially toxic elements. Beryllium, arsenic, nickel, thallium, etc.—concentration levels in every specimen of dried plant material were below their lowest detection limits (DL). So we will discuss in detail only the metals whose concentration was higher than their lowest detectable quantities and which can be potentially dangerous for medical marijuana patients.

Chromium concentration was 0.5-0.7 ppm (DL = 0.3 ppm). The concentration of chromium was so low that it would bring neither harm nor benefit.

Let us look at the dreaded cadmium ...

The Vancouver lab's detection limit (DL) for cadmium is 0.05 ppm. Cadmium concentration in medical marijuana grown with Advanced Nutrients products varies between below DL, i.e. less than 0.05 ppm, and 0.08 ppm.

To put this in perspective, imagine a stack of one-dollar

bills worth 1 million piled high (it would stand roughly 33 stories tall!). Now imagine taking just one little dollar bill from this stack ... and it's still more than 0.05 ppm. You would have to take that dollar bill and break it into change, then take just one nickel, and it would equal 0.05 ppm (parts per million)—the lowest detectable level of cadmium measured by BC Research Inc. in Advanced Nutrients products.

“Medical marijuana grown with Advanced Nutrients products is safer in respect of heavy metals than the water we drink ... Smoking 500 mg of this medical marijuana would be just as safe as ingesting 50 drops of extremely pure drinking water.”

Even more comforting, when looking carefully at the analysis protocols, we see that the samples with cadmium contamination higher than DL (> 0.05 ppm, never exceeding 0.08 ppm) were taken from plants in early stages of development only, i.e. in growth or vegetative phase. All samples taken when the same plants were in bloom show cadmium contamination of less than DL.

In other words, by the time the plants are ready to harvest for human consumption, the levels of cadmium are no longer *even detectable*, proving Advanced Nutrients products are as safe and pure as possible.

We all saw that phosphates go alongside zinc as a source of cadmium contamination. It seems that the lowering of the phosphorus concentration in blooming fertilizers, announced by Advanced Nutrients, works great: cadmium concentration is very low in all flowering plants tested. For comparison, **the concentration of cadmium in a routine sample of Nigerian hemp is at least 100**

³ DL stands for detection limit; it is the lowest contaminant concentration that can be measured with the method used. The lower the DL, the better the lab.

times higher, as shown in the scientific literature (L.O. Eboh, B.E. Thomas).

The DL of the analysis method used by the lab in Vancouver is considered appropriate for drinking water. Thus, *medical marijuana grown with Advanced Nutrients products is as pure, in respect of heavy metals, as the water we drink.*

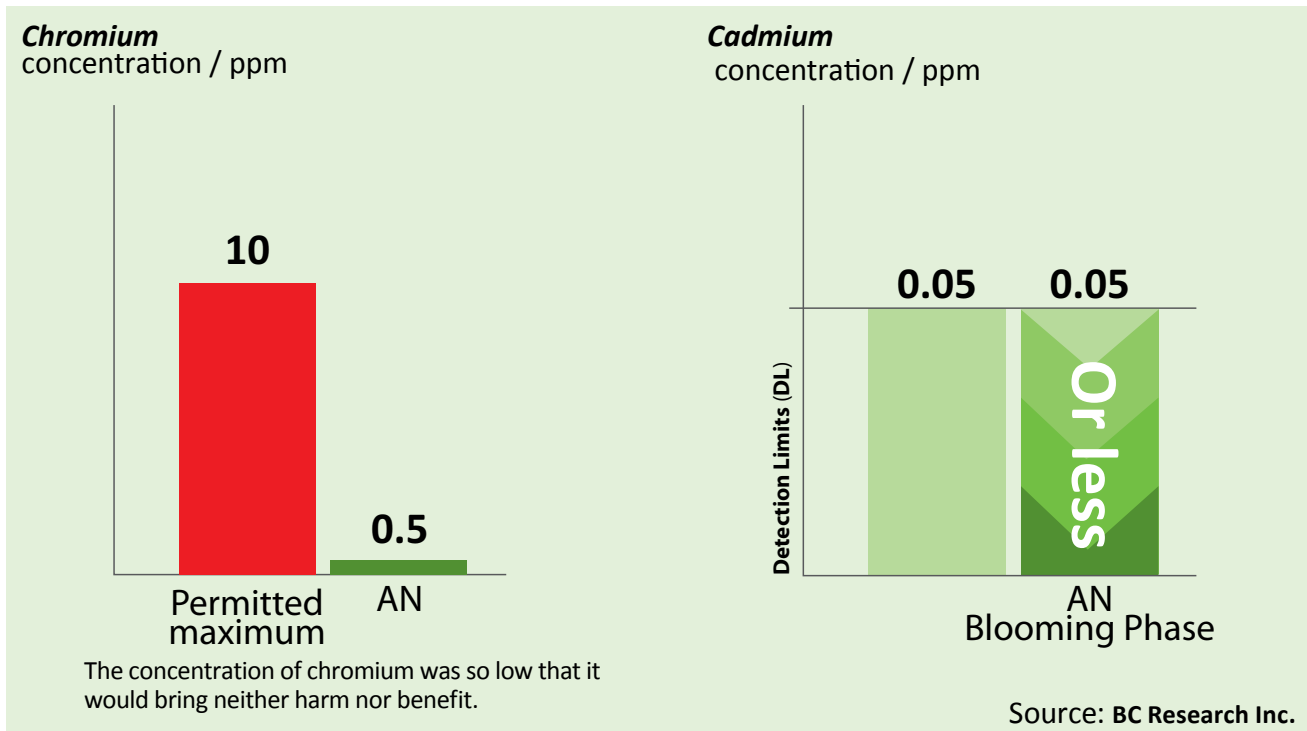
Having in mind that cadmium and other toxic metals are absorbed through the lungs up to 5 times more efficiently than through the intestines, smoking 500 mg of this medical marijuana (a typical dose for a non-tolerant person) would be no more poisonous than drinking a “shot glass” of water (approximately 30 ml).

