

Comparison of Farming in Production of Food Per Acre
Measuring vegan-organic agriculture
vs.
animal-based agriculture



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Report Preamble

The present document is meant to show how small-scale vegan-organic agriculture compares to animal-based agriculture in the United States in pounds per acre. To make the comparison, this report utilizes different formulas to obtain an accurate depiction of the production per acre of animals for meat and for their products.

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, USDA National Agricultural Statistics Service including the USDA Census of Agriculture 2012, United Nations FAO, animal agriculture industry and university extension data.

Keywords

United States, Agriculture, Vegan, Animals

Introduction

The vegetable crops used for the comparison were snap beans, dry beans, cabbage, carrots, cucumbers, kale, lettuce, onions, potatoes, summer squash and tomatoes.

The animals and/or products of animals measured were: cows/veal for meat, cows for milk, chickens for meat, chickens for eggs, pigs for meat and turkeys for meat.

This report seeks to compare the average production per acre (in lbs.) for the above vegetable crops to the average production of animals and their products in production per acre. Furthermore, the report seeks, through seven tables, to ascertain a true value for the actual land necessary to raise animals.

Values have been calculated for space (*Table A*), feed required (*Table B*), feed acres (*Table C*), total acres required (*Table D*), lbs. per acre (*Table E*), dressed weight lbs. per acre (*Table F*) and net pounds of food produced (*Table G*).

By calculating dressed weight percentages (also known as slaughtered weight, which includes carcass, but removes head, feet, blood, feathers and internal, non-edible organs) in our final analysis, we will accurately reveal the lbs. of food that the animal can provide to the consumer or animal raiser.

Key Findings

- Vegan-organic agriculture on average can yield **32,331 lbs./acre** (based on 11 primary crops).
- Animal-based agriculture on average can yield **770.22 lbs./acre**.
- Vegan-organic agriculture can be **4,198% more productive** than animal-based agriculture in the amount of food produced per acre.
- Grain-fed animals (9.5323 billion in the United States from 2017) required **241.63 billion pounds of grains** that could be fed directly to the human population.
- Animal-based agriculture’s grain fed animals (chickens, chickens for eggs, pigs and turkeys) yield a **net loss of 163.95 billion pounds of food**.

Discussion

Vegetable Findings

Crop	Lbs./acre
Snap Beans	13,129 lbs./acre
Dry Beans	2,236 lbs./acre
Cabbage	26,450 lbs./acre
Carrots	46,095 lbs./acre
Cucumbers	38,844 lbs./acre
Kale	21,275 lbs./acre
Lettuce	16,291 lbs./acre
Onions	28,654 lbs./acre
Potatoes	27,216 lbs./acre
Summer Squash	43,451 lbs./acre
Tomatoes	91,999 lbs./acre
Totals (avg.)	32,331 lbs./acre

Veganic agriculture can produce an average of **32,331 lbs./acre**

The data for production of vegetables/acre was taken from the Humane Party report, “The Productivity of Vegan-organic Farming: Measuring small-scale vegan-organic farming against large-scale conventional and organic practices.”

All values were converted into pounds by multiplying the kilograms by 2.2.

Animals Findings:

Data for the animal findings was taken from the Humane Party report, “Animal-based agriculture vs. Plant-based agriculture: A multi-product data comparison.”

From 2017 the United States raised:

- Cows for beef/veal: 82,680,000*
- Cows for milk: 9,320,000
- Chickens: 8,690,000,000
- Chickens for eggs: 461,013,000
- Pigs: 148,300,000
- Turkeys: 233,000,000

Total: 9,624,313,000 animals raised

*This number would include all cows not considered cows for milk, and could include replacement female cows, female cows for breeding, male cows for breeding and yearling cows.

Pounds per acre of animals in liveweight:

Table A

Animal	Total pounds	Acres*	#’s/acre
Cows for Beef/Veal	52.4 billion	348.596 million**	150.32/acre
Cows for Milk	209 billion (#’s of milk)	18.628 million	11,219.67/acre
Chickens	53.4 billion	3.138 million	17,017.21/acre
Chickens for eggs	9.64 billion (#’s eggs)	1.861 million	5,180.01/acre
Pigs	31.736 billion	5.208 million	6,093.70/acre
Turkeys	7.04 billion	.779 million	9,037.23/acre
Totals	363.216 billion	378.210 million	(avg.) 960.36/acre

*The total number of acres corresponds to the 2012 Census of Agriculture and would include the land necessary for grazing and housing (but NOT for raising the feed necessary to nourish the animals).

