Welcome to
Nettle Net International
token family.
Find the nettle spirit.

Composed by “nettle nerds”, written in free English.

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Abstract

Unlimited nettle products at fair prices for everyone. nettle as a crop available for humans all around the world. from tubes through the fields to households.

Contents

"If you eat herbs and nettles sparingly
amongst abundant food, you will live longer."

Horatio, the Roman ancient poet

1 Structure

We are a team of people with different skills focused on nettle. Based on farmer's and manufacturer's hands, nettle research and blockchain technology for nettle international market

Vision

- Let the nettle be available all year round to everyone in all its forms and full of flavor and nutrients!

Mission

- The popularizing nettle products, spreading awareness through education and media platforms
- The expanding opportunities for cultivating nettle on farms
- The publication of methodologies and technologies relating to the practical applications of nettle in industry

Value

- The study of nettle biology
- Publishing ways in which nettle can be applied in everyday life and in the home.
- Motivating the public to share knowledge of using nettle as plant fibre or for its health benefits.

1.1 Introduction

Our nettle farming, economy, products, and vision si based on the fact that the stinging nettle can be cultivated. The comany BURDOVA FARMA, s.r.o., farm in Europe-Czechia decided on a nettle weeding field for nettle production.

There are many benefits that nettle agriculture brings. Stinging nettle has several health benefits and have been used medicinally since the time of Ancient Greece.

Studies have shown that all parts of the nettle have antioxidant, antimicrobial, and pro-health capabilities. Most nettle medicines are made from flowers, stems, and leaves, but roots are also used in pharmacology and cosmetics. This valuable plant has been used most commonly as a diuretic and for treating painful muscles and joints, eczema, gout, and anemia. Nettles may be used as a vegetable, in juice, tea, and as an ingredient in many dishes. The use of Urtica spp. as a feed component could also positively affect the health of poultry and animal productivity.

The main challenge in starting a production of nettle products is in heterogeneous nettle growth. The solution is homogeneous material (clones). We had two options for how we could generate them.

The first one is based on nature's nettle ability to reproduce through rhizomes. The second one comes from totipotency and regeneration attributes that all plant cells use to create an intact plant in vitro conditions.

We chose the second approach despite the higher cost due to the need for a functional regeneration nettle protocol for further biotechnological applications, which makes the nettle breeding program shorter and more effective.

Our presumption, that nettle products will be attractive for customers, is based on the fact that in classic products of intensive agriculture, the levels of functional content substances have been declining for several decades in a row; properly processed or treated nettle can become one of the carrier food raw materials, supplements or additives on an industrial scale.

We have also seen that there is no company on the market focused on growing, processing and supplying nettle. Furthermore, dried nettle is typically the only form currently supplied by traders.

Fresh nettle provides improved biological properties that can be used in a broader range of products. Our main know-how is the production of three products: juice - spinach - cold syrup suitable for industiral and retail packaging. Our production process is specified in three types of fermentation.

We can preserve the nettle with salt, fat, acid and freeze it. Moreover, we are also able to produce nettle extract for the cosmetics and pharmaceutical industry. Furthermore, we have the protocol for nettle tissue culture, opening the door for a nettle breeding program using a biotechnological approach, which makes our expansion easier.

We see that our potential lies in the combination of new disciplines including biotechnology, nanotechnology, and blockchain.

Our vision is to make quality nettle products that will be appropriate for the food, textile, cosmetics, and pharmaceutical industry while following the scientific knowledge from genomics and/or nanotechnology and their tools.

1.2 Opportunity

The company BURDOVA FARMA s.r.o. cultivates on 6 ha agricultural soil in the status of ecological farming. Some from the fields are in the area where current crops growing was trouble. So we were up for a challenge for the nettle (Urtica dioica, L.)

