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Distribution Development for STORM Ingestion Input Parameters

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Prepared by
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Distribution Development for STORM Ingestion Input Parameters

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Abstract

The Sandia-developed Transport of Radioactive Materials (STORM) code suite is used as part of the Radioisotope Power System Launch Safety (RPSLS) program to perform statistical modeling of the consequences due to release of radioactive material given a launch accident. As part of this modeling, STORM samples input parameters from probability distributions with some parameters treated as constants.

This report described the work done to convert four of these constant inputs (Consumption Rate, Average Crop Yield, Cropland to Landuse Database Ratio, and Crop Uptake Factor) to sampled values. Consumption rate changed from a constant value of 557.68 kg / yr to a normal distribution with a mean of 102.96 kg / yr and a standard deviation of 2.65 kg / yr. Meanwhile, Average Crop Yield changed from a constant value of 3.783 kg_{edible} / m² to a normal distribution with a mean of 3.23 kg_{edible} / m² and a standard deviation of 0.442 kg_{edible} / m². The Cropland to Landuse Database ratio changed from a constant value of 0.0996 (9.96%) to a normal distribution with a mean value of 0.0312 (3.12%) and a standard deviation of 0.00292 (0.29%). Finally the crop uptake factor changed from a constant value of 6.37e-4 (Bq_{crop}/kg)/(Bq_{soil}/kg) to a lognormal distribution with a geometric mean value of 3.38e-4 (Bq_{crop}/kg)/(Bq_{soil}/kg) and a standard deviation value of 3.33 (Bq_{crop}/kg)/(Bq_{soil}/kg).

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The author would like to acknowledge William Cunningham of the United States Food and Drug Administration, and Denise Bleakly of Sandia National Laboratories for their technical advice and assistance in writing this report. The author would also like to acknowledge Nathan Bixler of Sandia National Laboratories for assistance in understanding his prior work. The author would also like to acknowledge Nathan Bixler, Lainy Cochran, and Daniel Clayton of Sandia National Laboratories and Deborah Phipps of Nuclear & Regulatory Support Services (NRSS) for their assistance in editing this report. The author would also like to thank Aubrey Eckert-Gallo and Dusty Brooks of Sandia National Laboratories for their help in devising statistical distributions and editing this document.

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NOMENCLATURE

AWG	Assessment Working Group
CDC	Center for Disease Control
EPA	Environmental Protection Agency
FDA	Food and Drug Administration
GLC	Global Land Coverage Database
GM	Geometric Mean
GSD	Geometric Standard Deviation
HFCS	High Fructose Corn Syrup
IAEA	International Atomic Energy Association
FRMAC	Federal Radiological Monitoring and Assessment Center
KSC	Kennedy Space Center
NRA	Nuclear Risk Assessment
PNNL	Pacific Northwest National Laboratories
RPSLS	Radioisotope Power System Launch Safety
SNL	Sandia National Laboratories
STORM	Sandia-developed Transport of Radioactive Material
USDA	United States Department of Agriculture

1. INTRODUCTION

This report describes the development of ingestion pathway parameters that will be used to support nuclear risk assessments and radiological contingency planning efforts for space missions which carry radioactive, particularly plutonium-238, fueled power systems. Specifically, this report describes the work done to develop distributions for the Consumption Rate, or Human Intake Rate; the Average Crop Yield, or Land Productivity; the Cropland to Landuse Database Ratio, and Crop Uptake Factor input parameters for the Sandia-developed Transport of Radioactive Material (STORM) code used by the Radioisotope Power System Launch Safety (RPSLS) program.

Consumption Rate describes the mass of food consumed per year by the typical American and is used in the calculation of ingestion dose. Average Crop Yield is the average mass of edible crop produced per land area in a given year. Average Crop Yield is an input parameter to the calculation of how much dose a person, or population, would receive from the consumption of contaminated produce. The average is calculated by multiplying the area dedicated to the production of a certain crop times the land productivity of that crop divided by the area dedicated to the production of all crops or mathematically:

$$AverageCropYield = \frac{\sum_i^n (CropAcreage_i * CropYield_i)}{\sum_i^n CropAcreage_i}$$

The Cropland to Landuse Database Ratio is the ratio of area dedicated to crops as determined by the United States Department of Agriculture (USDA) Cropscape database divided by the area defined by the Global Land Coverage 2000 (GLC2000) which is dedicated to crops. This is used to adjust the acreage dedicated to crops as defined by the GLC2000 database, which is the currently used default database in the STORM code due to the need to support launches globally.

Finally, the Crop Uptake Factor or Average Crop Uptake Factor is the ratio of activity in the plant over the activity deposited in the ground. It is used to determine how much of the activity that deposited on the ground and plant surfaces, eventually makes its way into the crop for consumption. This value is an average value for all crops in a given area weighted by how much of the crop is produced. Mathematically it is:

$$AverageCropUptake = \frac{\sum_i^n (CropAcreage_i * CropYield_i * CropUptake_i)}{\sum_i^n (CropAcreage_i * CropYield_i)}$$

The Mars 2020 Nuclear Risk Assessment¹ (NRA) value used in the STORM code for Consumption Rate was 557.68 kg / yr, for Average Crop Yield was 3.783 kg_{edible} / m², where

¹ John, B., Jones, C. A., Clayton, D. J., Rohe, D. P., Flores, G. J., Bartel, T. J., . . . Lipinski, R. J. (2014). *Nuclear Risk*

edible means the edible portion of the crop instead of the entire crop mass. The value used for Cropland to Landuse Database Ratio was 0.0996 (9.96%). The value used for Crop Uptake Factor was $6.37\text{e-}4 \text{ (Bq}_{\text{crop}}/\text{kg})/(\text{Bq}_{\text{soil}}/\text{kg})$.

It is proposed in this report to update these constant values with normal or lognormal distributions. For Consumption Rate, the normal distribution will have a mean of 102.96 kg / yr and a standard deviation of 2.65 kg / yr. For Average Crop Yield, the normal distribution will have a mean of $3.23 \text{ kg}_{\text{edible}} / \text{m}^2$ and a standard deviation of $0.442 \text{ kg}_{\text{edible}} / \text{m}^2$. For Cropland to Landuse Database, the normal distribution will have a mean of 0.0312 (3.12%) and a standard deviation of 0.00292 (0.29%). For Crop Uptake Factor, the normal distribution will have a mean of $3.38\text{e-}4 \text{ (Bq}_{\text{crop}}/\text{kg})/(\text{Bq}_{\text{soil}}/\text{kg})$ and a standard deviation of $3.33 \text{ (Bq}_{\text{crop}}/\text{kg})/(\text{Bq}_{\text{soil}}/\text{kg})$. Derivation of these distributions follows.

2. CONSUMPTION RATE

The value used for Consumption Rate in the Mars 2020 NRA was the constant value of 438.3 kg / yr. The principle issue with this value and associated analysis is there are no means by which to develop a distribution upon which to sample. Thus, development of a consumption rate distribution required finding alternate sources of consumption rate data. Details on the origin of and issues with the NRA consumption rate number are available in Appendix A – Origin of and issues with the MARS NRA Consumption Rate Value.

According to William Cunningham of the FDA, the primary source for data on consumption rate used by the United State Food and Drug Administration (FDA) for the average American is a series of ingestion reports put together by the United States Department of Agriculture^{2,3,4,5,6,7}. These reports provide the following data on Daily Food Consumption Rates by category for the typical American and represent a collaborative work between the USDA, FDA, and Center for Disease Control (CDC).

Table 1. USDA Average Daily Consumption for Fats, Oils, Miscellaneous; Caloric Sweeteners; Fruit including Citrus; and Citrus separately.

	Total Fat / Oil / Misc		Total Caloric Sweeteners		Total Fruit (contains total citrus)		Total Citrus	
Study	Daily intake (g)	Standard Deviation (g)	Daily intake (g)	Standard Deviation (g)	Daily intake (g)	Standard Deviation (g)	Daily intake (g)	Standard Deviation (g)
1994-1998	32.00	0.40	91.00	1.40	322.00	7.60	142.00	5.00
1999-2000	35.00	0.40	112.00	4.20	319.00	17.40	131.00	7.10
2001-2002	34.00	0.30	107.00	2.30	342.00	15.50	141.00	9.40
2003-2004	35.00	0.50	111.00	2.20	319.00	17.30	134.00	8.50
2005-2006	33.00	0.60	99.00	2.40	306.00	10.20	123.00	5.60
2007-2008	31.00	0.50	95.00	3.30	305.00	13.80	102.00	5.60

² United States Department of Agriculture. (2011, August). Retail Food Commodity Intakes: Mean Amounts of Retail Commodities per Individual, 1994-1998. Beltsville, Maryland: United States Department of Agriculture.

³ United States Department of Agriculture. (2011, August). Retail Food Commodity Intakes: Mean Amounts of Retail Commodities per Individual, 1999-2000. Beltsville, Maryland: United States Department of Agriculture.

⁴ United States Department of Agriculture. (2011, August). Retail Food Commodity Intakes: Mean Amounts of Retail Commodities per Individual, 2001-2002. Beltsville, Maryland: United States Department of Agriculture.

⁵ United States Department of Agriculture. (2011, August). Food Commodity Intakes: Mean Amounts of Retail Commodities per Individual, 2003-2004. Beltsville, Maryland: United States Department of Agriculture.

⁶ United States Department of Agriculture. (2011, August). Food Commodity Intakes: Mean Amounts of Retail Commodities per Individual, 2005-2006. Beltsville, Maryland: United States Department of Agriculture.

⁷ United States Department of Agriculture. (2011, August). Food Commodity Intakes: Mean Amounts of Retail Commodities per Individual, 2007-2008. Beltsville, Maryland: United States Department of Agriculture.

Table 2. USDA Average Daily Consumption for Grains, Nuts, and Vegetables.

Study	Total Grains		Total Nuts		Total Vegetables	
	Daily intake (g)	Standard Deviation (g)	Daily intake (g)	Standard Deviation (g)	Daily intake (g)	Standard Deviation (g)
1994-1998	125.00	1.10	5.00	0.20	371.00	3.90
1999-2000	125.00	2.40	6.00	0.40	352.00	5.70
2001-2002	127.00	2.00	7.00	0.50	360.00	7.20
2003-2004	122.00	2.30	8.00	0.50	355.00	5.10
2005-2006	124.00	1.80	8.00	0.40	345.00	7.10
2007-2008	117.00	1.90	7.00	0.50	341.00	7.80

Table 3. USDA Average Daily and Annual Consumption for All Categories listed in Tables 1 and 2.

Study	Total All Categories		Total All Categories	
	Daily intake (g)	Standard Deviation (g)	Annual intake (kg)	Standard Deviation (kg)
1994-1998	946.00	14.60	345.29	5.33
1999-2000	949.00	30.50	346.39	11.13
2001-2002	977.00	27.80	356.61	10.15
2003-2004	950.00	27.90	346.75	10.18
2005-2006	915.00	22.50	333.98	8.21
2007-2008	896.00	27.80	327.04	10.15

This author found two other data sources for consumption rate. These include Appendix G of the Pluto New Horizon's Final Safety Analysis Report, Volume III, Book 2, Appendix G⁸ and a 1984 report by the Environmental Protection Agency (EPA) further promulgated by the FDA in 1998⁹. Table 4 through Table 6 repeat Tables 1 through 3 but include two additional rows for the EPA and Pluto New Horizon studies.

Table 4. Daily Consumption for Fats, Oils, Miscellaneous; Caloric Sweeteners; Fruit including Citrus; and Citrus separately.

Study	Total Fat / Oil /Misc		Total Caloric Sweeteners		Total Fruit (contains total citrus)		Total Citrus	
	Daily intake (g)	Standard Deviation (g)	Daily intake (g)	Standard Deviation (g)	Daily intake (g)	Standard Deviation (g)	Daily intake (g)	Standard Deviation (g)
1994-1998	32.00	0.40	91.00	1.40	322.00	7.60	142.00	5.00

Washington, D.C.

1999-2000	35.00	0.40	112.00	4.20	319.00	17.40	131.00	7.10
2001-2002	34.00	0.30	107.00	2.30	342.00	15.50	141.00	9.40
2003-2004	35.00	0.50	111.00	2.20	319.00	17.30	134.00	8.50
2005-2006	33.00	0.60	99.00	2.40	306.00	10.20	123.00	5.60
2007-2008	31.00	0.50	95.00	3.30	305.00	13.80	102.00	5.60
Pluto New Horizon	173.47	3.36	0.00	0.00	86.15	2.55	86.15	2.55
EPA 84 / FDA 98	34.60	0.70	0.00	0.00	0.00	0.00	0.00	0.00

Table 5. Daily Consumption for Grains, Nuts, and Vegetables.

