

## Minnesota Overview

Oats are relatively resistant to disease and compete well with weeds, thus they can be grown with minimal amounts of fertilizers and herbicides, keeping production costs low. Compared to other crops, the low price and production cost of oats could make it a cost-effective source for the manufacture of a plant-based protein ingredient. However, manufacturers must also consider the cost of oat protein isolation. Estimates of Minnesota's oat yields in 2016 were 68 bu/acre and \$16.7 million. The price per bushel of oats was around \$2.05, which was lower than that of corn and soybean.



## Nutritional quality

The oat kernel contains between 11 to 24 percent protein. The protein content in oats depends upon growing conditions. Higher protein content also negatively correlates with yield. In general, the PDCAAS for most isolated oat proteins is between 0.45 and 0.51. PrOatein and oat proteins, in general, have inadequate content of lysine. Oat proteins meet all other FAO amino acid requirements for adults, and are particularly high in glutamine.

## Currently available protein ingredient forms

Recently released to the market is the PrOatein, an oat protein-based ingredient. PrOatein was commercialized for boosting the protein content of products such as breakfast cereals and bars, breads, nutritional shakes and healthy snacks. Beyond PrOatein, the market for oat protein ingredients is limited. Oat manufacturers have focused more upon utilizing oats for their  $\beta$ -glucans and oil content rather than their protein.

## Potential functionality and applications

Other potential applications for oat proteins include emulsions formed with oat protein isolates obtained from defatted oat flour that demonstrated a high level of stability. The gelling ability of OPI was acceptable upon enzymatic hydrolysis. Using trypsin hydrolyzed OPI, gels produced at pH 5 to 7 were comparable to, or better than, those made with egg whites, possessing comparable water-holding capacity and mechanical properties. Conversely, OPI did not perform well as a foaming agent compared to soy protein. Functionalization and production of oat protein ingredients require further investigation and development.

## Oat Facts

Relatively low in protein and PDCAAS

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Protein content depends upon growing conditions

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Natural resistance to disease

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Well-suited for organic farming

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Gluten-free

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Low allergenicity

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Grows well in northern regions

### Advantages

As mentioned earlier, for farmers, one of the major advantages of oats is that they are relatively disease-resistant and compete well with weeds, reducing fertilizer and herbicide usage. These traits make oats well-suited for organic farming, and usage in organic and clean-label products. Oats are gluten-free, and reports of allergenicity are low, found exclusively in infants. With advancement in processing technologies and protein modification approaches, oat proteins may have great potential for various food applications, including those requiring high-temperature processing.

### Barriers

Barriers to the utilization of oat proteins in food include their low nutritional value, digestibility and solubility. Being low in lysine, oats are an incomplete source of protein, often requiring the addition of legume proteins. The low nutritional quality of oat protein may not impact its potential use as an emulsifier or gelling agent, but it limits usefulness for protein fortification.

### Feasibility

While farmers currently grow oats in Minnesota, production levels are much lower than that of soybean and corn. The low production rate and relatively low protein content of oats may hinder the utilization of this crop for protein production on a large scale. Oats do grow well in northern regions, as well as areas with weather and slightly acidic soil, making many locations in Minnesota suitable for its production.

Additionally, oats' inherent disease resistance keeps the economic risk for oat production low, which could encourage farmers to plant it if demand and prices increase. The relatively low price of oats may motivate manufacturers to work with oats; however, the additional costs of protein functionalization may negate the monetary benefits of low oat prices. The presence of oat protein ingredients in the market, such as PrOatein, demonstrates that oats can be a viable protein source. In order to increase the availability of oat protein in the market, economic oat protein isolation and processing technologies will need to be developed.



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