How could these lands be beneficial? From agricultural historical data, we found out that nettle cultivation is possible. For example, during World War I, both Germany and Austria were running out of cotton. They chose the nettle as a suitable substitute. Furthermore, it is known, nettle is a suitable plant as well as for ecological cultivation or permaculture (Vogl and Hartl, 2003). Many scientists have already tried to cultivate nettles. The main benefits are: 1. there is data on good yield without nitrogen fertilization (Kohler et al., 1999) 2. the crop is grounded for several years (within 10-15 years it still achieves a satisfactory yield (Gatti et al., 2008) 3. green matter can be used in several ways (unsucked production to the food industry can be used in livestock feeding or for biogas production.

This creates minimal losses as nettle is one of the lowcost plants.
Other advantages include:

- easy propagation and sustainable yields when using the principles of organic farming (Gatti et al., 2008),
- as a perennial crop, it requires lower inputs in terms of soil processing, which maintains soil fertility and its structure (e.g. protects the top layer of soil against erosion, crusting and excretion (Szewczuk et al.,2002),
- in addition to these effects, it also promotes biodiversity and acts as a food source for useful insects (e.g. water nymphs),
- is a fast-growing plant and therefore has an advantage over other weeds in the absorption of water and nutrients (Bacci et al.,2009), so the use of chemicals against weeds is not necessary,
- the leaves are very rich in minerals and when they fall off, an important amount of nutrients are returned to the soil.

1.3 Nettle market

Although with high market potentials, the products made from nettle are currently more a result of curiosity rather than large-scale industrial production, mostly due to a lack of crop and postharvest management.

The definition of a production chain able to exploit the plant biomass as much as possible is a prerequisite to increase income and boost farmers' adoption, and attract investors . The nettle market offers a big potential due to the fact that most biomass comes from hand-picking and is only dried. This prefabricated part is further processed by the cosmetics and pharmaceutical, or tea industry. Our innovation brings the solution of how to preserve nettle biomass convenient to production companies or consumers.

Moreover, among the troubles with the cultivation of nettles, propagation belongs, actually, we have resolution onboarding, which makes the field establishment easier. We are the only ones to offer homogeneous nettle genetic material suitable for largescale production. The main advantage of the cultivation of nettle clones is that the operating cost is reduced and the standardised quality is increased due to homogeneity for harvest planning, uniformity of ripening, size and availability of soil block for mechanized harvesting.

Consequently, homogenous material is favourable for processors. Price comparison of clones and wild nettle is available for investors.

Hippocrates (460–377 BC) reported 61 remedies using stinging nettle. His statement "Let food be your medicine" has been incorporated into the traditional concept of food, and stinging nettle is a representative example. Since it has been used for several purposes by different folk traditions, some of these uses have been tested scientifically since a new interest in natural products has been discovered. Therefore we focused on the food and textile industry first of all.

Field of application Use Part of the plant Food Salads, pies, soups and decocted tea, juice, pasta, bread Leaves, young plants, seeds textile/fibre ropes and fishing nets, tissues and fabrics, silky fabric, cloth and paper, biocomposites, paper, natural dye (for yarns, food, etc.), fibre tissues of stems. Root and leaf extracts for anaemia, rheumatism, gout, eczema, diuretic, hypoglycaemia, hypotension, benign prostatic hyperplasia, cardiovascular problems, arthritis, allergic rhinitis, antioxidant, antimicrobial, antifungal, antiviral, antiulcer Leaves, seeds, roots.

Aqueous and alcoholic extracts cosmetics soaps, shampoo, skin lotions leaves. Field of application use part of the plant as bedding for animals, forage crop for poultry, cattle, horses and pigs, for enhancing yolk yellowness etc.

1.4 Main benefits of stinging nettle

There are other reasons for growing nettle, it can be used whole - leaves, seeds, stem and root. In addition, many studies confirm very interesting compounds found mainly in nettle leaves, which have great potential for the food, pharmaceutical and cosmetic industries.

Upton (2013) states that nettle has a high nutritional value and contains in its leaves: vitamins A, D,C, E, F, K and B3 complexes, proteins, calcium minerals, iron, potassium, manganese, choline, amines, antioxidants chlorophyll and 5-hydroxytryptophan.

There are several types of chlorophyll, but all share the chlorin magnesium ligand. Chlorophyll stimulates the immune system or eliminates fungus in the body.