**This number only includes the privately held lands used for the raising of cows for beef and veal. There are at least 250 million acres of public lands that are leased by western ranchers but, because this is split between sheep and cattle ranchers, the numbers are unobtainable. However, it is certain that the

amount of land used for cattle raising on pasture is higher than what we have depicted, making the amount of pounds yielded per acre lower.

Feed required to feed animals:

Table B

Animal	FCR	Total pounds	Total #'s of grain/hay required
Cows for Beef/Veal	N/a	52.4 billion	N/a (pasture)
Cows for Milk	1.04:1	209 billion (#'s of milk)	217.36 billion (hay)
Chickens	1.83:1	53.4 billion	97.722 billion (grain)
Chickens for eggs	3.31:1	9.64 billion (#'s eggs)	31.908 billion (grain)
Pigs	3.03:1	31.736 billion	96.160 billion (grain)
Turkeys	2.25:1	7.04 billion	15.840 billion (grain)

In order to correctly calculate how much actual acreage is needed to raise an animal, we must factor in the Feed Conversion Ratio (FCR), which is the amount of feed necessary for the animal to reach the weight at which it is slaughtered (live weight).

The following conversions have been calculated to be introduced above.

Cows for beef FCR n/a

The 82.7 million beef cows produce 52.4 billion pounds of weight and could only require pasture, which is already calculated. It is certain that many cows for beef are raised for the final three months or so in feedlots and are fed grain “to fatten them up,” in which case the feed conversion ratio would be much higher.

In many northern climates, cows are fed hay harvested during the season. It is possible that additional acres would be used to produce that feed than already discerned.

For the purpose of this comparison we are showing that it is possible to solely feed cows from pasturelands (they are spending the majority of their lives there already).

Cows for milk FCR 1.04:1

Cows for milk eat about 90-100 lbs. per day of “as fed” feed. Each cow requires a dry matter (DM) intake of 39-44 lbs/day, depending on breed, and 26 to 29 lbs. of DM intake as hay (67%).

Hay at 85% Dry Matter

26 lbs / 85% DM = 30.59 lbs.

29 lbs / 85% DM = 34.11 lbs.

and the rest could be silage, either alfalfa or corn.

Silage at 40% Dry Matter

13 lbs / 40% DM = 32.5 lbs.

15 lbs / 40% DM = 37.5 lbs.

On average, a dairy cow would require 63-71.5 lbs. (28.6 – 32.5 kg) of feed per day and produce 60-70 lbs. (27.3 – 31.8 kg) of milk per day, for an average ratio of 1.04:1.

The 9.32 million cows for milk produce 209 billion lbs. of milk and require 217.36 billion lbs. of hay.

Chickens. FCR 1.83:1

The 8.69 billion chickens produce 53.4 billion pounds of weight and require 97.72 billion lbs. of grain.

Chickens for Eggs FCR 3.31:1

Laying hens will average 208 eggs per year or 20.8 lbs. (9.45 kg) (10 eggs per pound). It takes them about 15-20 weeks to reach maturity (when they are not laying).

For the first 15 weeks, they will eat on average 52g of feed per day (5.4 kg in 15 weeks).

For the remaining 37 weeks, laying hens will eat 100g of feed per day (25.9 kg in 37 weeks).

9.45 kg of eggs produced from 31.3 kg, 3.31:1.

The 461.013 million laying hens produce 9.64 billion lbs. of eggs and require 31.908 billion lbs. of grain.

Pigs FCR 3.03:1

Pigs will eat approx. 3.03 kg of feed to reach 1 kg of weight.

The 148.3 million pigs produce 31.74 billion lbs. of weight and require 96.17 billion lbs. of grain.

Turkeys FCR 2.25:1

Turkeys will eat approx. 2.25 kg of feed to reach 1 kg of live weight on average of males and females. The range of feed is 1.75:1 to 2.5:1 (Avg. 2.13:1) for a 12-14 weeks-old hen turkey, and 2.14:1 to 2.57:1 (Avg. 2.36:1) for a tom turkey.

