

**Comparison of Protein and
Caloric Energy (KCal)
Produced Per Acre on U.S. Farms:
An Analysis of Appropriate Plants
vs.
*Animal Products***



Author: James Videle
Published: May 5, 2019

Report Preamble

The present document is meant to show how appropriate plants compare in protein and caloric energy (kcal) to products of animals per acre. To make the comparison, this report has created a series of tables showing the different plant and animal products and specific values.

Bias

There is an ethical obligation to disclose the bias of the preparers and analyzers involved in this report. The Humane Party aims and fights to free all animals from abuse, exploitation, and property status. It is in the Humane Party's interest that the results of this report support its goal insofar as possible. All members involved in this investigation, analysis, and report have acted at the margins of this bias, striving for their judgment to remain unaffected by said bias.

Sources

The sources used for this report include previous Humane Party reports, the United States Department of Agriculture National Nutrition Database, and the USDA 2012 Census of Agriculture data.

Keywords

Protein, Calories, Agriculture, Plants, Animals

Introduction

This report seeks to analyze and compare the protein and caloric energy (kcal) that can be produced per acre on farms in the United States. Pounds per acre were obtained from previous Humane Party reports. Protein(g) per acre and calories (kcal) per acre have been calculated in the present report. Caloric energy and calories (kcal) are used interchangeably.

The plant-based products used in this analysis are: soybeans, dry beans, dry peas, lentils, wheat, and sunflower seeds. These plant-based crops were discerned to be the most comparable (appropriate) transition to products of animals. Beans, or pulses, as they are sometimes called, would be the food item that would replace those animal products. Wheat was calculated as well because of its popularity in western diets. Sunflower seeds were also factored to show the dietary potential of seeds. Although grains, beans, and seeds such as quinoa, garbanzo beans, hemp, and pumpkin seeds could have been calculated, they were withheld from this study due to their lower acreage of production in the United States specifically and North America in general in comparison to those described above.

The animal-based products used in this analysis are: cows for meat, chickens for meat, eggs from chickens, milk from cows, pigs for meat, and turkeys for meat. The animal-based products identified are the ones most typically available in United States markets. They account for 99% of all animals raised on United States farms. Fish/aquatic species were not calculated because research on all the different species has not yet been conducted.

Key Findings

- Soybeans are the **highest** producer of protein per acre at 513,066 (g)/acre
- Soybeans, dry peas, and dry beans all yield **more** protein per acre than the most productive animal product, chicken for meat (163,212 g/acre)
- Soybeans produce **314% more** protein per acre than chicken
- Soybeans are the **highest** producer of calories per acre at 6,271,268 (g)/acre
- All plant-based crops (soybeans, dry beans, dry peas, lentils, wheat, and sunflower seeds) yield **more** calories (kcal) per acre than the most productive animal product, chicken for meat (1,496,809/acre)
- Soybeans produce **419% more** calories per acre than chicken

Discussion

Pounds per Acre

Plants

From the previously published Humane Party report, “Animal-based Agriculture vs. Plant-based Agriculture: A Multi Product Comparison,” we have the following data:

Crop	Pounds/acre (kg/acre)
Soybeans	3,097.10 lbs.
Wheat (spring and winter on avg.)	2,763.10 lbs.
Dry Peas	2,007.02 lbs.
Dry Beans (Black, Navy on avg.)	1,727.56 lbs.
Sunflower seeds	1,662.33 lbs.
Lentils	1,359.59 lbs.

These weights were calculated dry. All beans, grains, and seeds had been shelled or hulled to obtain their respective weights.

Animals

From the previously published Humane Party report, “Comparison of Farming in Food Production Per Acre,” we have the following data:

Animal (product of)	Pounds/acre (kg/acre)
Milk from cows	3308.59 lbs.
Chicken (meat)	1773.47 lbs.
Turkeys (meat)	1423.92 lbs.
Eggs from chickens	1032.69 lbs.
Pigs (meat)	927.47 lbs.
Cows (meat)	91.69 lbs.

These weights were calculated factoring in how many animals could be raised per acre and the amount of land necessary to raise the crops to feed the animals. In addition, the calculation was based on Feed Conversion Ratios (FCR), the amount of feed necessary for the animal to reach its live weight. Finally, the number of pounds produced for each animal was calculated using the raw slaughtered weight (dressed weight, head, feet, fluids, internal organs removed), not the live weight, since this is what most people would be consuming.

Protein Comparison

Plants

All protein values were taken from the USDA National Nutrient Database. 1 lb. = 454 g (see identifiers after the table)

Crop	Pounds/acre	Protein(g)/lb.	Protein (g)/acre
Soybeans	3,097.10 lbs.	165.66 (g)	513,066 (g)/acre
Dry Peas	2,007.02 lbs.	104.96 (g)	210,657 (g)/acre
Dry Beans (Black)	1,727.56 lbs.	98.06 (g)	169,405 (g)/acre
Wheat (winter)	2,763.10 lbs.	57.25 (g)	158,188 (g)/acre
Lentils	1,359.59 lbs.	111.72 (g)	151,893 (g)/acre
Sunflower seeds	1,662.33 lbs.	90.80 (g)	150,940 (g)/acre

Soybeans, mature seeds, raw; *Peas*, green, split, mature seeds, raw; *Beans*, black, mature seeds, raw; *Wheat*, hard red winter; *Lentils*, raw; *Sunflower seeds*, raw

Animals

All protein values were taken from the USDA National Nutrient Database. 1 lb. = 454 g (see identifiers after the table)