Carotenoids (which include vitamin A) are a nutritionally important component, and a total of 9 have been identified in nettle leaves, the largest proportion being β-carotene, which is a precursor of vitamin A. It is a member of the carotenes, which are terpenoids (isoprenoids), synthesized biochemically from eight isoprene units and thus having 40 carbons. Among the carotenes, β-carotene is distinguished by having beta-rings at both ends of the molecule. Guil-Guerrero et al., 2003 states that the total amount of carotenoids in fresh leaves is 29.6 mg 100 -1g dry weight. As is known, their fundamental contribution lies in antioxidant action. This means that it protects cells from damage from unstable oxygen molecules, so-called free radicals.

Rafajlovska et al. (2001) states that extracts of nettle plants contain 6.8% palmitic, 1.1% stearic, 3.6% oleic, 20.2% linoleic and 12.4% linoleic acid.

These fatty acids are an important component of lipids, and some of them are essential. They are important sources of cellular energy for humans and animals too. Therefore, when they are metabolized, they yield large quantities of ATP. A lot of studies have shown that Urtica dioica can be used in medicine. The aqueous and alcoholic extracts have been used for hundreds of years for the treatment of anaemia (Pinelli et al., 2008), rheumatism (Jaric´ et al., 2007), gout and eczema (Orčic´ et al., 2014), and treatment of urinary, bladder and kidney problems (Orčic´ et al., 2014).

Beneficial effects have also been reported on inflammation, hypoglycaemia, hypotension, benign prostatic hyperplasia, cardiovascular problems, arthritis, and allergic rhinitis (Upton, 2013).

Furthermore, stinging nettle exhibits antioxidant, antimicrobial, antifungal, antiviral, and antiulcer activity (Upton, 2013). Nettles possess noticeable antimicrobial activity against Gram-positive and Gram-negative bacteria when compared with standard and strong antimicrobial compounds, such as miconazole nitrate, amoxicillinclavulanic acid, ofloxacin and netilmicin (Gülçin et al., 2004). Different fractions of various Urtica species have been studied to determine their antimicrobial activity. The results indicate the great potential of this plant for the discovery of novel effective compounds.

Moisture	(%)	7.04±0.77
Crude protein	(%)	33.77±0.35
Crude fiber	(%)	9.08±0.14
Crude fat	(%)	3.55±0.06
Total ash	(%)	16.21±0.54
Carbohydrate	(%)	37.39±0.72
Calcium	(mg/100 g)	168.77±1.47
Iron	(mg/100 g)	227.89±0.21
Tannins	(%)	0.93±0.01
Polyphenols	(mg GAE/g)	128.75±0.21
Carotenoids	(μg/g, db)	3496.67±0.56
Caloric value	(kcal/100 g)	307.24±0.13

Table 1: *Chemical composition of nettle leaf powders (Adhikari et al. 2016)*

Nettle provides humans and animals with nutrients and bioactive components, which support antimicrobial activity, immune enhancement and stress reduction.

It is worth noting that the World Health Organization (WHO), in its monographs on 'Selected medicinal plants', describes Urticae as valuable herbs for many medicinal uses.

The European Commission Directorate-General For Health and Food Safety showed that Urtica spp. fulfils the criteria of a foodstuff, as defined in Regulation (EC) No. 178/2002. This opinion is supported by the European Food Safety Authority(EFSA). It concluded that nettle has neither an immediate nor delayed harmful effect on human or animal health and has no negative effect on the environment.

1.5 Solution

We established and tested cultivation nettle field. There was information about the cultivation of stinging nettle for the textile industry during the second war in Germany. In 1940 stinging nettle joined the wild plant breeding programme for fibre production at the Institute of Applied Botany in Hamburg, which managed to derive several clones with high fibre content and in this point of view, that could be considered an agricultural crop for this purpose. These clones are still kept in German and Austrian research institutions (Vogl and Hartl, 2003).