That’s skipping all the math, but if you have doubts, you can do the calculations yourself. Some medical marijuana patients who are very sick smoke up to 100 grams of plant material per month. Even in these rare cases the monthly uptake of heavy metals that comes with the smoked plant material grown with Advanced Nutrients would be much less than that from drinking 1 liter of water. Certainly, we all drink more than 1 liter of water each month.

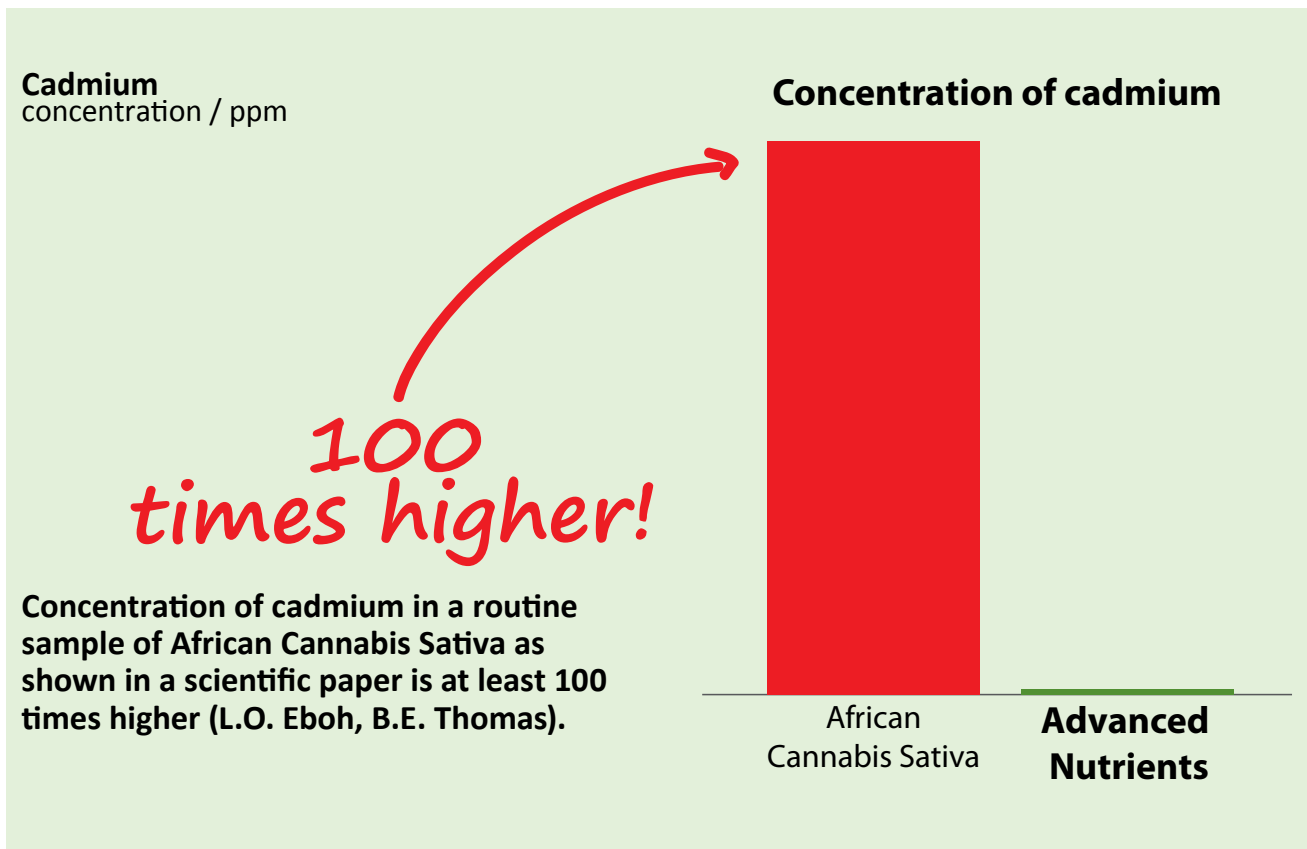
In addition, the concentration of medically active cannabinoids in the plants was registered, and the results were almost double the results from the University of Mississippi experiment which we will review next. See the original report as released by BC Research Inc., Vancouver, in the next section as well.