Study	Total Grains		Total Nuts		Total Vegetables	
	Annual intake (g)	Standard Deviation (g)	Annual intake (g)	Standard Deviation (g)	Annual intake (g)	Standard Deviation (g)
1994-1998	125.00	1.10	5.00	0.20	371.00	3.90
1999-2000	125.00	2.40	6.00	0.40	352.00	5.70
2001-2002	127.00	2.00	7.00	0.50	360.00	7.20
2003-2004	122.00	2.30	8.00	0.50	355.00	5.10
2005-2006	124.00	1.80	8.00	0.40	345.00	7.10
2007-2008	117.00	1.90	7.00	0.50	341.00	7.80
Pluto New Horizon	211.33	5.60	10.59	0.50	455.54	19.30
EPA 84 / FDA 98	200.00	3.00	0.00	0.00	282.60	3.50

Table 6. Daily and Annual Consumption for All Categories.

Study	Total All Categories		Total All Categories	
	Daily intake (g)	Standard Deviation (g)	Annual intake (kg)	Standard Deviation (kg)
1994-1998	946.00	14.60	345.29	5.33
1999-2000	949.00	30.50	346.39	11.13
2001-2002	977.00	27.80	356.61	10.15
2003-2004	950.00	27.90	346.75	10.18
2005-2006	915.00	22.50	333.98	8.21
2007-2008	896.00	27.80	327.04	10.15
Pluto New Horizon	937.09	31.32	342.04	11.43
EPA 84 / FDA 98	517.20	7.20	188.78	2.63

The USDA studies are relatively self-consistent with each other. Pluto New Horizon categories did not exactly match the USDA categories, but for those that did, such as grains and vegetables, the numbers differed significantly. Yet, despite the differences, the end result for total consumption for Pluto New Horizon lined up well with the USDA studies.

The EPA study is far more incomplete than either the Pluto New Horizon study or the USDA studies. Many of the categories are empty, but the few that do contain values (other than Total Vegetables) agree quite well with the USDA studies.

The question arises regarding how to merge these eight studies to derive a statistical mean and standard deviation. Traditionally, the mean is simply the weighted average of the means of each study. The assumed weighting is the population sample size of each study or mathematically

$$weightedMean = \frac{\sum_i^n (distributionMean_i * distributionSampleSize_i)}{\sum_i^n distributionSampleSize_i}$$

where n represents the number of distributions to average over or in this case nominally eight.

However, this equation presents a problem in that the sample size is unknown for the Pluto New Horizon and EPA studies while known for the USDA studies. Given the various problems with the non-USDA studies and the number of USDA studies, it seems reasonable to exclude the non-USDA studies in calculating the weighted mean. Doing so yields a weighted mean of 343.21 kg.

Table 7. Calculation of Weighted Mean using USDA studies.

Study	Yearly intake (kg)	Sample Size	Mean * Sample Size (kg)
1994-1998	345.29	19017	6.57E+06
1999-2000	346.39	8074	2.80E+06
2001-2002	356.61	9033	3.22E+06
2003-2004	346.75	8723	3.02E+06
2005-2006	333.98	8549	2.86E+06
2007-2008	327.04	8529	2.79E+06
Summation		61925	2.13E+07
Weighted Mean	343.21		

If all the studies are simply given equal weighting of 1, since no sample sizes are available for the other two studies, then the weighted mean changes from 343.21 kg to 323.26 kg. If the EPA study, which lacked so many food categories, is left out, the weighted mean using a weight of one for all studies would be 342.68 kg. Given the relatively small change in annual consumption rate, it is recommended that STORM use the weighted mean value of 343.21 kg for its calculations. A modification to this recommendation will follow.

Now, having calculated the weighted mean, all that remains is to calculate the weighted standard deviation. Assuming that variance in each distribution is the same, the weighted standard deviation can be calculated from the pooled variance. Strictly speaking, it is not appropriate to assume that the variance of each distribution is the same; particularly between USDA, Pluto New Horizon, and EPA studies; since each sampled from a different population. However, since each study was sampling the U.S. population the calculation of a weighted standard deviation takes

this assumption as valid given that each study was sampling from essentially the same population. Thus the equation to calculate the pooled standard deviation is:

$$weightedStandardDeviation = \sqrt{\frac{\sum_{i=1}^n ((distributionSampleSize_i - 1) * distributionVariance_i)}{\sum_{i=1}^n (distributionSampleSize_i - 1)}}$$

Table 8 contains the values from the USDA studies used to calculate a weighted or pooled standard deviation for those studies.

Table 8. Calculation of Pooled Standard Deviation using USDA studies.

Study	Standard Deviation (kg)	Variance (kg ²)	Sample Size - 1	((Sample Size -1) * Variance) (kg ²)
1994-1998	5.33	28.40	19016	540020.95
1999-2000	11.13	123.93	8073	1000507.53
2001-2002	10.15	102.96	9032	929949.25
2003-2004	10.18	103.70	8722	904503.43
2005-2006	8.21	67.45	8548	576521.20
2007-2008	10.15	102.96	8528	878056.60
Summation			61917	4829558.96
Weighted Standard Deviation	8.83			

Thus, the calculated weighted or pooled standard deviation for the USDA studies is 8.83 kg. Weighting all studies equally yields a weighted average standard deviation of 9.13 kg. Eliminating the less applicable EPA study and assuming equal weighting yields a standard deviation of 9.71 kg.

Since neither the EPA nor the Pluto New Horizon reports give information on sample size and to be consistent with the above recommendation regarding the mean value, it is recommended that STORM use a standard deviation value of 8.83.

Finally, the recommended values for the mean of 343.21 kg and the standard deviation of 8.83 kg when used in the STORM personal ingestion dose calculation assume that 100 percent of an individual's food is contaminated. This assumption is unreasonable, since authorities would bring in uncontaminated food from outside sources. Thus, one final change to these recommended values is suggested.

It is recommended that the ingestion rate be multiplied by 0.3, which is consistent with the Federal Radiological Monitoring and Assessment Center's (FRMAC) Assessment Manual¹⁰ and

Interagency Assessment Working Group (AWG). This reduces the fraction of contaminated food intake to 30 percent of total food intake. This would change the recommended values for the mean to 102.96 kg and the standard deviation to 2.65 kg. Note that FRMAC, AWG, and FDA consider a 30 percent contamination of the diet as conservative due to the expected importation of clean food.

¹⁰ Federal Radiological Monitoring and Assessment Center. (2015). *FRMAC Assessment Manual: Overview and Methods* (SAND2015-2884 R ed., Vol. 1). Albuquerque, New Mexico: Sandia National Laboratories. (pg. 3.1-2)

3. AVERAGE CROP YIELD

The Mars 2020 NRA value used in STORM for Average Crop Yield is $3.783 \text{ kg}_{\text{edible}} / \text{m}^2$, which comes from a report written by Nathan Bixler of Sandia National Laboratories (Bixler, 2013)¹¹ Table 3. That reference is condensed and reproduced below in Table 9.

Table 9. Values Used to Calculate MARS 2020 NRA Storm Land Productivity

Food Or Crop Type	Area (km ²)	Production (kg _{edible})	Yield (kg / yr)
Grains	0.95	6.57E+06	6.916
Leafy Vegetables	8.07	1.61E+07	1.995
Roots	14.67	4.00E+07	2.727
Fruits w/ Edible Peel	0.41	3.08E+05	0.751
Fruits w/ Inedible Peel	499.97	1.92E+09	3.840
Legumes	0.05	2.02E+04	0.404
Total	524.12	1.98E+09	3.783

As with data for Food Consumption Rate, the data for Average Crop Productivity did not provide values for multiple years from which to generate statistical information. In order to generate statistical values there is need for the area used for production of crops as a function of year as well as production data. A search found this data for Florida to be readily available back to 1995 at http://www.nass.usda.gov/Statistics_by_State/Florida/index.php.

Table 10 below contains the weighted crop yields by crop category for the entire state of Florida as well as the total weighted crop yield by year. At the bottom of the table is the mean or average weighted crop yield as well as its standard deviation value. The appendix to this report contains the detailed data for each category necessary to recalculate these values. Here, only a discussion of the method used to calculate these values is present.

First, recording of values in the Florida USDA data¹² for the number of acres harvested for a crop as well as the yield of the crop for each year occurred. Conversion of all yield values to a consistent unit of $\text{kg}_{\text{edible}} / \text{m}^2$ then took place. Division of the number of acres dedicated to the production of a crop by the total number of acres dedicated to all crop production for the state of Florida followed. This value represents the fractional acreage dedicated to each crop in Florida. Next, multiplication of the fractional acreage by the crop's individual yield produced a weighted yield for the crop. For each category these weighted yields were then summed. Combination of the category-weighted yields arrived at the weighted yield for all crops for the state of Florida.

¹¹ Bixler, N. E. (2013). *Food and Water Ingestion Model for FDOSE*. Albuquerque: Sandia National Laboratories.

¹² (United States Department of Agriculture, n.d.)

Table 10. Weighted crop yields by category for the entire state of Florida.

Florida Weighted Yield by Category (kg _{edible} / m ²)					
Year	Vegetables	Fruit	Grains	Citrus	Total
2014	1.77E-01	3.74E-02	5.81E+00	6.11E-01	6.63E+00
2013	1.72E-01	5.81E-02	4.71E+00	9.43E-01	5.88E+00
2012	2.09E-01	5.65E-02	4.91E+00	1.03E+00	6.21E+00
2011	2.06E-01	6.66E-02	5.03E+00	9.83E-01	6.29E+00
2010	1.94E-01	6.77E-02	4.28E+00	9.78E-01	5.52E+00
2009	2.45E-01	7.22E-02	4.47E+00	1.20E+00	6.00E+00
2008	2.35E-01	7.37E-02	3.92E+00	1.37E+00	5.60E+00
2007	2.78E-01	7.21E-02	4.74E+00	8.74E-01	5.97E+00
2006	2.36E-01	7.54E-02	4.67E+00	9.62E-01	5.95E+00
2005	2.85E-01	7.32E-02	3.93E+00	8.72E-01	5.16E+00
2004	2.41E-01	5.44E-02	3.73E+00	1.86E+00	5.88E+00
2003	2.02E-01	4.51E-02	4.87E+00	1.26E+00	6.38E+00
2002	2.12E-01	4.98E-02	4.56E+00	1.52E+00	6.35E+00
2001	2.38E-01	4.88E-02	4.07E+00	1.45E+00	5.81E+00
2000	2.25E-01	5.97E-02	4.31E+00	1.57E+00	6.16E+00
1999	2.42E-01	6.93E-02	4.22E+00	1.13E+00	5.66E+00
1998	1.73E-01	3.35E-02	4.72E+00	1.54E+00	6.47E+00
1997	2.07E-01	4.17E-02	4.18E+00	1.48E+00	5.91E+00
1996	2.01E-01	3.69E-02	3.72E+00	1.40E+00	5.35E+00
1995	1.95E-01	4.75E-02	3.93E+00	1.49E+00	5.66E+00
1995-2014 Statistics	Mean	Standard Deviation	Max	Min	
	5.94E+00	3.83E-01	6.63E+00	5.16E+00	

Table 11 contains identical data to Table 10 except that the data is for the land area within 200 km of the Kennedy Space Center (KSC). Modification of the process discussed above for Table 10 to generate this data follows.

First, determination of the number of acres in the state of Florida dedicated to each individual crop occurred using the Cropscape website¹³. Next, Cropscape was used to determine the number of acres dedicated to each individual crop within 200 km of KSC. Then a weighting factor was calculated to adjust the Cropscape Acreage within 200 km of KSC. The weighting factor was the number of acres determined by Cropscape for the entire state of Florida divided by the number of acres determined by the land truth Florida data¹⁴ for the entire state of Florida. The corrected

¹³ United States Department of Agriculture. (2016, April 29). *CropScape - Cropland Data Layer*. Retrieved from Cropscape - NASS CDL Program: <http://nassgeodata.gmu.edu/CropScape/>

¹⁴ (United States Department of Agriculture, n.d.)

Cropscape acreage was then the original Cropscape acreage times the weighting factor or mathematically:

$$adjusted200kmAcerage_{crop} = original200kmAcerage_{crop} \frac{CropscapeFloridaAcerage_{crop}}{LandTruthAcerage_{crop}}$$

This additional step occurred because it was determined from the statewide data and expert elicitation from Denise Bleakly of Sandia National Laboratories that satellite estimates are quite inaccurate in their estimation of vegetation type and coverage.

Table 11. Weighted crop yields by category for the area within 200 km of KSC.

Cropscape 200 km KSC Weighted Yield (kg _{edible} / m ²)					
Year	Vegetables	Fruit	Grains	Citrus	Total
2014	1.06E-01	1.25E-02	7.74E-03	2.44E+00	2.56E+00
2013	8.96E-02	1.75E-02	4.25E-02	3.04E+00	3.19E+00
2012	1.52E-01	2.10E-02	8.28E-02	3.16E+00	3.41E+00
2011	1.72E-01	2.33E-02	4.25E-02	3.07E+00	3.31E+00
2010	9.34E-02	5.58E-03	1.03E-01	2.93E+00	3.13E+00
2009	6.00E-02	2.82E-02	5.71E-03	3.48E+00	3.57E+00
2008	7.60E-02	1.38E-01	2.01E-02	3.55E+00	3.78E+00
2008-2014 Statistics	Mean	Standard Deviation	Max	Min	
	3.28E+00	3.88E-01	3.78E+00	2.56E+00	

The analysis of the dataset for the entire state of Florida gives a mean weighted yield of 5.94 kg_{edible} / m² with a standard deviation of 0.383 kg_{edible} / m². Meanwhile, analysis of the Cropscape Data gives a mean weighted yield of 3.28 kg_{edible} / m² with a standard deviation of 0.388 kg_{edible} / m² within 200 km of KSC.