At the start, we took this historical agrotechnical data and we tried to apply them to our conditions. However, the chemical composition of plants is affected by different factors, including the variety, genotype, climate, soil, vegetative stage of the plant, harvest time, storage, processing and treatment (Angela and Meireles, 2009).

When and how nettles are harvested strongly determines the final product. For example, for fibre production, stinging nettles should be harvested when the seeds are mature or when the stalks reach 80the aboveground biomass, from the second year of planting. During the first year, the stalks are too thin, too ramified and have too many leaves. If the main product is to be the leaves, younger plants are harvested. The time of year for nettle harvesting depends on the purpose. Plants collected in April are used for fodder, medicine or chlorophyll production. Nettles harvested at the end of June are used for fibre production. The second harvest in September may be used for the collection of leaves (Di Virgilio et al., 2015).

It seems that the quality and chemical composition of stinging nettle will be affected by epigenetic factors. It means we are able by suitably chosen agrotechnology to produce suitable plant material for food production in this way we can influence the taste of final products (eg. hydroponic or aquaponic culture, as well as indoor technology).

It is important to realize that a big advantage of nettle cultivation is that harvest could be used for plenty of usages: feed, fertilizer, mass into biogas, textile and last, not least food. Therefore, nettle is appropriate for a circular economy. After harvesting non-cultivated nettle (heterogeneous material), we started to test if it would be possible to make food products (pasta, lemonade etc.) based on different conditions of agrotechnology. After we fine-tuned agrotechnology and food technology, we found the taste, which is interesting and extra the nettle belongs to a superfood (Kriegel et al., 2018). Nettle products are fit not only for a healthy lifestyle.

Our pilot food products we released in the market and customers reacted positively. Based on this data we did market research and we revealed a gap - there are a few food products from nettle and all of them are not customer convenience.

Therefore we take advantage. We found out we need to have nettle as a crop.

However, we did not have homogenous material due to the dioecy of nettle, which has a separate male and female sex. Closely, the stinging nettle is a perennial herbaceous plant belonging to the Urticaceae family.

Plant habitus of Urtica dioica It is a well-known and common species, adapted to a variety of climatic conditions. Stinging nettle is a perennial, monoecious plant, flowering and fruiting in the summertime. Its stems and leaves are covered by stinging trichomes containing a fluid that causes blistering when entering the skin (Bisht et al., 2012).

Surprisingly, there are several subspecies for this species, probably due to polyploidization; most plants are predominantly tetraploid in nature (Rejlová et al., 2019). Genetic analyses point to a model of gender inheritance that is not bound to sex chromosomes and is predominantly Mendelistically controlled by one gene, however, there are exceptions to this model (Glawe and Jong, 2008).

For this reason, homogenisation of nettle is difficult, however by using the in vitro method, it is possible. In vitro plant tissue culture is a collection of techniques used to maintain or grow plant cells, tissues or organs under sterile conditions on a nutrient culture medium of known composition. It is widely used to produce clones of a plant in a method known as micropropagation.

Plant tissue culture is used widely in the plant sciences, forestry, and horticulture. For nettle applications, we can use:

- the commercial production of plants used as potting, landscape, and florist subjects, which uses meristem and shoot culture to produce large numbers of identical individuals – clones,
- to conserve rare or endangered nettle species,
- a plant breeder may use tissue culture to screen cells rather than plants for advantageous characters, e.g. salt resistance/tolerance,

- large-scale growth of plant cells in liquid culture in bioreactors for the production of valuable compounds, like plant-derived secondary metabolites and recombinant proteins used as biopharmaceuticals,
- to cross distantly related species by protoplast fusion and regeneration of the novel hybrid,
- to rapidly study the molecular basis for physiological, biochemical, and reproductive mechanisms in plants, for example in vitro selection for stress-tolerant plants,
- for chromosome doubling and induction of polyploidy, for example, doubled haploids, tetraploids, and other forms of polyploids; this is usually achieved by the application of antimitotic agents,
- as a tissue for transformation, followed by either shortterm testing of genetic constructs or regeneration of transgenic plants.