Beryllium, arsenic, nickel, thallium, etc.—concentration in every specimen of dried plant material was below DL.



Advanced Nutrients vs. African Cannabis Sativa



University of Mississippi Study Demonstrates the Dramatic Difference Advanced Nutrients Fertilizers Can Make ...

Throughout this white paper, we have claimed that specialized, ultra-pure and cannabis-specific fertilizers are a must for growing high-grade medicine. We first covered the research and scientific proof that properly fertilized cannabis is safer for both the plant and the people consuming it.

Next, we will show you the research confirming Advanced Nutrients fertilizers increase bud weight, THC, and cannabinoids. Scientists are humans and may be biased. A second, independent opinion by other scientists emotionally detached from the testing is the highest standard of testing available. Let us give you the results of one such independent study confirming that Advanced Nutrients fertilizers are proven better than other hydroponic fertilizers.

The then-only scientific institution authorized to carry out cannabis research in the USA—the Mississippi State University—did the experiment. It was completed by the team of Research Prof. M.A. ElSohly from the Plant & Soil Department at the University. The field experiment's design was simple and straightforward—to compare the yield and quality of medicinal cannabis grown with the best available hydroponic fertilizers and the fertilizers offered by Advanced Nutrients, specially developed and optimized for your favorite plant.

A head-to-head comparison ...

More than a decade ago, when the research was realized, fertilizers used for growing sorghum and corn were considered best for growing cannabis. A plot a thousand square feet large (about 100 sq. m) was used to grow cannabis with these two types of fertilizers. Scientists would call this a control group of plants, or a control plot. In order to have a fair comparison, the plants on the control plot received basic fertilizers only, without sophisticated additives.

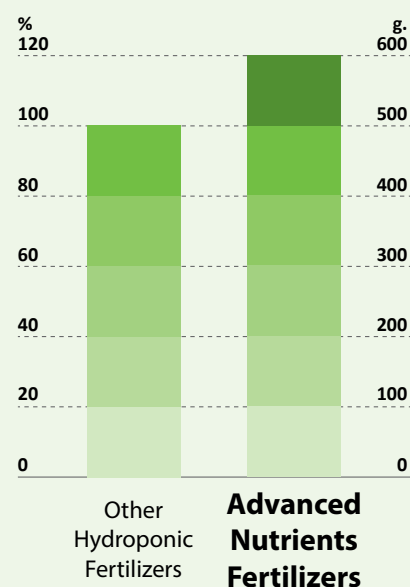
Another plot, the same size as the control plot, would be called the experimental plot. It was sown with cannabis that was fed with the newly developed Advanced Nutrients fertilizers. In order to have a fair comparison, the plants on the experimental plot received basic fertilizers only, and the other received Advanced Nutrients.

Clearly, as you can see for yourself in the included research, the difference in the results was quite dramatic when using nutrients precisely tuned for cannabis, compared to the results when using a general-purpose fertilizer.