Following recommendations from reviewers to maintain the MARS 2020 NRA usage of 100 km as the area considered local to KSC, the process noted above was repeated for 100 km. The values for 100 km are in the following table.

Table 12. Weighted crop yields by category for the area within 100 km of KSC.

Cropscape 100 km KSC Weighted Yield (kg_{edible} / m²)					
Year	Vegetables	Fruit	Grains	Citrus	Total
2014	7.38E-02	3.10E-02	8.95E-03	2.33E+00	2.44E+00
2013	9.60E-02	5.70E-03	3.36E-02	3.01E+00	3.14E+00
2012	1.29E-01	1.70E-04	3.61E-02	3.29E+00	3.46E+00
2011	1.41E-01	6.85E-04	3.92E-02	2.88E+00	3.07E+00
2010	4.82E-02	0.00E+00	4.12E-02	3.03E+00	3.12E+00
2009	6.40E-04	9.45E-02	1.46E-02	3.48E+00	3.59E+00
2008	2.43E-02	2.01E-01	1.03E-02	3.56E+00	3.80E+00
2008-2014 Statistics	Mean	Standard Deviation	Max	Min	
	3.23E+00	4.42E-01	3.80E+00	2.44E+00	

It is this last set of values with a mean of 3.23 kg_{edible} / m² and a standard deviation of 0.442 kg_{edible} / m² which are recommended for use in the STORM runs for calculation of ingestion dose. These values are chosen because the dose consequences are driven by accidents that occur close to KSC and the usage of values further away from KSC inappropriately weights the dose to the yield of crops that would generally not be affected.

Furthermore, note that changing from 200 km to 100 km only changes the mean from 3.28 kg_{edible} / m² to 3.23 kg_{edible} / m² and the standard deviation from 0.388 kg_{edible} / m² to 0.442 kg_{edible} / m². Thus modifying the distance used to determine relevant ingestion parameters for ingestion calculations is relatively insensitive to distance.

4. CROPLAND TO LANDUSE DATABASE RATIO

The STORM application is required to both support worldwide launches, as well as, be able to analyze accident conditions for any place on the globe where the accident may occur. To be able to determine the impact to both the human ingestion pathway and cropland, the software requires a global landcover database. The global landcover database currently used by STORM is the Global Land Coverage 2000 (GLC) database¹⁵. Figure 1 shows an image of the database.

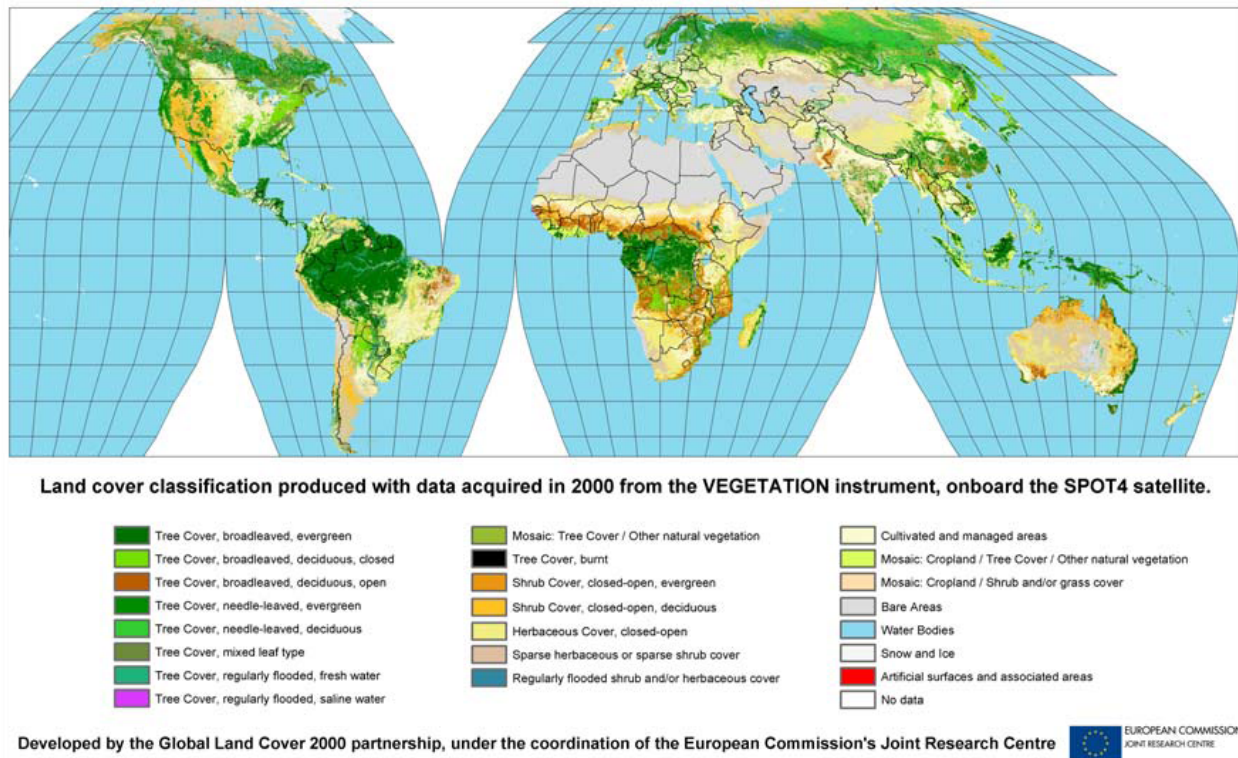


Figure 1. Map of the Global Land Coverage 2000 Database.

For the analysis of affected cropland, it was determined that category 16, Cultivated and Managed areas, was the category which equated to cropland. However, especially for launches from the United States, the 1 km resolution of the GLC database is particularly coarse. Thus to generate better cropland statistics the Cropscape database mentioned previously, which has 30 m (0.03 km) resolution, was used to devise a Cropland to Landuse Database ratio.

Figure 2 shows the Cropscape data within 100 km of KSC. As noted early, 100 km was chosen as the distance to consider local to KSC for Crop and Landuse analysis. The significantly more detailed resolution of the Cropscape data over the GLC data is obvious. Meanwhile, Figure 3 shows the portion of the GLC database that corresponds to Figure 2. Here reduction of the GLC data to four categories: water (blue), cropland (green), other landuse (red), and beyond 100 km from KSC (purple), has occurred.

¹⁵ Centre, E. C. (n.d.). *GLC2000 database*. Retrieved from The Global Land Cover Map for the Year 2000, 2003: <http://www-gem.jrc.it/glc2000>.

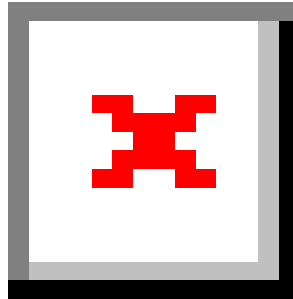


Figure 2. Cropscape Landuse within 100 km of KSC. Colors represent various Landuse categories (e.g. orange for orange groves). Black represents salt or brackish waters or land outside the 100 km radius.

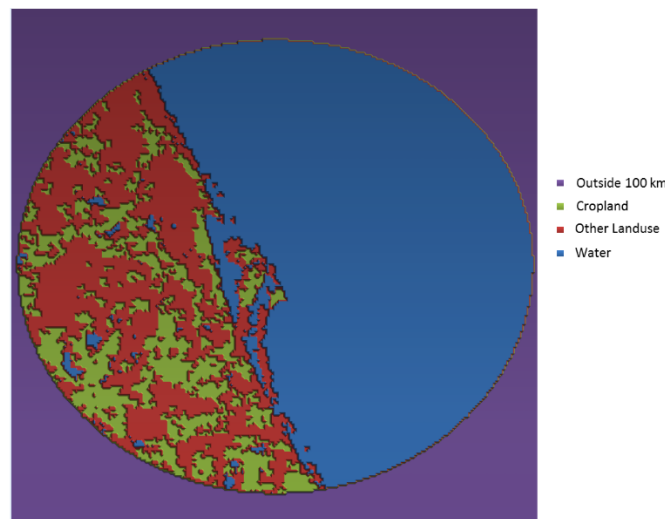


Figure 3. Landuse from the Global Land Coverage (GLC2000) database reduced to four categories: (1) Water (Blue), (2) Other Landuse (Red), (3) Cropland (Green), and (4) Area outside 100 km from Cape Canaveral (purple).

It was determined that 4205 km² of land were used as cropland within 100 km of KSC from Figure 3. Meanwhile, summation of the corrected Cropscape data within 100 km of KSC generated total cropland values on a year-by-year basis. Division of the year-by-year value by the GLC values resulted in a Cropland to Landuse Database ratio for each year. Table 13 shows the total cropland area for each year, the GLC value, the calculated ratio, along with the mean and standard deviation of the ratio values.

Table 13. Land area (km²) dedicated to crops by year for Cropscape and Global Land Coverage 2000 databases, and the ratio between the two datasets.

Year	Total Crop Land Area (km²)	Global Land Cover 2000 Crop Land Area (km²)	Ratio (%)
2014	128	4205	3.05%
2013	118	4205	2.81%
2012	120	4205	2.84%
2011	155	4205	3.69%
2010	135	4205	3.22%
2009	132	4205	3.13%
2008	131	4205	3.11%
		Mean	3.12%
		Standard Deviation	0.29%

Using the values in Table 13 it was determined that when the GLC database indicates that one square kilometer of land (1000000 m²) is dedicated to cropland there is in actuality only 0.03 square kilometer of land (30500 m²) dedicated to cropland. The standard deviation of this ratio was 0.0029 square kilometer of land (2900 m²).

The previously calculated value for this ratio was 0.0996 square kilometers of cropland (99600 m²) for every one square kilometer indicated by the GLC database. The principle reason for the reduction in value was the correcting of the Cropscape data using land truth as described previously. In particular, Cropscape on average was overestimating land dedicated to orange groves by 223% (see Table 78). This alone would have dropped the value of 0.0996 to approximately 0.045. Further fine-tuning eliminated the inclusion of land outside 100 km of KSC in both the Cropscape and GLC data during the generation of the ratio.

Therefore, this report recommends updating the Cropland to Landuse Database Ratio from a constant value of 0.0996 to a normal distribution with a mean of 3.12% and a standard deviation of 0.29%.

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5. CROP UPTAKE FACTOR

The value used for Crop Uptake Factor in the Mars 2020 NRA was the constant value of 6.37×10^{-4} . (Bixler, 2013) describes the derivation of the value. Consistent with values already discussed, the principle issue with this value is there are no means by which to develop a distribution.

Conduction of a literature review regarding crop transfer factors for plutonium, discovered two principle documents that were compendiums of transfer factor studies conducted throughout the world. The first was published by the International Atomic Energy Association (IAEA)¹⁶, and the other by Pacific Northwest National Laboratories (PNNL)¹⁷. Each contained transfer factors for environmental biota.

From these documents, the following distributions for plutonium transfer factors for the crops of interest were extracted. Table 14 provides the geometric mean (GM) and geometric standard deviation (GSD) for the lognormal distributions used to represent the uptake factor distribution for each crop.

Table 14. Crop Uptake Factor Distributions.

Crop	Geometric Mean (Bq _{crop} /kg)/(Bq _{soil} /kg)	Geometric Standard Deviation (Bq _{crop} /kg)/(Bq _{soil} /kg)
Bell Peppers	2.02E-04	2.77
Blueberries	2.30E-05	3.30
Citrus	1.40E-04	2.90
Cucumbers	2.02E-04	2.77
Peanuts	6.30E-05	1.40
Potatoes	2.97E-04	5.63
Squash	2.02E-04	2.77
Strawberries	2.30E-05	3.30
Sugarcane	4.40E-05	16.40
Sweet Corn	3.00E-06	3.30
Tomatoes	2.02E-04	2.77
Watermelon	2.30E-05	3.30
Wheat	9.50E-06	6.70

¹⁶ International Atomic Energy Association. (2010). *Handbook of Parameter Values for the Prediction of Radionuclide Transfer in Terrestrial and Freshwater Environments: Technical Reports Series no. 472*. Austria: IAEA.

¹⁷ Staven, L. H., Napier, B. A., Rhoads, K., & Strenge, D. L. (2003). *A Compendium of Transfer Factors for Agriculture and Animal Products*. Pacific Northwest National Laboratory. Oak Ridge: Office of Scientific and Technical Information.