The 233 million turkeys produce 7.04 billion lbs. of weight and require 15.84 billion lbs. of grain.

Calculated acres needed to feed animals:

Table C

Animal	Total #'s of grain/hay required	Total acres needed to feed them
Cows for Beef/Veal	N/a (pasture)	N/a (pasture)
Cows for Milk	217.36 billion (hay)	44.541 million acres
Chickens	97.722 billion (grain)	19.746 million acres

Chickens for eggs	31.908 billion (grain)	6.447 million acres
Pigs	96.160 billion (grain)	19.430 million acres
Turkeys	15.840 billion (grain)	3.201 million acres

Based on feed conversion ratios (FCR's) and average amount of hay and grains produced per acre, we can estimate the amount of acres needed to feed them.

Cows for beef or veal:

could live their entire lives on pasture. In doing so, the space needed to raise the 82.68 million cows require the same 348.596 million acres as their pasture lands.

Cows for milk:

require a hay-based feed. Based on the averages of all hay area in the United States, all hay types can yield 2.44 tons/acre (4,880 lbs/acre).

Cows for milk require 217.36 billion lbs. of alfalfa hay (for example), which requires 44.541 million acres to grow it.

Chickens:

require 97.722 billion lbs. of feed, which requires 19.746 million acres to grow it.

Chickens for eggs:

require 31.91 billion lbs. of feed, which requires 6.447 million acres to grow it.

Pigs:

require 96.16 billion lbs. of feed, which requires 19.430 million acres to grow it.

Turkeys:

require 15.84 billion lbs. of feed, which requires 3.201 million acres to grow it.

*Chickens (both types), pigs and turkeys are all fed grain-based feed.

In theory they could eat a mix of corn (11,280 lbs/acre), soy (3,097 lbs/acre), sorghum (4,469 lbs/acre), barley (3,134 lbs/acre) and wheat (2,763 lbs/acre). Data was taken from the HP report, "Plant-based vs. Animal-based agriculture: A multi product comparison."

Averaging the above production/acre, feed produced would result in 4,949 lbs/acre.

Calculating total acres needed to raise animals:

Table D

Animal	Total # of animals	Acres (Space)	Acres (Feed)	Total Acres
Cows for Beef/Veal	82.68 million	348.596 million	N/a	348.596 million
Cows for Milk	9.32 million	18.628 million	44.541 million	63.169 million
Chickens	8.69 billion	3.138 million	19.746 million	22.884 million
Chickens for eggs	461 million	1.861 million	6.447 million	8.308 million
Pigs	148.3 million	5.208 million	19.43 million	24.64 million
Turkeys	233 million	.779 million	3.201 million	3.98 million

Cows for beef or veal:

82.68 million cows require 348.596 million acres (*4.22 acres/cow for beef*), which would also be their feeding grounds.

Cows for milk:

9.32 million cows for milk require 63.169 million acres (*6.78 acres/cow for milk*).

Chickens:

8.69 billion chickens require 22.884 million acres (*.003 acres/chicken*).

Chickens for eggs:

461 million chickens for eggs require 8.308 million acres (*.02 acres/chicken for eggs*).

Pigs:

148.3 million pigs require 24.638 million acres (*.17 acres/pig*).

Turkeys:

233 million turkeys require 3.98 million acres (*.02 acres/turkey*).

Calculating total acres compared to lbs. raised (live weight):

Table E

Animal	Total # of pounds	Acres (total)	#’s/acre
Cows for Beef/Veal	52.4 billion	348.596 million	150.32lbs./acre
Cows for Milk	209 billion (milk)	63.169 million	3308.59lbs./acre
Chickens	53.4 billion	22.884 million	2333.51lbs./acre
Chickens for eggs	9.64 billion (eggs)	8.308 million	1160.33lbs/acre

Pigs	31.74 billion	24.64 million	1288.15lbs/acre
Turkeys	7.04 billion	3.98 million	1768.84lbs/acre

Factoring in the land needed for feed, we now have a more accurate estimate of the land required to house, raise and feed the animals. This will give a true reflection of the live weight pounds that can be produced per acre.