The experimental plants gave a substantially stronger harvest in terms of both usable biomass and potency in

Advanced Nutrients Fertilizers Produced 21% More Yield Than Other Hydroponic Fertilizers

Source: University of Mississippi:



Difference in usable biomass production in plants fertilized with fertilizers and with Advanced Nutrients specially created formulation.

comparison with the second set of control plants. See the original report, as released by Mahmoud A. ElSohly, PhD. Research Professor, and his team at the University of Mississippi on the next few pages.

As a side note, this study was conducted in 2003 on the first generation of Advanced Nutrients fertilizers. We are now in our eighth generation of improvements on these original formulations. This is why the more recent BC Research Inc.'s study showed the concentration

of medically active cannabinoids was almost double the results from the 2003 University of Mississippi experiment.

In other words, our formulations are nearly twice as effective now, after eight generations of continual improvements—meaning these formulations have almost doubled the potency of beneficial cannabinoids and THC compared to when first tested over ten years ago.

THC and other cannabinoid levels were significantly higher in the Advanced Nutrients grown cannabis plants

Source: University of Mississippi

Fertilizers used	Percentage of cannabinoids					
	THC	CBD	CBN	CBC	CBG	THCV
Advanced Nutrients Basic Fertilizers	11.35 ±0.20	0.53 ±0.04	0.17±0.002	0.24±0.01	—	0.13±0.002
Regular Fertilizers	7.99±0.46	0.34±0.06	0.14±0.01	0.18±0.01	0.23±0.13	0.10±0.001





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a division of The Research Institute of Pharmaceutical Sciences

March 7, 2003

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Abbotsford, B.C. V2T 6J8

Attached please find abstract of the study of plants with the use of your fertilizer.

If you have any questions please feel free to contact me.

Sincerely,

Mahmoud A. ElSohly, Ph.D.
Research Professor

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Please notice, this University study was performed over 11 years ago. Since that time, Advanced Nutrients has come to its eighth generation of improved nutrients. And the results of this painstaking development speak for themselves.

EFFECT OF TWO DIFFERENT FERTILIZERS ON THC AND OTHER CANNABINOIDS CONTENTS, TOTAL BIOMASS PRODUCTION AND SEED PRODUCTION POTENTIAL IN A HIGH YIELDING VARIETY OF CANNABIS SATIVA.

This study was conducted to assess the effect of two different fertilizers treatments on Δ^9 -tetrahydrocannabinol (THC), other cannabinoids (THCV, CBD, CBC, CBG, CBN) contents, total biomass and seed production in a high yielding variety of *Cannabis sativa*. Selected seeds were grown under similar environmental conditions in indoor cultivation room and after 30 days, seedlings were transferred to research garden, School of pharmacy, University of Mississippi. Research plot was prepared in 2000 square feet area and was divided in two parts, each plot with 1000 square feet area. Plants in plot A were treated with 'advanced nutrients' formula whereas plants in plot B were fertilized with the regular fertilizer composition used to grow Corn and Sorghum, recommended by Soil testing laboratory, Plant and soil science department, Mississippi state University, MS. Delta 9 -tetrahydrocannabinol (THC) content of the plants treated with 'advanced nutrients' formula was found significantly higher than those treated with regular fertilizer. Similarly, in comparison of the plants treated with the regular fertilizer, those treated with 'advanced nutrients' formula produced more useable biomass and seeds. Therefore, within the limits of this study it can be concluded that 'advanced nutrients' formula can be useful to grow *Cannabis sativa* crop to achieve higher yield in terms of potency and biomass. See table 1 for analytical data on the biomass produced from both plots and fig. 1 and 2 for the biomass yield data.

Table 1: Variations in THC and Other cannabinoids in the harvest samples from plot A and B. Plot A was treated with 'Advance Nutrients' formula whereas regular fertilizer was used in plot B.