Because STORM currently has no way to distinguish between individual crop types, the STORM code cannot use the distributions for each crop in Table 14. Hence, a merged or average crop uptake factor distribution is necessary. Calculation of a merged distribution occurred as follows.

For a user specified minimum number of iterations, or until convergence to a specified precision on the mean value between iteration to iteration, calculation of an average uptake factor used the following steps.

1. Calculate an individual merged crop uptake factor.
 - a. For each crop
 - i. Sampling of the acreage (acre) distribution generated an acreage value.
 - ii. Sampling of the yield distribution generated a yield value.
 - iii. The acreage value and yield value were multiplied to generate a crop mass.
 - iv. Sampling of the uptake factor distribution generated an uptake factor value.
 - v. The uptake factor value and the mass value were multiplied to generate a crop mass weighted uptake factor
 - b. Summing the crop masses produced a total crop mass.
 - c. Summing the weighted crop uptake factors produced a total weighted crop uptake factor.
 - d. Dividing the total weighted crop uptake factor by the total crop mass generated a single instance of a merged crop uptake factor.
2. Addition of the new single instance uptake factor to a running total of all single instance uptake factors yielded a new value for the total of all single instance uptake factors.
3. Dividing the total by the number of iteration yielded a new average uptake factor.
4. Once the minimum number of iterations and the user-desired precision between the prior and current average uptake factor was reached, looping over steps one through three terminated.
5. All the single instance merged uptake factors were then used to generate a GM and GSD for a merged crop uptake factor distribution.

Table 15 provides the acreage and crop yield distributions used in this analysis. Values are from the Cropscape data within 100 km of KSC as corrected by land truth. Description of this process follows in the Appendix B – Crop Tables and the section on Average Crop Yield.

Table 15. Crop Acreage and Yield Distribution Mean and Standard Deviation Values

Crop	Acreage		Yield	
	Mean	Standard Deviation	Mean	Standard Deviation
Bell Peppers	27.799	55.641	3.073	0.427
Blueberries	288.102	258.302	0.319	0.142
Citrus	30211.304	2411.459	3.445	0.445
Cucumbers	12.791	26.522	3.079	0.546
Peanuts	3.040	0.240	0.338	0.059
Potatoes	520.430	82.390	2.927	0.358
Squash	3.882	5.270	1.304	0.187
Strawberries	2.952	2.560	2.904	0.435
Sugarcane	92.008	9.090	8.074	0.503
Sweet Corn	409.330	197.700	1.668	0.162
Tomatoes	53.189	65.515	3.789	0.356
Watermelon	379.570	335.945	3.313	0.418
Wheat	431.979	385.610	0.292	0.045

The results of these calculations produced a GM of $3.38\text{e-}4$ and a GSD of 3.33. These results were determined using a minimum of 10,000 iterations; however, the values converged generally after only a couple hundred iterations (samples). Indeed, 10 and 100 times as many required iterations did not change the results within the precision specified in this document.

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6. RECOMMENDATIONS

Based on the analyses above, this report recommends that STORM analyses use the distributions in Table 16 for Average Consumption Rate, Average Crop Yield, Cropland to Landuse Database Ratio, and Crop Uptake Factor.

Table 16. Recommended Mean and Standard Deviation Values For Average Consumption Rate, Average Crop Yield, Cropland to Landuse Database Ratio, and Crop Uptake Factor.

	Mean	Standard Deviation
Average Consumption Rate (kg / yr)	102.96	2.65
Average Crop Yield (kg _{edible} / m ²)	3.23	0.442
Cropland to Landuse Database Ratio (%)	3.12	0.29
	Geometric Mean	Geometric Standard Deviation
Crop Uptake Factor (Bq _{crop} /kg)/(Bq _{soil} /kg)	3.38e-4	3.33

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7. CONCLUSIONS

The Human Consumption Rate, Average Crop Yield, the Cropland to Landuse Database Ratio, and Crop Uptake Factor parameters were analyzed. These parameters are inputs to the STORM code used as part of the Consequence Analysis portion of the Radioisotope Powered System Launch Safety Program. For the Mars 2020 NRA, these parameters had the constant values of 557.69 kg / yr, 3.783 kg_{edible} / m², 9.96%, and 6.37e-4 (Bq_{crop}/kg)/(Bq_{soil}/kg), respectively. Performance of these analyses occurred in order to develop distributions for these parameters that were previously constants within the STORM framework for the MARS 2020 NRA.

The analysis of the Human Consumption rate value focused on various datasets for which annual ingestion is available. This included six sets of data from the CDC/USDA/FDA, the data set used for Pluto New Horizon, and an EPA/FDA ingestion dataset. Further analysis excluded the EPA dataset, because it lacked many of the categories for ingestion found in the other datasets.

Similar analysis excluded the Pluto New Horizon data since it lacked the population data required to calculate the weighted mean and pooled variance. A simple equal weighting including the Pluto New Horizon data showed only minor differences from the values without Pluto New Horizon data. Thus, discarding Pluto New Horizon had little impact on the final analysis.

Using the technique of pooled variance and weighted means, an annual ingestion rate of 343.21 kg / yr with a standard deviation of 8.83 kg / yr was calculated. Noting that the FDA and the FRMAC Assessment Working Group assume that only 30 percent of the diet is contaminated, these values were updated by multiplying by 0.3 to yield a mean of 102.96 kg / yr and a standard deviation of 2.65 kg / yr.

Next, a discussion followed on the analysis of Crop Yield. This analysis compiled Florida Crop data for individual crops for the entire state. This data included yield and acres of production back to 1995. This data was augmented with acres of production attained by the Cropscape program using satellite data. Cropscape data was compiled for the area within 100 and 200 km of the Kennedy Space Center and the entire state of Florida.

Since the calculation of the Crop Yield depends on the area over which the yield is being calculated and the crops grown in the designated area, it is important to define the appropriate area over which to calculate the crop yield. The value of 200 km was investigated when STORM analyses showed that greater than 80% of the total ingestion dose could be captured with this value. However, the value of 100 km was selected after feedback from reviewers indicated that this value should be used in order to maintain consistency with other metrics. Furthermore, the relevant ingestion parameters between 200 km and 100 km were insensitive to distance.

Calculation of the values for Crop Yield used a modified 100 km Cropscape acreage and the Crop Yields from the USDA Florida Crop statistics. Modification of the original 100 km Cropscape acreage occurred after noting that Cropscape estimated acreage differed greatly from USDA land truth acreage. Thus, the ratio of Cropscape Acreage for the entire state of Florida divided by the ground truth USDA acreage for the entire state of Florida was used to modify the original Cropscape acreage within 100 km of Kennedy Space Center. The assumption being that

Cropscape was equally off in its estimation of acreage over the entire state as it was within 100 km of KSC. These corrected values yielded an Average Crop Yield mean and standard deviation of $3.23 \text{ kg}_{\text{edible}} / \text{m}^2$ and $0.442 \text{ kg}_{\text{edible}} / \text{m}^2$.

After this, discussion followed regarding the calculation of a distribution for the Cropland to Landuse Database Ratio. This value is used to adjust the area designated by the coarse resolution Global Land Coverage 2000 database as cropland to account for the reality revealed by finer resolution databases. The coarse database is required since Launch Safety must support launches and accidents globally, thus this factor is used to account for errors introduced by the coarseness of the dataset.

The way this factor is calculated is to calculate the land area dedicated to crops within 100 km of KSC according to the GLC database. Then the fine resolution (30 m instead of 1000 m) Cropscape database is used to calculate the same value. The two values are then ratioed to calculate the database correction used to adjust the value of land area dedicated to crops as calculated by the GLC database. Unlike prior analyses, this analysis further corrected the Cropscape data using land truth data from the USDA. This adjustment alone led to a factor of two reduction in the ratio value. This, along with tighter control to ensure the areas used for GLC and Cropscape matched closer, changed the ratio from the original constant value of 9.96% to a mean value of 3.12% with a standard deviation of 0.29%.

Finally, discussion occurred on the methodology used to calculate a distribution for the Crop Uptake Factor. Using (International Atomic Energy Association, 2010) and (Staven, Napier, Rhoads, & Streng, 2003), crop uptake factor distributions for each of the crops used in the Average Crop Yield calculation were obtained. Successive sampling of these distributions along with distributions for crop yield and crop acreage obtained individual realizations of a crop mass weighted uptake factor. These individual realizations then enabled development of distribution parameters for a merged uptake factor. The GM of this distribution was $3.38\text{e-}4$, while the GSD was 3.33.

To conclude, the recommended changes in parameters for use in STORM are to change the ingestion rate, crop yield, Cropland to Landuse Database Ratio, and Crop Uptake Factors from constant values to distributions. For ingestion rate, this is a change from a constant value of $557.69 \text{ kg} / \text{yr}$ to a normal distribution with a mean of $102.96 \text{ kg} / \text{yr}$ and a standard deviation of $2.65 \text{ kg} / \text{yr}$. For Crop Yield, this is a change from a constant value of $3.783 \text{ kg}_{\text{edible}} / \text{m}^2$ to a normal distribution with a mean of $3.23 \text{ kg}_{\text{edible}} / \text{m}^2$ and a standard deviation of $0.442 \text{ kg}_{\text{edible}} / \text{m}^2$. For Cropland to Landuse Database ratio, this is a change from a constant value of 9.96% to a normal distribution with a mean of 3.12% and a standard deviation of 0.29%. Finally, for Crop Uptake Factor, this is a change from a constant value of $6.37\text{e-}4 \text{ (Bq}_{\text{crop}}/\text{kg})/(\text{Bq}_{\text{soil}}/\text{kg})$ to a lognormal distribution with a geometric mean of $3.38\text{e-}4 \text{ (Bq}_{\text{crop}}/\text{kg})/(\text{Bq}_{\text{soil}}/\text{kg})$ and a geometric standard deviation of 3.33 $(\text{Bq}_{\text{crop}}/\text{kg})/(\text{Bq}_{\text{soil}}/\text{kg})$.

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APPENDIX A – ORIGIN OF AND ISSUES WITH THE MARS NRA CONSUMPTION RATE VALUE

As noted in the introduction, one of the goals of this work was to develop a distribution for the Consumption Rate parameter used in STORM. The Mars 2020 NRA value used in STORM is 557.68 kg / yr. A report written by Nathan Bixler of Sandia National Laboratories (Bixler, 2013)¹⁸ describes the derivation of this value. Table A-1 reproduces Table 3 from the Bixler report and contains the values used in the derivation.

Table A-1. Reproduction of Table 3 from Bixler, 2013

Table 3: COMIDA2 Inputs Used for the KSC Food-Ingestion Model in STORM

Food or Crop Type	Planted Area (km ²)	Production (kg edible)	Yield (kg edible/m ²)	Consumption (kg/yr)
Grains	0.95	6.57E+06	6.92	446.7
Sweet Corn	0.01	7.80E+03	0.78	5.4
Sugarcane	0.77	6.52E+06	8.47	438.3
Sorghum	0.17	4.42E+04	0.26	3.0
Leafy Vegetables	8.07	1.61E+07	2.00	13.5
Other Crops	8.07	1.61E+07	2.00	13.5
Roots	14.67	4.00E+07	2.73	60.6
Potatoes	14.67	4.00E+07	2.73	60.6
Fruits w/ Edible Peel	0.41	3.08E+05	0.75	3.5
Blueberries	0.38	2.39E+05	0.63	1.0
Strawberries	0.03	6.63E+04	2.21	1.0
Peppers	0.00	2.52E+03	2.80	1.5
Fruits w/ Inedible Peel	499.97	1.92E+09	3.84	31.38
Oranges	443.45	1.74E+09	3.93	31.4
Other Citrus	56.52	1.79E+08	3.16	0.0
Legumes	0.05	2.02E+04	0.40	2.0
Peanuts	0.04	1.76E+04	0.44	1.0
Soybeans	0.01	2.60E+03	0.26	1.0
Pasture and Animal Feed	2463.21	0.00E+00	0.00	0.0
Corn (silage)	0.34	2.65E+05	0.78	0.0
Grassland	93.76	4.78E+07	0.51	0.0
Other Hay/Non Alfalfa	6.20	3.16E+06	0.51	0.0
Pasture/Hay	2362.91	1.21E+09	0.51	0.0
Beef			0.0010	26.8
Milk		4.06E+07	0.0165	256.8
Poultry			0.0010	22.0
Other			0.0010	8.4
Total Farmed Area	2987.33			

¹⁸ Bixler, N. E. (2013). *Food and Water Ingestion Model for FDOSE*. Albuquerque: Sandia National Laboratories.

The Mars 2020 NRA value used in STORM for consumption rate is derived from the sum of the consumption rate for crops grown in the Florida area which are grouped into grains, leafy vegetables, roots, fruits with edible peel, fruits with inedible peel, and legumes or (446.7, 13.5, 60.6, 3.5, 31.38, 2.0) respectively. The initial problem with the COMIDA2 data is it does not include any standard deviation values and thus does not suit itself for use in generating values for a consumption rate distribution.