Cows for beef/veal:

To produce 52.4 billion lbs. of beef and veal now requires 348.596 million acres (150.32lbs./acre).

Cows for milk:

To produce 209 billion lbs. of milk now requires 63.169 million acres (3,308.59lbs./acre).

Chickens:

To produce 53.4 billion lbs. of chicken now requires 22.884 million acres (2,333.51lbs./acre).

Chickens for eggs:

To produce 9.64 billion lbs. of eggs now requires 8.308 million acres (1160.33lbs./acre).

Pigs:

To produce 31.74 billion lbs. of pig now requires 24.64 million acres (1288.15 lbs/acre).

Turkeys:

To produce 7.04 billion lbs. of turkey now requires 3.98 million acres (1768.84lbs/acre).

Calculating dressed weight compared to acres:

Table F

Animal	# of pounds x dress %	Acres (total)	#’s/acre (dressed weights)
Cows for Beef/Veal	52.4 billion x 61%	348.596 million	91.69lbs./acre
Cows for Milk	209 billion x 100%	63.169 million	3308.59lbs./acre
Chickens	53.4 billion x 76%	22.884 million	1773.47lbs./acre
Chickens for eggs	9.64 billion x 89%	8.308 million	1032.69lbs/acre
Pigs	31.74 billion x 72%	24.64 million	927.47lbs/acre
Turkeys	7.04 billion x 80.5%	3.98 million	1423.92lbs/acre
Totals	363.22 billion	471.577 million	770.22lbs./acre

In the final analysis we look at the dressed weight (also known as the slaughterhouse weight) of all animals for this would be the weight that people would most likely be eating.

Dressed weight would remove the head, feet, blood and internal organs, which are not edible.

The following calculations have been made to be introduced above.

Cows for beef/veal:

On average a 1,000 lb. cow for beef would yield 610 lbs dressed weight (61%).

Cows for dairy:

Assuming that no loss occurs from pasteurization, 100% of all milk is edible.

Chickens:

Taken from current slaughterhouse data, chickens have a dressed weight of 76%.

Chickens for eggs:

The weight of the shell is 11%, making the edible weight in this case 89% of the egg.

Pigs:

On average a 250lb. pig would yield 180 lbs. of dressed weight (72%).

Turkeys:

Taken from current slaughterhouse data, turkeys have a dressed weight of 80.5%.

Net Pounds of food produced (grain fed animals):

Table G

Animal	# of animals	# of pounds dressed weight	#' of food required	Net pounds
Chickens	8.69 billion	40.58 billion	97.722 billion	-57.142 billion
Chickens for eggs	461 million	8.58 billion	31.908 billion	-23.328 billion
Pigs	148.3 million	22.85 billion	96.16 billion	-73.31 billion
Turkeys	233 million	5.67 billion	15.84 billion	-10.17 billion
Totals	9.5323 billion	77.68 billion	241.63 billion	-163.95 billion

The 9.5323 billion grain-fed animals raised in the United States produced 77.68 billion pounds of dressed weight meat (eggs/shell removed) but required 241.63 billion pounds of grain that theoretically could be fed to humans.

Grain-fed animals are eating grain that could be otherwise fed to humans, mostly soy, corn, wheat, oats, barley and sorghum.

Hay- or pasture-fed cows are not calculated because the hay and/or pasture can not be directly fed to humans, however it is important to mention that all lands used to pasture cows and/or raise the hay could be used for growing crops directly for human consumption or left to re-wild in the case of some very marginal forested pastured areas.

Alfalfa hay or clover lands in particular are extraordinarily fertile for growing vegetable crops as they are nitrogen-fixing forages.

Conclusions

Animal agriculture requires vast amounts of land for space and manure dispersal (cows/all types) and land to grow their feed (grain or hay fed animals). Production per acre for animals is on average **770 lbs./acre** where the field crops surveyed can produce **32,331 lbs./acre**, a **4,197% better production per acre**.

Animal agriculture based on the feed needed to feed grain-fed animals has a **net loss result of 163.95 billion lbs. of food**. However, those grain-fed animals require in total **241.63 billion pounds of grain** that could be fed directly to the human population.

The solutions do not require finding more efficient ways to raise animals, but how to best transition farmers to completely grow plant-based crops.

Resources

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