Plot ID	Percentage of Cannabinoids					
	THCV	CBD	CBC	THC	CBG	CBN
A	0.13±0.002	0.53±0.04	0.24±0.01	11.35±0.20	0.00	0.17±0.002
B	0.10±0.01	0.34±0.06	0.18±0.01	7.99±0.46	0.23±0.13	0.14±0.01

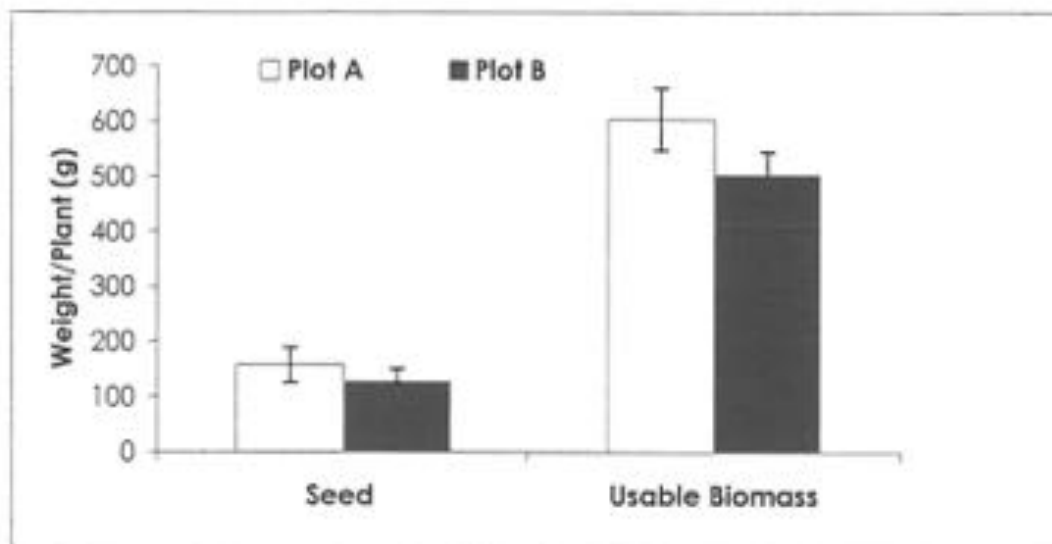


Fig. 2: Variations in seed and usable biomass production in plot A and Plot B. Where plot A was fertilized by Advanced Nutrients formula and plot B was fertilized by regular fertilizer.

Certified THC and Cannabinoid Increases Throughout Weeks 1-7



HEDRON ANALYTICAL INC
10471 PALMBERG RD. RICHMOND, BC, CANADA V6W 1C5

Advanced Nutrients
109-31063 Wheel Ave.
Abbotsford, B.C.
V2T 6H1
Attention: Michael

November 28, 2003

Certificate of Analysis

P.O. 112203a

Data Summary

Advanced Nutrients Tester

Northern Lights #1

CODE	SAMPLE DESCRIPTION	CBD %	CBN %	^9-THC %	THC-A %	TOTAL THC %
AN-1	week 1 vegetive	0.1	0.0	0.1	1.2	1.3
AN-2	week 1 flower	0.1	0.0	0.1	0.9	1.0
AN-3	week 2 flower	0.1	0.0	0.2	1.0	1.2
AN-4	week 3 flower	0.1	0.1	0.1	2.4	2.5
AN-5	week 4 flower	0.5	0.1	0.1	5.2	5.3
AN-6	week 5 flower	0.6	0.1	1.2	14.5	14.5
AN-7	week 6 flower	0.7	1.0	0.3	18.3	18.6
AN-8	week 7 flower	1.0	1.4	0.3	22.6	22.9

BHT listed in the chromatograms is an antioxidant added to one of the solvents and is irrelevant to the results. CBD is a total of CBDA and CBD thus total CBD potential.

Thank you for using Hedron

A. Paul Hornby, Ph.D.

Laboratory Manager

Now, a Decade Later -- Advanced Nutrients Formulations Tested to Produce a Staggering ... 31.7% in THC Levels ...

SC Labs | Sample Detail

<http://sclabs.com/sample-detail.html?id=64342>

Alien Quick Silver

Point Loma Patients

Sample ID: 140617
U025

Doses per Serving: N/A

Sample Type: Hybrid


Standard Dose: N/A

Potency Test

Full spectrum cannabinoid profiling and analysis utilizing High Performance Liquid Chromatography (HPLC/DAD)