Further review of the table brought to attention another potential issue. The consumption rate for sugarcane is 438.3 kg / yr, or 2.64 lb / day. This seemed excessively high, as the typical American does not eat nearly three pounds of sugarcane sugar per day. Investigation of the Excel™ spreadsheet used to generate the table noted that the sugarcane value was a calculated value. The formula used to calculate the value was $135 / 2.2 / 0.14$, which equal 438.3. The 135 represents the amount of sugar in pounds consumed annually by the typical American. 2.2 is the conversion from pounds to kilograms, while either this author or Nate Bixler could not trace the origin of the 0.14 value down.

However, the author and Nate Bixler were able to track down United States Department of Agriculture (USDA) statistics on sugar production¹⁹. From Tables 51, 52, and 53, the average consumption in lb / yr of High Fructose Corn Syrup (HFCS), Sugarcane and Sugarbeet sugar, and other sugars (e.g. Honey) is 33.7, 37.9, and 11.7 respectively, or 41, 45, and 14 percent of total sugar consumption. The total sugar consumption thus equals 83.3 pounds. However, the USDA accounts for spoilage (food not consumed) in this number. The uncorrected for spoilage numbers are 57.4, 64.6, and 19.5 lb / yr or 40, 46, and 14 percent for a total of 141.5 lb / yr. A number very close to the 135 lb used in the Bixler report.

Now, the sugarcane and sugarbeet number above represents the combined sugarcane and sugarbeet sugar consumption while the value needed is the sugarcane number by itself. Using Table 16 of the same USDA report gives the percentage of sugar from sugarcane reported in the Sugarcane and Sugar Beet total as 44 percent. Thus, the fraction of sugar consumed by the average American which comes from sugarcane is 0.44 (the fraction of sugar from sugarcane in the sugarcane and sugarbeet total) times 0.46 (the fraction of total sugar which comes from sugarcane and sugarbeets). This yields 0.20 or 20 percent of total sugar from sugarcane.

This value of 0.20 is very close to the value of 0.14 used in the Bixler report and it is the best conjecture by Bixler and this author that the meaning of the 0.14 number was the percentage of total sugar in the average American diet that comes from sugarcane. If so, then the division by 0.14 should have been a multiplication by 0.14.

Thus modifying the formula from the Bixler report to multiply and not divide and using the USDA numbers gives 141.5 lb / yr divided by 2.2 lb / kg times 0.20 sugar from sugar cane per total sugar yields a result of 12.9 kg / yr for average U.S. consumption of sugarcane sugar. Using this number, instead of the 438.3, gives a total consumption rate of 132.28 kg / yr.

¹⁹ United States Department of Agriculture. (2016). *Sugar and Sweeteners Yearbook Tables*. Retrieved from United States Department of Agriculture Economic Research Service: <http://ers.usda.gov/data-products/sugar-and-sweeteners-yearbook-tables.aspx#25456>

However, the sugar from sorghum in the Bixler table of 3.0 kg / yr was a calculated value as well. Sorghum consumption, as a fraction of sugarcane consumption is $3.0 / 438.3$ or 0.684 percent of sugarcane consumption. This report maintains this methodology for calculating sorghum consumption since no better way to calculate sorghum sugar consumption is presently available. Using the updated sugarcane number yields an updated sorghum number of 0.0883 kg / yr and an updated total consumption of 129.37 kg / yr.

This corrected value of consumption of 129.37 kg / yr is in line with the ultimate recommendation of this report to use a consumption rate with a mean of 102.96 kg / yr and a standard deviation of 2.65 kg / yr. Thus, the change in recommendation from 557.68 kg / yr to 102.96 kg / yr is not as drastic a change as first glance might indicate, but instead occurs because of an error in the original ingestion calculation.

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APPENDIX B – CROP TABLES

The following tables list the detailed crop data from the USDA²⁰ and Cropscape²¹. The tables are broken up into four major categories of Vegetables, Fruits, Grains, and Citrus. Within each category, individual tables are provided for each crop type. All tables for each individual crop are of the same format from crop to crop. Thus only the tables for the first crop listed, which is for SNAP peas, will be described in depth.

The first table in each individual crop section lists data for the crop going back to 1995. The first column is the year for which the data is relevant. The second column lists the USDA acreage for the crop for the year specified. The third column lists the Cropscape satellite derived acreage for the crop for the entire state of Florida. The fourth column displays the ratio of the third column divided by the second column. This is the ratio of what the satellite estimated to the ground truth reported acreage. This column also displays the average of this calculated ratio for all years in which both USDA and Cropscape data for acreage exists. The fifth column is the acreage reported by Cropscape within 200 km of Kennedy Space Center (KSC), while the last column is the value in the fifth column corrected or modified by dividing by the calculated ratio in the fourth column. The assumption here is that if the satellite was off by the ratio for the entire state in the fourth column, then it was off by the same ratio for the area within 200 km of KSC.

The second table in each section repeats the year in the first column. The second column is the USDA crop yield for that crop. Although not shown in this report, that value is the production of that crop in kg_{edible} divided by the acreage reported in the first table of each section, and then converted to m² basis. Knowing the yield per acre and the acreage, the production can be backed out if necessary. The third column in this table is the Florida weighting factor, or the acreage in the entire state dedicated to that crop divided by the total acreage in the entire state dedicated to all crops. The fourth column is the weighted yield for the crop, or the yield for the entire state multiplied by the weighting factor in column three. The fifth and sixth columns repeat the third and fourth columns, except they use the corrected Cropscape acreage within 200 km of Kennedy Space Center.

The third and fourth tables in each section repeat the data in the first two tables except that values are for 100 km within KSC instead of 200 km.

²⁰ (United States Department of Agriculture, n.d.)

²¹ (United States Department of Agriculture, 2016)

B.1 Vegetables

B.1.1. Snap Peas

Table B-1. Snap Peas Acreage by year for USDA Land Truth and Cropscape within 200 km of Kennedy Space Center.

Snap Peas					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	200 km KSC Cropscape Acreage	200 km Corrected Cropscape Acreage
2014	26600	2411.00	9.06%	0.00	0.00
2013	28800	1655.50	5.75%	0.00	0.00
2012	42700	1130.40	2.65%	0.00	0.00
2011	40000	3243.60	8.11%	0.00	0.00
2010	32200	6551.10	20.35%	0.40	1.97
2009	32800	8327.30	25.39%	0.00	0.00
2008	33200	8714.80	26.25%	0.00	0.00
2007	38000		Average		
2006	28700		13.94%		
2005	34000				
2004	33200				
2003	31800				
2002	34000				
2001	34000				
2000	35000				
1999	31300				
1998	33800				
1997	30300				
1996	25300				
1995	31600				

Table B-2. Snap Peas Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 200 km of Kennedy Space Center.

Snap Peas					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 200 km KSC Weighting Factor	Cropscape 200 km KSC Weighted Yield (kg / m ²)
2014	5.62E-01	0.28%	1.57E-03	0.00%	0.00E+00
2013	6.74E-01	0.36%	2.45E-03	0.00%	0.00E+00
2012	6.40E-01	0.47%	3.02E-03	0.00%	0.00E+00
2011	6.74E-01	0.48%	3.22E-03	0.00%	0.00E+00
2010	6.74E-01	0.43%	2.88E-03	0.00%	8.04E-06
2009	7.31E-01	0.42%	3.10E-03	0.00%	0.00E+00
2008	9.00E-01	0.53%	4.74E-03	0.00%	0.00E+00
2007	1.01E+00	0.70%	7.12E-03		
2006	1.07E+00	0.55%	5.88E-03		
2005	7.31E-01	0.48%	3.49E-03		
2004	9.54E-01	0.46%	4.43E-03		
2003	9.33E-01	0.42%	3.95E-03		
2002	9.54E-01	0.43%	4.13E-03		
2001	8.46E-01	0.40%	3.42E-03		
2000	8.73E-01	0.41%	3.56E-03		
1999	9.40E-01	0.44%	4.10E-03		
1998	7.24E-01	0.32%	2.31E-03		
1997	4.65E-01	0.19%	9.06E-04		
1996	6.57E-01	0.25%	1.68E-03		
1995	5.73E-01	0.27%	1.54E-03		

Table B-3. Snap Peas Acreage by year for USDA Land Truth and Cropscape within 100 km of Kennedy Space Center.

Snap Peas					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	100 km KSC Cropscape Acreage	100 km Corrected Cropscape Acreage
2014	26600	2411.00	9.06%	0.00	0.00
2013	28800	1655.50	5.75%	0.00	0.00
2012	42700	1130.40	2.65%	0.00	0.00
2011	40000	3243.60	8.11%	0.00	0.00
2010	32200	6551.10	20.35%	0.00	0.00
2009	32800	8327.30	25.39%	0.00	0.00
2008	33200	8714.80	26.25%	0.00	0.00
2007	38000		Average		
2006	28700		13.94%		
2005	34000				
2004	33200				
2003	31800				
2002	34000				
2001	34000				
2000	35000				
1999	31300				
1998	33800				
1997	30300				
1996	25300				
1995	31600				

Table B-4. Snap Peas Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 100 km of Kennedy Space Center.

Snap Peas					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 200 km KSC Weighting Factor	Cropscape 200 km KSC Weighted Yield (kg / m ²)
2014	5.62E-01	0.28%	1.57E-03	0.00E+00	0.00E+00
2013	6.74E-01	0.36%	2.45E-03	0.00E+00	0.00E+00
2012	6.40E-01	0.47%	3.02E-03	0.00E+00	0.00E+00
2011	6.74E-01	0.48%	3.22E-03	0.00E+00	0.00E+00
2010	6.74E-01	0.43%	2.88E-03	0.00E+00	0.00E+00
2009	7.31E-01	0.42%	3.10E-03	0.00E+00	0.00E+00
2008	9.00E-01	0.53%	4.74E-03	0.00E+00	0.00E+00
2007	1.01E+00	0.70%	7.12E-03		
2006	1.07E+00	0.55%	5.88E-03		
2005	7.31E-01	0.48%	3.49E-03		
2004	9.54E-01	0.46%	4.43E-03		
2003	9.33E-01	0.42%	3.95E-03		
2002	9.54E-01	0.43%	4.13E-03		
2001	8.46E-01	0.40%	3.42E-03		
2000	8.73E-01	0.41%	3.56E-03		
1999	9.40E-01	0.44%	4.10E-03		
1998	7.24E-01	0.32%	2.31E-03		
1997	4.65E-01	0.19%	9.06E-04		
1996	6.57E-01	0.25%	1.68E-03		
1995	5.73E-01	0.27%	1.54E-03		

B.1.2. Cabbage

Table B-5. Cabbage Acreage by year for USDA Land Truth and Cropscape within 200 km of Kennedy Space Center.

Cabbage					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio Cropscape / land truth)	200 Km KSC Cropscape Acreage	200 Km Corrected Cropscape Acreage
2014	8800	358.90	4.08%	0.00	0.00
2013	8300	0.00	0.00%	0.00	0.00
2012	9200	0.00	0.00%	0.00	0.00
2011	8100	46.50	0.57%	0.00	0.00
2010	9700	0.00	0.00%	0.00	0.00
2009	9500	0.00	0.00%	0.00	0.00
2008	9190	0.00	0.00%	0.00	0.00
2007	9500		Average		
2006	6200		0.66%		
2005	7800				
2004	7600				
2003	7600				
2002	8000				
2001	7900				
2000	7900				
1999	8400				
1998	7500				
1997	7500				
1996	9000				
1995	7000				

Table B-6. Cabbage Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 200 km of Kennedy Space Center.

Cabbage					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 200 km KSC Weighting Factor	Cropscape 200 km KSC Weighted Yield (kg / m ²)
2014	3.82E+00	0.63%	2.40E-02	0.00%	0.00E+00
2013	3.71E+00	0.58%	2.13E-02	0.00%	0.00E+00
2012	3.82E+00	0.61%	2.32E-02	0.00%	0.00E+00
2011	3.82E+00	0.55%	2.10E-02	0.00%	0.00E+00
2010	3.37E+00	0.64%	2.17E-02	0.00%	0.00E+00
2009	4.32E+00	0.73%	3.14E-02	0.00%	0.00E+00
2008	3.93E+00	0.64%	2.51E-02	0.00%	0.00E+00
2007	3.71E+00	0.65%	2.39E-02		
2006	3.71E+00	0.41%	1.53E-02		
2005	3.82E+00	0.57%	2.18E-02		
2004	4.16E+00	0.46%	1.93E-02		
2003	3.48E+00	0.38%	1.31E-02		
2002	3.44E+00	0.37%	1.27E-02		
2001	3.32E+00	0.37%	1.22E-02		
2000	2.85E+00	0.30%	8.56E-03		
1999	2.74E+00	0.34%	9.31E-03		
1998	3.03E+00	0.30%	8.98E-03		
1997	4.12E+00	0.43%	1.76E-02		
1996	3.31E+00	0.46%	1.51E-02		
1995	3.07E+00	0.32%	9.83E-03		

Table B-7. Cabbage Acreage by year for USDA Land Truth and Cropscape within 100 km of Kennedy Space Center.