Animal (product of)	Pounds/acre	Protein(g)/lb.	Protein (g)/acre
Chicken (meat)	1773.47 lbs.	92.03 (g)	163,212 (g)/acre
Turkeys (meat)	1423.92 lbs.	99.70 (g)	141,965 (g)/acre
Pigs (meat)	927.47 lbs.	82.72 (g)	76,720 (g)/acre
Eggs from chickens	1032.69 lbs.	57.02 (g)	58,884 (g)/acre
Milk from cows	3308.59 lbs.	15.12 (g)	50,026 (g)/acre
Cows (meat)	91.69 lbs.	90.85 (g)	8,330 (g)/acre

Chicken, broilers or fryers, light meat, meat and skin, raw; *Turkey*, whole, light meat, meat and skin, raw
Pork, fresh, composite of trimmed leg, loin, shoulder, and spareribs, (includes cuts to be cured), separable lean and fat, raw; *Egg*, whole, raw, fresh; *Whole Milk* (most UPC)
Beef, composite of trimmed retail cuts, separable lean and fat, trimmed to 1/8" fat, all grades, raw

Caloric energy (kcal) Comparison

Plants

All protein values were taken from the USDA National Nutrient Database. 1 lb. = 454 g (see identifiers after the table)

Crop	Pounds/acre	Calories/lb.	Calories/acre
Soybeans	3,097.10 lbs.	2025	6,271,628/acre
Sunflower seeds	1,662.33 lbs.	2633	4,376,915/acre
Wheat (winter)	2,763.10 lbs.	1485	4,103,204/acre
Dry Peas	2,007.02 lbs.	1653	3,317,604/acre
Dry Beans (Black)	1,727.56 lbs.	1548	2,674,263/acre
Lentils	1,359.59 lbs.	1597	2,171,265/acre

Soybeans, mature seeds, raw; *Sunflower seeds*, raw; *Wheat*, hard red winter
Peas, green, split, mature seeds, raw; *Beans*, Black, mature seeds, raw; *Lentils*, raw

Animals

All protein values were taken from the USDA National Nutrient Database. 1 lb. = 454 g (see identifiers after the table)

Animal (product of)	Pounds/acre	Calories/lb.	Calories/acre
Chicken (meat)	1773.47 lbs.	844	1,496,809/acre
Turkeys (meat)	1423.92 lbs.	731	1,040,886/acre
Milk from cows	3308.59 lbs.	304	1,005,811/acre
Pigs (meat)	927.47 lbs.	958	888,516/acre
Eggs from chickens	1032.69 lbs.	649	670,216/acre
Cows (meat)	91.69 lbs.	976	89,489/acre

Chicken, broilers or fryers, light meat, meat and skin, raw; *Turkey*, whole, light meat, meat and skin, raw
Whole Milk (most UPC); *Pork*, fresh, composite of trimmed leg, loin, shoulder, and spareribs, (includes cuts to be cured), separable lean and fat, raw; *Egg*, whole, raw, fresh
Beef, composite of trimmed retail cuts, separable lean and fat, trimmed to 1/8" fat, all grades, raw

Conclusions

Unequivocally, protein from soybeans, dry beans, dry peas, lentils, wheat, and sunflower seeds are viable replacements for animal products. The most productive protein source (whether plant or animal) is soybeans, which produce 314% more protein per acre than chickens for meat (the most productive animal protein source). Dry peas produce 29% more protein and dry beans 3.8% more. Even though wheat produces 3.1% less, lentils 7% less, and sunflower seeds 7.5% less than chicken, they all produce more protein per acre than the next most productive animal product, turkeys for meat. Sunflower seeds, the lowest production of protein per acre among the plant-based crops analyzed, produces **1,812% more** protein per acre than cows for meat (the lowest protein production per acre of the animal sources analyzed).

In comparing caloric energy (kcal), the differences are even more dramatic. Every plant-based crop produced more calories per acre than chicken for meat. Soybeans were the highest producer yielding 419% more calories per acre. Analyzing the least productive plant-based energy source, lentils, it was found that they were **2,426% more** productive than cows for meat (the lowest caloric energy production per acre).

The following question should be highly considered: if cows for meat utilize the most agricultural land (see Table D of the HP report, “Comparison of Farming in Production of Food Per Acre”) and produce the least amount of pounds, protein, and calories per acre, why are we occupying our lands with such an inefficient food source, not to mention sacrificing millions of these animals’ lives?

Another aspect to consider is that these numbers would hold true worldwide. Pulses, grains, and seeds produced regionally would have roughly the same protein and calorie values per pound. While their yields may be different (higher or lower depending on variety), some varieties have been grown for thousands of years and have become ever adaptable to frequent climate changes. With seed stewardship and conservation practices by farmers, more adaptable and higher yielding varieties are possible.

In conclusion, the numbers analyzed for the products of animals are specific to the United States. Farmers in the U.S. would claim that they have the highest efficiency and productivity in the world. If that is the case, the differences in plant-based proteins and energy sources may even be higher in favor of plants in countries where raising animals is occurring. At any rate, it is clear that in the United States the exploitation of farmland for raising animals is unnecessarily wasteful, while billions of animals are needlessly suffering. In order to ensure a secure and viable agricultural America for future generations, a complete transition towards cultivating solely plant-based crops should be championed without delay. Through our schools, on our farms, and within governmental programs we have the power to change.

Resources

“Nutrition Value.” Nutrition Value.org. 2019. (Lentils, raw only)

Sigler, Jorge et. al. “Animal-based Agriculture vs. Plant-based Agriculture: A Multi Product Comparison.” *Humane Herald*. March 2017.

“USDA Food Composition Databases: Food Search.” USDA. April 2019. (All identifiers except lentils, raw)

Videle, James. “Comparison of Farming in Production of Food Per Acre.” *Humane Herald*. January 2019. (Table D & F)

“2012 Census of Agriculture United States: Summary and State Data.” USDA. May 2014.