Cannabinoid Summary

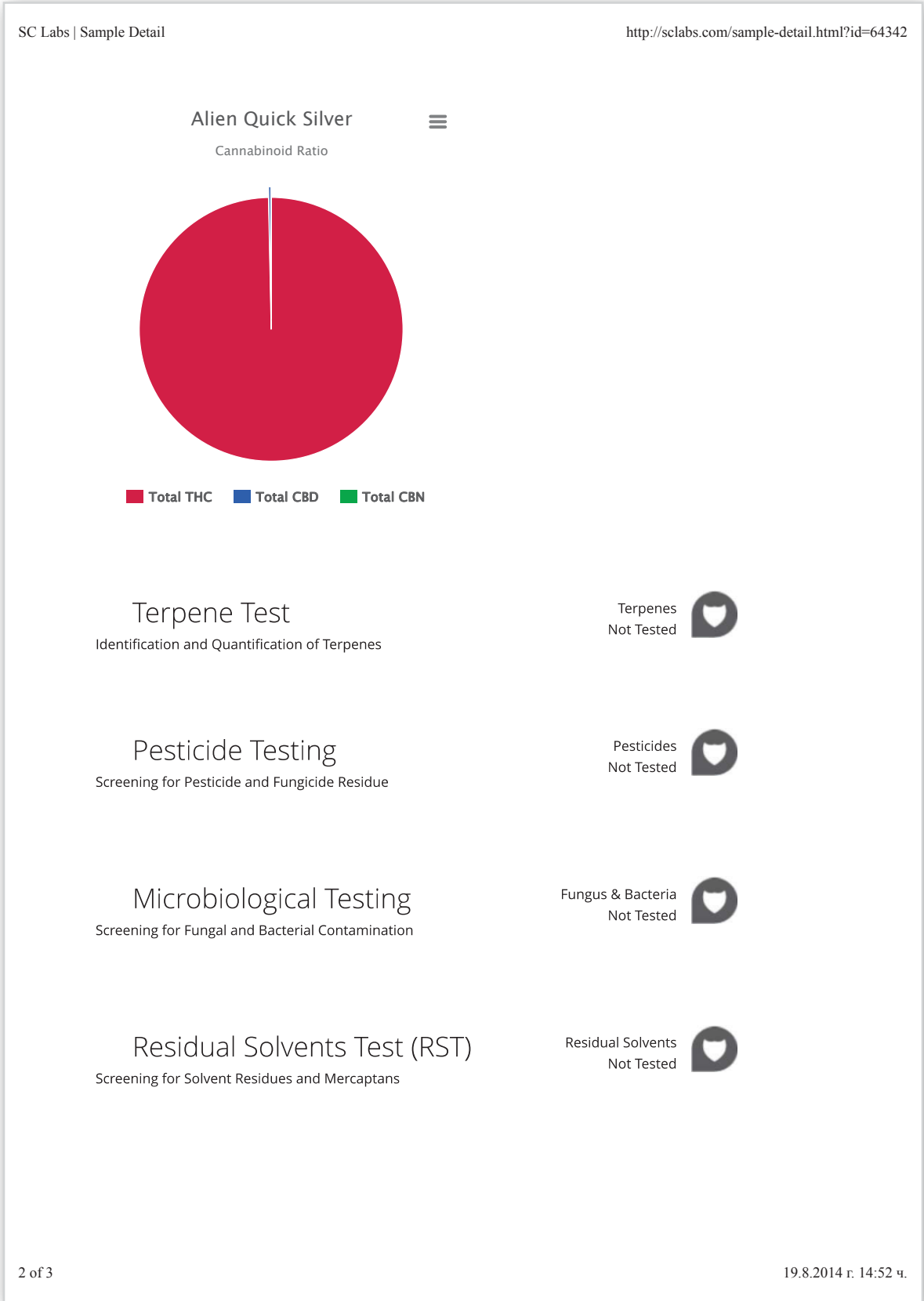
 Total THC	Δ9THC+THCa	31.7 %
Total Potential Δ9THC	278.7 mg/g	27.87 %

 Total CBD	CBD+CBDA	0.1 %
Total Potential CBD	0.9 mg/g	0.09 %

 Total CBN	Total CBN	0 %
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Full Cannabinoid Profile

Tetrahydrocannabinol	Δ9THC	0.53 %
Tetrahydrocannabinolic Acid	THCa	31.17 %
Cannabidiol	CBD	0 %
Cannabidiolic Acid	CBDA	0.1 %
Cannabinol	CBN	0 %
Total Active Cannabinoids:		31.8 %



The Dangers of “Home Brews” and Do-It-Yourselfers ...

Many growers, even large commercial ones, feel that it is not necessary to invest in scientifically engineered nutrients ...

They feel as if the premium price of such nutrients is unjustified.