Cabbage					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	100 km KSC Cropscape Acreage	100 km Corrected Cropscape Acreage
2014	8800	358.90	4.08%	0.00	0.00
2013	8300	0.00	0.00%	0.00	0.00
2012	9200	0.00	0.00%	0.00	0.00
2011	8100	46.50	0.57%	0.00	0.00
2010	9700	0.00	0.00%	0.00	0.00
2009	9500	0.00	0.00%	0.00	0.00
2008	9190	0.00	0.00%	0.00	0.00
2007	9500		Average		
2006	6200		0.66%		
2005	7800				
2004	7600				
2003	7600				
2002	8000				
2001	7900				
2000	7900				
1999	8400				
1998	7500				
1997	7500				
1996	9000				
1995	7000				

Table B-8. Cabbage Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 100 km of Kennedy Space Center.

Cabbage					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 100 km KSC Weighting Factor	Cropscape 100 km KSC Weighted Yield (kg / m ²)
2014	3.82E+00	0.63%	2.40E-02	0.00E+00	0.00E+00
2013	3.71E+00	0.58%	2.13E-02	0.00E+00	0.00E+00
2012	3.82E+00	0.61%	2.32E-02	0.00E+00	0.00E+00
2011	3.82E+00	0.55%	2.10E-02	0.00E+00	0.00E+00
2010	3.37E+00	0.64%	2.17E-02	0.00E+00	0.00E+00
2009	4.32E+00	0.73%	3.14E-02	0.00E+00	0.00E+00
2008	3.93E+00	0.64%	2.51E-02	0.00E+00	0.00E+00
2007	3.71E+00	0.65%	2.39E-02		
2006	3.71E+00	0.41%	1.53E-02		
2005	3.82E+00	0.57%	2.18E-02		
2004	4.16E+00	0.46%	1.93E-02		
2003	3.48E+00	0.38%	1.31E-02		
2002	3.44E+00	0.37%	1.27E-02		
2001	3.32E+00	0.37%	1.22E-02		
2000	2.85E+00	0.30%	8.56E-03		
1999	2.74E+00	0.34%	9.31E-03		
1998	3.03E+00	0.30%	8.98E-03		
1997	4.12E+00	0.43%	1.76E-02		
1996	3.31E+00	0.46%	1.51E-02		
1995	3.07E+00	0.32%	9.83E-03		

B.1.3. Sweet Corn

Table B-9. Sweet Corn Acreage by year for USDA Land Truth and Cropscape within 200 km of Kennedy Space Center.

Sweet Corn					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	200 km KSC Cropscape Acreage	200 km Corrected Cropscape Acreage
2014	34000	65371.30	192.27%	2677.40	1392.53
2013	39500	79524.80	201.33%	2921.20	1450.96
2012	42000	56178.90	133.76%	146.80	109.75
2011	43000	62885.40	146.25%	299.30	204.66
2010	42100	44233.60	105.07%	5.10	4.85
2009	43100	29843.80	69.24%	0.80	1.16
2008	42000	15079.20	35.90%	24.00	66.85
2007	39000		Average		
2006	26300		126.26%		
2005	33600				
2004	38700				
2003	38800				
2002	38900				
2001	37200				
2000	36900				
1999	39600				
1998	41300				
1997	43600				
1996	42000				
1995	36900				

Table B-10. Sweet Corn Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 200 km of Kennedy Space Center.

Sweet Corn					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 200 km KSC Weighting Factor	Cropscape 200 km KSC Weighted Yield (kg / m ²)
2014	1.52E+00	0.96%	1.46E-02	0.92%	1.39E-02
2013	1.57E+00	1.16%	1.83E-02	0.95%	1.49E-02
2012	1.85E+00	1.35%	2.49E-02	0.08%	1.41E-03
2011	1.68E+00	1.29%	2.17E-02	0.12%	2.10E-03
2010	1.57E+00	1.30%	2.05E-02	0.00%	4.63E-05
2009	1.74E+00	1.33%	2.31E-02	0.00%	1.23E-05
2008	1.80E+00	1.33%	2.39E-02	0.04%	6.77E-04
2007	1.91E+00	1.37%	2.61E-02		
2006	2.08E+00	0.98%	2.04E-02		
2005	1.80E+00	1.16%	2.08E-02		
2004	1.74E+00	0.99%	1.72E-02		
2003	1.63E+00	0.90%	1.47E-02		
2002	1.55E+00	0.81%	1.25E-02		
2001	1.64E+00	0.86%	1.41E-02		
2000	1.67E+00	0.82%	1.37E-02		
1999	1.55E+00	0.91%	1.41E-02		
1998	1.62E+00	0.87%	1.42E-02		
1997	1.55E+00	0.93%	1.44E-02		
1996	1.42E+00	0.92%	1.31E-02		
1995	1.46E+00	0.80%	1.17E-02		

Table B-11. Sweet Corn Acreage by year for USDA Land Truth and Cropscape within 100 km of Kennedy Space Center.

Sweet Corn					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	100 km KSC Cropscape Acreage	100 km Corrected Cropscape Acreage
2014	34000	65371.30	192.27%	2620.50	1362.94
2013	39500	79524.80	201.33%	2821.30	1401.34
2012	42000	56178.90	133.76%	54.90	41.04
2011	43000	62885.40	146.25%	50.70	34.67
2010	42100	44233.60	105.07%	14.00	13.32
2009	43100	29843.80	69.24%	0.80	1.16
2008	42000	15079.20	35.90%	3.90	10.86
2007	39000		Average		
2006	26300		126.26%		
2005	33600				
2004	38700				
2003	38800				
2002	38900				
2001	37200				
2000	36900				
1999	39600				
1998	41300				
1997	43600				
1996	42000				
1995	36900				

Table B-12. Sweet Corn Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 100 km of Kennedy Space Center.

Sweet Corn					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 100 km KSC Weighting Factor	Cropscape 100 km KSC Weighted Yield (kg / m ²)
2014	1.52E+00	0.96%	1.46E-02	4.30E-02	6.52E-02
2013	1.57E+00	1.16%	1.83E-02	4.81E-02	7.56E-02
2012	1.85E+00	1.35%	2.49E-02	1.39E-03	2.57E-03
2011	1.68E+00	1.29%	2.17E-02	9.05E-04	1.52E-03
2010	1.57E+00	1.30%	2.05E-02	3.99E-04	6.26E-04
2009	1.74E+00	1.33%	2.31E-02	3.55E-05	6.18E-05
2008	1.80E+00	1.33%	2.39E-02	3.36E-04	6.03E-04
2007	1.91E+00	1.37%	2.61E-02		
2006	2.08E+00	0.98%	2.04E-02		
2005	1.80E+00	1.16%	2.08E-02		
2004	1.74E+00	0.99%	1.72E-02		
2003	1.63E+00	0.90%	1.47E-02		
2002	1.55E+00	0.81%	1.25E-02		
2001	1.64E+00	0.86%	1.41E-02		
2000	1.67E+00	0.82%	1.37E-02		
1999	1.55E+00	0.91%	1.41E-02		
1998	1.62E+00	0.87%	1.42E-02		
1997	1.55E+00	0.93%	1.44E-02		
1996	1.42E+00	0.92%	1.31E-02		
1995	1.46E+00	0.80%	1.17E-02		

B.1.4. Cucumbers

Table B-13. Cucumbers Acreage by year for USDA Land Truth and Cropscape within 200 km of Kennedy Space Center.

Cucumbers					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	200 km KSC Cropscape Acreage	200 km Corrected Cropscape Acreage
2014	9400	11.10	0.12%	0.00	0.00
2013	10700	47.80	0.45%	0.00	0.00
2012	10800	0.00	0.00%	0.00	0.00
2011	10000	0.00	0.00%	0.00	0.00
2010	11600	0.00	0.00%	0.00	0.00
2009	11300	0.00	0.00%	0.00	0.00
2008	11600	0.00	0.00%	0.00	0.00
2007	15200		Average		
2006	9500		0.08%		
2005	10500				
2004	10700				
2003	11300				
2002	7500				
2001	8500				
2000	10700				
1999	8800				
1998	9500				
1997	10900				
1996	10400				
1995	13200				

Table B-14. Cucumber Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 200 km of Kennedy Space Center.

Cucumbers					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 200 km KSC Weighting Factor	Cropscape 200 km KSC Weighted Yield (kg / m ²)
2014	2.92E+00	0.51%	1.50E-02	0.00%	0.00E+00
2013	2.53E+00	0.51%	1.28E-02	0.00%	0.00E+00
2012	2.92E+00	0.55%	1.59E-02	0.00%	0.00E+00
2011	2.81E+00	0.50%	1.40E-02	0.00%	0.00E+00
2010	2.25E+00	0.51%	1.16E-02	0.00%	0.00E+00
2009	2.64E+00	0.53%	1.39E-02	0.00%	0.00E+00
2008	3.14E+00	0.64%	2.02E-02	0.00%	0.00E+00
2007	3.03E+00	0.85%	2.57E-02		
2006	2.81E+00	0.48%	1.35E-02		
2005	3.03E+00	0.61%	1.86E-02		
2004	2.64E+00	0.41%	1.09E-02		
2003	2.69E+00	0.43%	1.17E-02		
2002	4.33E+00	0.43%	1.88E-02		
2001	3.66E+00	0.44%	1.60E-02		
2000	4.29E+00	0.61%	2.63E-02		
1999	3.58E+00	0.47%	1.67E-02		
1998	3.28E+00	0.41%	1.33E-02		
1997	3.27E+00	0.49%	1.61E-02		
1996	3.16E+00	0.50%	1.60E-02		
1995	2.59E+00	0.51%	1.32E-02		

Table B-15. Cucumber Acreage by year for USDA Land Truth and Cropscape within 100 km of Kennedy Space Center.

Cucumber					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	100 km KSC Cropscape Acreage	100 km Corrected Cropscape Acreage
2014	9400	11.10	0.12%	0.00	0.00
2013	10700	47.80	0.45%	0.40	89.54
2012	10800	0.00	0.00%	0.00	0.00
2011	10000	0.00	0.00%	0.00	0.00
2010	11600	0.00	0.00%	0.00	0.00
2009	11300	0.00	0.00%	0.00	0.00
2008	11600	0.00	0.00%	0.00	0.00
2007	15200		Average		
2006	9500		0.08%		
2005	10500				
2004	10700				
2003	11300				
2002	7500				
2001	8500				
2000	10700				
1999	8800				
1998	9500				
1997	10900				
1996	10400				
1995	13200				

Table B-16. Cucumber Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 100 km of Kennedy Space Center.

Cucumber					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 100 km KSC Weighting Factor	Cropscape 100 km KSC Weighted Yield (kg / m ²)
2014	2.92E+00	0.51%	1.50E-02	0.00E+00	0.00E+00
2013	2.53E+00	0.51%	1.28E-02	3.07E-03	7.76E-03
2012	2.92E+00	0.55%	1.59E-02	0.00E+00	0.00E+00
2011	2.81E+00	0.50%	1.40E-02	0.00E+00	0.00E+00
2010	2.25E+00	0.51%	1.16E-02	0.00E+00	0.00E+00
2009	2.64E+00	0.53%	1.39E-02	0.00E+00	0.00E+00
2008	3.14E+00	0.64%	2.02E-02	0.00E+00	0.00E+00
2007	3.03E+00	0.85%	2.57E-02		
2006	2.81E+00	0.48%	1.35E-02		
2005	3.03E+00	0.61%	1.86E-02		
2004	2.64E+00	0.41%	1.09E-02		
2003	2.69E+00	0.43%	1.17E-02		
2002	4.33E+00	0.43%	1.88E-02		
2001	3.66E+00	0.44%	1.60E-02		
2000	4.29E+00	0.61%	2.63E-02		
1999	3.58E+00	0.47%	1.67E-02		
1998	3.28E+00	0.41%	1.33E-02		
1997	3.27E+00	0.49%	1.61E-02		
1996	3.16E+00	0.50%	1.60E-02		
1995	2.59E+00	0.51%	1.32E-02		

B.1.5. Bell Peppers

Table B-17. Bell Peppers Acreage by year for USDA Land Truth and Cropscape within 200 km of Kennedy Space Center.

Bell Peppers					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	200 km KSC Cropscape Acreage	200 km Corrected Cropscape Acreage
2014	11900	159.50	1.34%	0.00	0.00
2013	12300	0.00	0.00%	0.00	0.00
2012	18000	18.50	0.10%	0.40	389.19
2011	17600	49.80	0.28%	6.70	2367.87
2010	17700	0.00	0.00%	0.00	0.00
2009	18200	0.00	0.00%	0.00	0.00
2008	17800	0.00	0.00%	0.00	0.00
2007	19300		Average		
2006	16500		0.25%		
2005	19000				
2004	18300				
2003	17700				
2002	17100				
2001	18200				
2000	18100				
1999	19000				
1998	18800				
1997	19800				
1996	20300				
1995	20300				

Table B-18. Bell Pepper Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 200 km of Kennedy Space Center.