Therefore we started a biotechnological approach in collaboration with Mendel University in Brno. Based on in vitro technology, our co-partner was able to generate genetic homogenous nettle called clones.

1.6 2021/2022

Our teams collect and brings together information about the nettle plant to establish an international market. We have already opened some collaborations, so we can deliver dairy, bread and pasta, beverages and much more on the market. Another collaboration and expansion plans are in progress.

We are actively seeking further business partners who will work with us all around the world.

From 1 kg of fresh nettle, companies made appx 10 dkg of dry nettle. Just on the Czech market (10mil people) is realised about 25 tons of dry nettle which is about 250 tons of fresh nettle. The market is prepared to absorb multiply more nettle. The global market for nettle includes approximately 4 billion people and we can make many more products from fresh nettle than typically made using dried nettle.

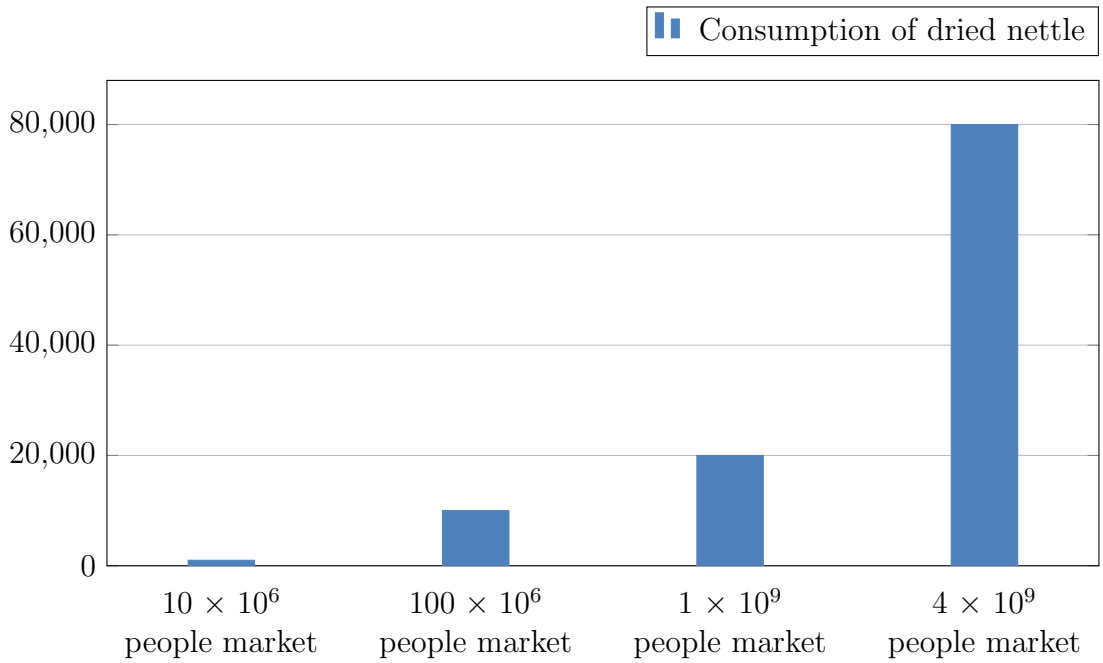

Figure 1: *Current consumption of manually harvested dried nettles (convertion to fresh) in tons per year*

Because we have obtained knowledge about nettle habitus connected to food properties from field observation, we could provide appropriate candidates for micropropagation.

After acclimatization, we obtained special clones to make our growth of nettle homogenous. Nowadays, we cultivate these clones in the field. We are able to supply these clones.

Our main know-how lies in farming and semi-products production and some ways of fermentation. We processed the protocol for nettle explant, so we have opened the door for the breeding program of nettle by using a biotechnological approach, which makes our expansion easier.

Buy up the price from the field is between 1-2 € per kg. The nettle supply chain was built from the field to retail products.

Genetic research and manipulation will bring new ways to use nettle like other plants and with healing and protein properties.

1.7 Space botanical program

The nettle plant seems suitable for space botanical programs as well.