Hemp Protein

Agricultural Utilization Research Institute

Minnesota Overview

The production of hemp, also known as industrial hemp, became legal in Minnesota after the 2014 Farm Bill shifted the responsibility of regulating hemp farming from the federal government to the states. Its production is still limited and heavily controlled. Regulation stems from both hemp and marijuana coming from the same cannabis species; yet, industrial hemp contains negligible levels, if any, of the narcotic substance.

In 2016, the Minnesota Department of Agriculture (MDA) began its first hemp pilot program with 37 acres being planted the first year and 2,100 acres the second. Currently, there are few Minnesota processors of industrial hemp and only processed (non-viable) seed can cross state borders. For reference, hemp seed sells for about $2.50/lb in Canada, which results in a seed cost per acre of about $125.

Nutritional quality

Hemp is high in oil content and contains about 25 percent protein. The protein concentration found in hemp is similar to that of yellow field pea, but lower than that of soybean. Hemp protein is low in lysine and tryptophan. The protein has high digestibility (95%), but has a relatively low PDCAAS at 0.66, attributed mainly to lysine deficiency. Hemp meets the United Nations' Food and Agriculture Organization's essential amino acid recommendations for infants and children. An absence of protease inhibitor, compared to beans, further improves its nutritional value.

Currently available protein ingredient forms

Hemp use is limited in the United States, but a number of hemp protein-related products are available in Canadian and European markets, including hemp seed cakes, defatted hemp seed flour, hemp protein concentrate and hemp protein isolate. Hemp seed cake is high in protein and mostly used as animal feed. Hemp protein concentrates produced from defatted cake have 50 to 70 percent protein, while isolates often have greater than 85 percent protein.

Hemp Facts

- High in oil
- Protein concentration comparable to yellow field peas
- High digestibility
- Low PDCAAS score due to lysine deficiency
- Requires less pesticides and fungicides
- Industrial applications such as paper and durable fabric production
- Best results as rotation crop
- Non-allergenic
- Requires large amounts of water
- Inferior functionality compared to soy protein

Potential functionality and applications

Hemp and its products, namely fiber, are for industrial applications such as paper and durable fabric production. Historically, hemp seed was used for food sources, and is currently legal for human consumption in the United States. In addition to raw, cooked and roasted consumption, hemp produces edible oil and protein ingredients. In general, the most effective use of hemp protein is as emulsifiers, foaming agents and moisture retainers. Compared to defatted hemp seed flours, hemp protein isolates tend to have superior oil-holding capacity, gel-forming ability, and foaming capacity and ability.

Advantages

Hemp can be used as a rotation crop. The crop prevents soil erosion and enriches the soil with valuable nutrients from after-harvest residue. The need for pesticides and fungicides is limited for hemp production, thus growing hemp is less input-intensive and inexpensive. Hemp is also advertised as non-allergenic, which is an added advantage compared to other protein sources.

Barriers

Farmers must obtain State approval before they can grow hemp, which presents a barrier to farmers who are not familiar with governmental procedures. The production and sale of hemp is further complicated by the differing allowable tetrahydrocannabinol (THC) levels among countries, which could potentially hinder international trade for Minnesota grown hemp. Hemp also requires large amounts of water, nitrogen, phosphorus and potassium.

Barriers to the use of hemp as a source of protein include supply chain and inferior protein functionality. Hemp protein isolates have lower solubility than soy protein isolate, contributing to reduced functionality.

Feasibility

Hemp production in Minnesota is possible. Optimal growth occurs under conditions similar to that of corn. This includes moderate climate; lots of water; and well-aerated, fertile soil containing large amounts of organic matter. Best results stemmed from the addition of hemp to a four-year crop rotation. Commercial production in Minnesota is illegal, which will have to change for large-scale hemp protein production to be feasible. There is limited potential for hemp as a protein ingredient because of its inferior functionality compared to soy protein. Additional processing steps, such as hydrolysis, may improve functionality, but may also increase costs.

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