Bell Peppers					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 200 km KSC Weighting Factor	Cropscape 200 km KSC Weighted Yield (kg / m ²)
2014	2.92E+00	0.65%	1.90E-02	0.00%	0.00E+00
2013	2.81E+00	0.65%	1.81E-02	0.00%	0.00E+00
2012	2.81E+00	0.87%	2.45E-02	0.27%	7.56E-03
2011	2.81E+00	0.88%	2.46E-02	1.44%	4.06E-02
2010	2.58E+00	0.90%	2.33E-02	0.00%	0.00E+00
2009	2.75E+00	0.88%	2.43E-02	0.00%	0.00E+00
2008	3.14E+00	0.99%	3.11E-02	0.00%	0.00E+00
2007	2.53E+00	0.89%	2.26E-02		
2006	2.76E+00	0.82%	2.25E-02		
2005	2.71E+00	0.99%	2.68E-02		
2004	3.48E+00	0.94%	3.26E-02		
2003	3.14E+00	0.79%	2.50E-02		
2002	3.59E+00	0.82%	2.95E-02		
2001	3.76E+00	0.96%	3.62E-02		
2000	3.81E+00	0.92%	3.50E-02		
1999	3.58E+00	1.01%	3.61E-02		
1998	3.34E+00	0.82%	2.73E-02		
1997	3.52E+00	0.96%	3.39E-02		
1996	2.95E+00	0.92%	2.70E-02		
1995	2.48E+00	0.75%	1.86E-02		

Table B-19. Bell Peppers Acreage by year for USDA Land Truth and Cropscape within 100 km of Kennedy Space Center.

Bell Peppers					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	100 km KSC Cropscape Acreage	100 km Corrected Cropscape Acreage
2014	11900	159.50	1.34%	0.00	0.00
2013	12300	0.00	0.00%	0.00	0.00
2012	18000	18.50	0.10%	0.20	194.59
2011	17600	49.80	0.28%	0.00	0.00
2010	17700	0.00	0.00%	0.00	0.00
2009	18200	0.00	0.00%	0.00	0.00
2008	17800	0.00	0.00%	0.00	0.00
2007	19300		Average		
2006	16500		0.25%		
2005	19000				
2004	18300				
2003	17700				
2002	17100				
2001	18200				
2000	18100				
1999	19000				
1998	18800				
1997	19800				
1996	20300				
1995	20300				

Table B-20. Bell Peppers Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 100 km of Kennedy Space Center.

Bell Peppers					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape100 km KSC Weighting Factor	Cropscape 100 km KSC Weighted Yield (kg / m ²)
2014	2.92E+00	0.65%	1.90E-02	0.00E+00	0.00E+00
2013	2.81E+00	0.65%	1.81E-02	0.00E+00	0.00E+00
2012	2.81E+00	0.87%	2.45E-02	6.58E-03	1.85E-02
2011	2.81E+00	0.88%	2.46E-02	0.00E+00	0.00E+00
2010	2.58E+00	0.90%	2.33E-02	0.00E+00	0.00E+00
2009	2.75E+00	0.88%	2.43E-02	0.00E+00	0.00E+00
2008	3.14E+00	0.99%	3.11E-02	0.00E+00	0.00E+00
2007	2.53E+00	0.89%	2.26E-02		
2006	2.76E+00	0.82%	2.25E-02		
2005	2.71E+00	0.99%	2.68E-02		
2004	3.48E+00	0.94%	3.26E-02		
2003	3.14E+00	0.79%	2.50E-02		
2002	3.59E+00	0.82%	2.95E-02		
2001	3.76E+00	0.96%	3.62E-02		
2000	3.81E+00	0.92%	3.50E-02		
1999	3.58E+00	1.01%	3.61E-02		
1998	3.34E+00	0.82%	2.73E-02		
1997	3.52E+00	0.96%	3.39E-02		
1996	2.95E+00	0.92%	2.70E-02		
1995	2.48E+00	0.75%	1.86E-02		

B.1.6. Potatoes

Table B-21. Potato Acreage by year for USDA Land Truth and Cropscape within 200 km of Kennedy Space Center.

Potatoes					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	200 km KSC Cropscape Acreage	200 km Corrected Cropscape Acreage
2014	29300	20934.20	71.45%	3397.70	4755.50
2013	29500	23957.20	81.21%	3333.30	4104.50
2012	36600	29093.40	79.49%	5984.20	7528.23
2011	35600	28772.10	80.82%	5745.30	7108.72
2010	31800	27687.00	87.07%	3376.40	3877.98
2009	28900	17910.00	61.97%	2029.50	3274.85
2008	27900	28762.80	103.09%	4244.20	4116.89
2007	27200		Average		
2006	28100		80.73%		
2005	29000				
2004	30000				
2003	34400				
2002	33000				
2001	30000				
2000	29500				
1999	37300				
1998	42500				
1997	42100				
1996	44300				
1995	42900				

Table B-22. Potato Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 200 km of Kennedy Space Center.

Potatoes					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 200 km KSC Weighting Factor	Cropscape 200 km KSC Weighted Yield (kg / m ²)
2014	2.70E+00	1.48%	3.99E-02	3.14%	8.46E-02
2013	2.70E+00	1.49%	4.01E-02	2.68%	7.22E-02
2012	2.74E+00	1.73%	4.75E-02	5.21%	1.43E-01
2011	2.88E+00	1.82%	5.23E-02	4.33%	1.25E-01
2010	2.81E+00	1.76%	4.94E-02	2.35%	6.61E-02
2009	2.99E+00	1.53%	4.56E-02	2.01%	6.00E-02
2008	3.20E+00	1.58%	5.05E-02	2.32%	7.42E-02
2007	3.22E+00	1.61%	5.19E-02		
2006	3.12E+00	1.58%	4.92E-02		
2005	3.03E+00	1.69%	5.12E-02		
2004	3.46E+00	1.52%	5.27E-02		
2003	3.07E+00	1.50%	4.61E-02		
2002	3.27E+00	1.44%	4.71E-02		
2001	3.46E+00	1.46%	5.05E-02		
2000	3.19E+00	1.26%	4.01E-02		
1999	3.20E+00	1.77%	5.67E-02		
1998	2.31E+00	1.28%	2.96E-02		
1997	2.40E+00	1.40%	3.36E-02		
1996	2.44E+00	1.66%	4.04E-02		
1995	2.36E+00	1.51%	3.55E-02		

Table B-23. Potato Acreage by year for USDA Land Truth and Cropscape within 100 km of Kennedy Space Center.

Potato					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	100 km KSC Cropscape Acreage	100 km Corrected Cropscape Acreage
2014	29300	20934.20	71.45%	72.90	102.03
2013	29500	23957.20	81.21%	7.60	9.36
2012	36600	29093.40	79.49%	926.50	1165.55
2011	35600	28772.10	80.82%	1507.40	1865.12
2010	31800	27687.00	87.07%	221.90	254.86
2009	28900	17910.00	61.97%	3.90	6.29
2008	27900	28762.80	103.09%	247.20	239.78
2007	27200		Average		
2006	28100		80.73%		
2005	29000				
2004	30000				
2003	34400				
2002	33000				
2001	30000				
2000	29500				
1999	37300				
1998	42500				
1997	42100				
1996	44300				
1995	42900				

Table B-24. Potato Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 100 km of Kennedy Space Center.

Potato					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 100 km KSC Weighting Factor	Cropscap 100 km KSC Weighted Yield(kg / m ²)
2014	2.70E+00	1.48%	3.99E-02	3.22E-03	8.67E-03
2013	2.70E+00	1.49%	4.01E-02	3.21E-04	8.65E-04
2012	2.74E+00	1.73%	4.75E-02	3.94E-02	1.08E-01
2011	2.88E+00	1.82%	5.23E-02	4.87E-02	1.40E-01
2010	2.81E+00	1.76%	4.94E-02	7.62E-03	2.14E-02
2009	2.99E+00	1.53%	4.56E-02	1.93E-04	5.78E-04
2008	3.20E+00	1.58%	5.05E-02	7.41E-03	2.37E-02
2007	3.22E+00	1.61%	5.19E-02		
2006	3.12E+00	1.58%	4.92E-02		
2005	3.03E+00	1.69%	5.12E-02		
2004	3.46E+00	1.52%	5.27E-02		
2003	3.07E+00	1.50%	4.61E-02		
2002	3.27E+00	1.44%	4.71E-02		
2001	3.46E+00	1.46%	5.05E-02		
2000	3.19E+00	1.26%	4.01E-02		
1999	3.20E+00	1.77%	5.67E-02		
1998	2.31E+00	1.28%	2.96E-02		
1997	2.40E+00	1.40%	3.36E-02		
1996	2.44E+00	1.66%	4.04E-02		
1995	2.36E+00	1.51%	3.55E-02		

B.1.7. Squash

Table B-25. Squash Acreage by year for USDA Land Truth and Cropscape within 200 km of Kennedy Space Center.

Squash					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	200 km KSC Cropscape Acreage	200 km Corrected Cropscape Acreage
2014	6800	212.80	3.13%	18.00	575.19
2013	7800	1076.80	13.81%	5.10	36.94
2012	9700	2268.90	23.39%	0.00	0.00
2011	9300	207.00	2.23%	7.80	350.43
2010	9100	205.00	2.25%	3.30	146.49
2009	8800	0.00	0.00%	0.00	0.00
2008	8300	44.90	0.54%	0.80	147.88
2007	7800		Average		
2006	10200		6.48%		
2005	8200				
2004	10300				
2003	10000				
2002	11700				
2001	11500				
2000	11800				
1999	12600				
1998	12500				
1997	10900				
1996	9600				
1995	11900				

Table B-26. Squash Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 200 km of Kennedy Space Center.

Squash					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 200 km KSC Weighting Factor	Cropscape 200 km KSC Weighted Yield (kg / m ²)
2014	1.35E+00	0.17%	2.31E-03	0.38%	5.11E-03
2013	1.40E+00	0.20%	2.88E-03	0.02%	3.38E-04
2012	9.16E-01	0.15%	1.41E-03	0.00%	0.00E+00
2011	1.60E+00	0.26%	4.25E-03	0.21%	3.43E-03
2010	1.32E+00	0.24%	3.11E-03	0.09%	1.17E-03
2009	1.46E+00	0.23%	3.32E-03	0.00%	0.00E+00
2008	1.35E+00	0.20%	2.67E-03	0.08%	1.12E-03
2007	1.03E+00	0.15%	1.53E-03		
2006	1.12E+00	0.21%	2.31E-03		
2005	1.46E+00	0.23%	3.37E-03		
2004	1.48E+00	0.22%	3.30E-03		
2003	1.46E+00	0.21%	3.05E-03		
2002	1.51E+00	0.24%	3.59E-03		
2001	1.11E+00	0.18%	2.01E-03		
2000	1.38E+00	0.22%	3.01E-03		
1999	1.32E+00	0.25%	3.26E-03		
1998	1.20E+00	0.20%	2.35E-03		
1997	1.34E+00	0.20%	2.72E-03		
1996	9.91E-01	0.15%	1.44E-03		
1995	1.25E+00	0.22%	2.75E-03		

Table B-27. Squash Acreage by year for USDA Land Truth and Cropscape within 100 km of Kennedy Space Center.

Squash					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	100 km KSC Cropscape Acreage	100 km Corrected Cropscape Acreage
2014	6800	212.80	3.13%	0.00	0.00
2013	7800	1076.80	13.81%	1.30	9.42
2012	9700	2268.90	23.39%	0.00	0.00
2011	9300	207.00	2.23%	0.00	0.00
2010	9100	205.00	2.25%	0.40	17.76
2009	8800	0.00	0.00%	0.00	0.00
2008	8300	44.90	0.54%	0.00	0.00
2007	7800		Average		
2006	10200		6.48%		
2005	8200				
2004	10300				
2003	10000				
2002	11700				
2001	11500				
2000	11800				
1999	12600				
1998	12500				
1997	10900				
1996	9600				
1995	11900				

Table B-28. Squash Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 100 km of Kennedy Space Center.

Squash					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscap 100 km KSC Weighting Factor	Cropscap 100 km KSC Weighted Yield (kg / m ²)
2014	1.35E+00	0.17%	2.31E-03	0.00E+00	0.00E+00
2013	1.40E+00	0.20%	2.88E-03	3.23E-04	4.54E-04
2012	9.16E-01	0.15%	1.41E-03	0.00E+00	0.00E+00
2011	1.60E+00	0.26%	4.25E-03	0.00E+00	0.00E+00
2010	1.32E+00	0.24%	3.11E-03	5.31E-04	7.00E-04
2009	1.46E+00	0.23%	3.32E-03	0.00E+00	0.00E+00
2008	1.35E+00	0.20%	2.67E-03	0.00E+00	0.00E+00
2007	1.03E+00	0.15%	1.53E-03		
2006	1.12E+00	0.21%	2.31E-03		
2005	1.46E+00	0.23%	3.37E-03		
2004	1.48E+00	0.22%	3.30E-03		
2003	1.46E+00	0.21%	3.05E-03		
2002	1.51E+00	0.24%	3.59E-03		
2001	1.11E+00	0.18%	2.01E-03		
2000	1.38E+00	0.22%	3.01E-03		
1999	1.32E+00	0.25%	3.26E-03		
1998	1.20E+00	0.20%	2.35E-03		
1997	1.34E+00	0.20%	2.72E-03		
1996	9.91E-01	0.15%	1.44E-03		
1995	1.25E+00	0.22%	2.75E-03		

B.1.8. Tomatoes

Table B-29. Tomatoes Acreage by year for USDA Land Truth and Cropscape within 200 km of Kennedy Space Center.