If you care at all about your medical marijuana patients' safety, please carefully consider these facts before you make such a decision...

First, as we have repeatedly demonstrated (and scientifically proven) throughout this white paper, cannabis is an incredible accumulator plant that will take up and store whatever contaminants are present in the growing environment, and specifically, in the nutrients it is fed.

What quality controls and purity guidelines do home brewers follow? Mixing a 55-gallon drum of your own nutrients is quite possibly the lowest level of quality control one could imagine ...

Second, we commend and admire the first generations of “home brew pioneers” who first started experimenting with cannabis-specific formulations over 20 years ago. Through many years of trial and error an established “base” of knowledge was handed down from grower to grower.

The medical marijuana industry is becoming more legitimate every single day ...

However, over the past 20 years regulations, red tape, and the legality of cannabis growing have improved to the point that it is now a legitimate science. And that base of knowledge has been upgraded remarkably.

The Advanced Nutrients Bulgarian research lab is run by

23 PhDs—supported by a small army of undergraduates utilizing the most sophisticated plant tissue testing equipment in the world (like our quadrupole gas chromatograph allowing for measurements with a precision of parts per trillion).

**“If you would not expect some “doctor” to sell you cholesterol medication he mixed himself in a 55-gallon drum in the back of his office ...
Then ... why would you sell your medical marijuana patients the same potentially dangerous medicine you mixed in the same manner yourself?”**

In short, hydroponics growing and the science behind it have developed by leaps and bounds. The rigorous scientific method has been employed by Advanced Nutrients on thousands of tests of plant tissues for over a decade. As a result, all our formulations are in their eighth generation of continual improvement (because we redesign, tweak and further improve our formulas whenever we come across new scientific breakthroughs in the lab).

The bottom line is that because of the secretive nature of his “recipes”, the grower who mixes his own nutrients can at best only rely on maybe his entire family of growers (10 to 20 people). And their only scientific “proof” are what they see from flip to flip, and the question “Does this grow look better than the last?”.

This type of growing is, quite simply, obsolete.

Even more important, the medical marijuana industry is no longer a primitive one. We are responsible for providing real medicine to real people.

The health and life of your patients are in your hands ...

Medical marijuana patients deserve the same care, quality control, guarantees of purity, and scientific basis in their formulations as any other patient using any other medicine.

Further, as medical marijuana becomes more and more mainstream, and if (and when) the federal prohibition against this plant is repealed, the very next step will be heavy regulation by the authorities—the same as with any other medicine (available by prescription, over-the-counter, or otherwise).

It will no longer be the “wild west” of regulation-free growing that we see now. Wouldn't you like to be ahead of the curve, already meeting and exceeding the probable quality control regulations that authorities will eventually impose?

In conclusion, if you would not expect some “doctor” to sell you cholesterol medication he mixed himself in a 55-gallon drum in the back of his office ... then ... why would you sell your medical marijuana patients the same potentially dangerous medicine you mixed in the same manner yourself?



Conclusions and Next Steps ...



There was a lot of ground covered in this white paper. We believe that we have provided relevant and sufficient research and scientific evidence to support our main claims:

Number 1: Because cannabis is an amazing accumulator plant—which absorbs nearly everything in its environment—and because it is mainly grown for human consumption (either via ingestion, inhalation or otherwise), incredible attention and effort must be invested to use only the most pure substances in all phases of this plant's cultivation.

Number 2: Scientific research proves the importance of using not just cannabis-specific, but pharmaceutical-grade, ultra-pure raw ingredients in cannabis-specific fertilizers. We saw this demonstrated, as measured by both third-party research labs and Advanced Nutrients labs, and it is paramount for human safety.

Number 3: Scientific testing at multiple third-party labs also proves, beyond a shadow of a doubt, that cannabis-

specific fertilizers—Advanced Nutrients products specifically—increase overall yields, THC, and other cannabinoids in cannabis.

Further, it should be noted that at the time of publishing the author of this paper is unaware of any nutrient companies, other than Advanced Nutrients, having such cannabis-specific research to support their claims.

It is the author's professional recommendation as an expert on cannabis cultivation that growers everywhere take the science and conclusions in this report and act on the information therein with a view to both their patients' safety and maximizing their results. In particular, if growing cannabis for human consumption you should consider using only scientifically proven cannabis-specific nutrients—available only from Advanced Nutrients.

Thank you for reading this white paper. Full studies and links to further sources are included for your review.

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