Tomatoes					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	200 km KSC Cropscape Acreage	200 km Corrected Cropscape Acreage
2014	33000	677.20	2.05%	2.70	131.57
2013	34000	736.80	2.17%	2.40	110.75
2012	29000	0.00	0.00%	0.00	0.00
2011	28500	300.00	1.05%	0.40	38.00
2010	29500	304.50	1.03%	13.60	1317.57
2009	33600	0.00	0.00%	0.00	0.00
2008	31500	464.20	1.47%	0.00	0.00
2007	34600		Average		
2006	38500		0.71%		
2005	42000				
2004	42000				
2003	43000				
2002	43500				
2001	43800				
2000	43200				
1999	43400				
1998	39300				
1997	37300				
1996	45500				
1995	49000				

Table B-30. Tomato Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 200 km of Kennedy Space Center.

Tomatoes					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 200 km KSC Weighting Factor	Cropscape 200 km KSC Weighted Yield (kg / m ²)
2014	3.14E+00	1.94%	6.11E-02	0.09%	2.73E-03
2013	2.98E+00	1.89%	5.64E-02	0.07%	2.15E-03
2012	3.71E+00	1.86%	6.89E-02	0.00%	0.00E+00
2011	3.59E+00	1.82%	6.54E-02	0.02%	8.33E-04
2010	3.26E+00	1.89%	6.17E-02	0.80%	2.60E-02
2009	4.11E+00	2.44%	1.00E-01	0.00%	0.00E+00
2008	3.73E+00	2.07%	7.73E-02	0.00%	0.00E+00
2007	4.32E+00	2.75%	1.19E-01		
2006	3.93E+00	2.72%	1.07E-01		
2005	4.16E+00	3.35%	1.39E-01		
2004	4.04E+00	2.49%	1.01E-01		
2003	3.71E+00	2.27%	8.42E-02		
2002	3.79E+00	2.21%	8.37E-02		
2001	4.09E+00	2.52%	1.03E-01		
2000	4.04E+00	2.33%	9.43E-02		
1999	3.97E+00	2.55%	1.01E-01		
1998	3.84E+00	1.96%	7.52E-02		
1997	4.12E+00	2.13%	8.76E-02		
1996	3.51E+00	2.45%	8.60E-02		
1995	3.73E+00	2.72%	1.02E-01		

Table B-31. Tomato Acreage by year for USDA Land Truth and Cropscape within 100 km of Kennedy Space Center.

Tomato					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	100 km KSC Cropscape Acreage	100 km Corrected Cropscape Acreage
2014	33000	677.20	2.05%	0.00	0.00
2013	34000	736.80	2.17%	2.40	110.75
2012	29000	0.00	0.00%	0.00	0.00
2011	28500	300.00	1.05%	0.00	0.00
2010	29500	304.50	1.03%	2.70	261.58
2009	33600	0.00	0.00%	0.00	0.00
2008	31500	464.20	1.47%	0.00	0.00
2007	34600		Average		
2006	38500		0.71%		
2005	42000				
2004	42000				
2003	43000				
2002	43500				
2001	43800				
2000	43200				
1999	43400				
1998	39300				
1997	37300				
1996	45500				
1995	49000				

Table B-32. Tomato Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 100 km of Kennedy Space Center.

Tomato					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 100 km KSC Weighting Factor	Cropscape 100 km KSC Weighted Yield (kg / m ²)
2014	3.14E+00	1.94%	6.11E-02	0.00E+00	0.00E+00
2013	2.98E+00	1.89%	5.64E-02	3.80E-03	1.13E-02
2012	3.71E+00	1.86%	6.89E-02	0.00E+00	0.00E+00
2011	3.59E+00	1.82%	6.54E-02	0.00E+00	0.00E+00
2010	3.26E+00	1.89%	6.17E-02	7.83E-03	2.55E-02
2009	4.11E+00	2.44%	1.00E-01	0.00E+00	0.00E+00
2008	3.73E+00	2.07%	7.73E-02	0.00E+00	0.00E+00
2007	4.32E+00	2.75%	1.19E-01		
2006	3.93E+00	2.72%	1.07E-01		
2005	4.16E+00	3.35%	1.39E-01		
2004	4.04E+00	2.49%	1.01E-01		
2003	3.71E+00	2.27%	8.42E-02		
2002	3.79E+00	2.21%	8.37E-02		
2001	4.09E+00	2.52%	1.03E-01		
2000	4.04E+00	2.33%	9.43E-02		
1999	3.97E+00	2.55%	1.01E-01		
1998	3.84E+00	1.96%	7.52E-02		
1997	4.12E+00	2.13%	8.76E-02		
1996	3.51E+00	2.45%	8.60E-02		
1995	3.73E+00	2.72%	1.02E-01		

B.2 Fruit

B.2.1. Watermelons

Table B-33. Watermelon Acreage by year for USDA Land Truth and Cropscape within 200 km of Kennedy Space Center.

Watermelon					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	200 km KSC Cropscape Acreage	200 km Corrected Cropscape Acreage
2014	19700	1581.70	8.03%	7.60	94.66
2013	20200	2392.70	11.85%	69.40	585.90
2012	25300	2963.40	11.71%	64.50	550.67
2011	24400	2264.90	9.28%	97.60	1051.45
2010	24600	0.00	0.00%	0.00	0.00
2009	25800	93.00	0.36%	4.60	1276.13
2008	26100	310.70	1.19%	76.70	6443.10
2007	22800		Average		
2006	25300		6.06%		
2005	26000				
2004	25000				
2003	24000				
2002	23000				
2001	24000				
2000	27000				
1999	35000				
1998	32000				
1997	30000				
1996	34000				
1995	33000				

Table B-34. Watermelon Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 200 km of Kennedy Space Center.

Watermelon					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 200 km KSC Weighting Factor	Cropscape 200 km KSC Weighted Yield (kg / m ²)
2014	2.75E+00	1.01%	2.79E-02	0.06%	1.72E-03
2013	3.48E+00	1.32%	4.58E-02	0.38%	1.33E-02
2012	3.31E+00	1.45%	4.80E-02	0.38%	1.26E-02
2011	3.48E+00	1.51%	5.25E-02	0.64%	2.23E-02
2010	3.43E+00	1.66%	5.69E-02	0.00%	0.00E+00
2009	3.56E+00	1.62%	5.78E-02	0.78%	2.79E-02
2008	3.71E+00	1.71%	6.33E-02	3.63%	1.34E-01
2007	3.67E+00	1.54%	5.64E-02		
2006	3.71E+00	1.68%	6.24E-02		
2005	3.54E+00	1.77%	6.25E-02		
2004	3.59E+00	1.32%	4.74E-02		
2003	3.37E+00	1.15%	3.89E-02		
2002	3.71E+00	1.14%	4.22E-02		
2001	3.48E+00	1.18%	4.09E-02		
2000	3.59E+00	1.30%	4.66E-02		
1999	3.37E+00	1.75%	5.89E-02		
1998	2.53E+00	1.05%	2.66E-02		
1997	2.81E+00	1.16%	3.27E-02		
1996	2.36E+00	1.23%	2.90E-02		
1995	2.81E+00	1.38%	3.87E-02		

Table B-35. Watermelon Acreage by year for USDA Land Truth and Cropscape within 100 km of Kennedy Space Center.

Watermelon					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	100 km KSC Cropscape Acreage	100 km Corrected Cropscape Acreage
2014	19700	1581.70	8.03%	0.00	0.00
2013	20200	2392.70	11.85%	4.00	33.77
2012	25300	2963.40	11.71%	0.00	0.00
2011	24400	2264.90	9.28%	0.70	7.54
2010	24600	0.00	0.00%	0.00	0.00
2009	25800	93.00	0.36%	3.10	860.00
2008	26100	310.70	1.19%	20.90	1755.68
2007	22800		Average		
2006	25300		6.06%		
2005	26000				
2004	25000				
2003	24000				
2002	23000				
2001	24000				
2000	27000				
1999	35000				
1998	32000				
1997	30000				
1996	34000				
1995	33000				

Table B-36. Watermelon Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 100 km of Kennedy Space Center.

Watermelon					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 100 km KSC Weighting Factor	Cropscape 100 km KSC Weighted Yield (kg / m ²)
2014	2.75E+00	1.01%	2.79E-02	0.00E+00	0.00E+00
2013	3.48E+00	1.32%	4.58E-02	1.16E-03	4.03E-03
2012	3.31E+00	1.45%	4.80E-02	0.00E+00	0.00E+00
2011	3.48E+00	1.51%	5.25E-02	1.97E-04	6.85E-04
2010	3.43E+00	1.66%	5.69E-02	0.00E+00	0.00E+00
2009	3.56E+00	1.62%	5.78E-02	2.64E-02	9.41E-02
2008	3.71E+00	1.71%	6.33E-02	5.42E-02	2.01E-01
2007	3.67E+00	1.54%	5.64E-02		
2006	3.71E+00	1.68%	6.24E-02		
2005	3.54E+00	1.77%	6.25E-02		
2004	3.59E+00	1.32%	4.74E-02		
2003	3.37E+00	1.15%	3.89E-02		
2002	3.71E+00	1.14%	4.22E-02		
2001	3.48E+00	1.18%	4.09E-02		
2000	3.59E+00	1.30%	4.66E-02		
1999	3.37E+00	1.75%	5.89E-02		
1998	2.53E+00	1.05%	2.66E-02		
1997	2.81E+00	1.16%	3.27E-02		
1996	2.36E+00	1.23%	2.90E-02		
1995	2.81E+00	1.38%	3.87E-02		

B.2.2. Strawberries

Table B-37. Strawberry Acreage by year for USDA Land Truth and Cropscape within 200 km of Kennedy Space Center.

Strawberries					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	200 km KSC Cropscape Acreage	200 km Corrected Cropscape Acreage
2014	10900	11379.70	104.40%	76.10	72.89
2013	10600	11023.70	104.00%	177.00	170.20
2012	8700	9822.90	112.91%	50.00	44.28
2011	9900	1980.90	20.01%	8.00	39.98
2010	8800	1927.90	21.91%	20.70	94.49
2009	8800	1745.90	19.84%	3.90	19.66
2008	6900	508.30	7.37%	17.80	241.63
2007	6600		Average		
2006	7300		55.78%		
2005	7300				
2004	7100				
2003	7100				
2002	6900				
2001	6500				
2000	6300				
1999	6200				
1998	6200				
1997	6100				
1996	6000				
1995	6000				

Table B-38. Strawberry Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 200 km of Kennedy Space Center.

Strawberries					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 200 km KSC Weighting Factor	Cropscape 200 km KSC Weighted Yield (kg / m ²)
2014	2.13E+00	0.44%	9.29E-03	0.05%	1.03E-03
2013	2.47E+00	0.49%	1.21E-02	0.11%	2.74E-03
2012	2.36E+00	0.35%	8.37E-03	0.03%	7.22E-04
2011	2.81E+00	0.49%	1.39E-02	0.02%	6.84E-04
2010	2.47E+00	0.43%	1.06E-02	0.06%	1.42E-03
2009	3.03E+00	0.47%	1.43E-02	0.01%	3.66E-04
2008	2.92E+00	0.36%	1.04E-02	0.14%	3.97E-03
2007	3.59E+00	0.44%	1.56E-02		
2006	3.14E+00	0.41%	1.30E-02		
2005	2.75E+00	0.39%	1.06E-02		
2004	2.58E+00	0.27%	6.96E-03		
2003	2.47E+00	0.25%	6.18E-03		
2002	2.87E+00	0.26%	7.57E-03		
2001	2.92E+00	0.27%	7.80E-03		
2000	3.93E+00	0.33%	1.30E-02		
1999	3.37E+00	0.31%	1.04E-02		
1998	2.92E+00	0.24%	6.88E-03		
1997	3.26E+00	0.27%	8.95E-03		
1996	2.92E+00	0.27%	7.85E-03		
1995	3.14E+00	0.28%	8.83E-03		

Table B-39. Strawberry Acreage by year for USDA Land Truth and Cropscape within 100 km of Kennedy Space Center.

Strawberries					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	100 km KSC Cropscape Acreage	100 km Corrected Cropscape Acreage
2014	10900	11379.70	104.40%	4.00	3.83
2013	10600	11023.70	104.00%	11.10	10.67
2012	8700	9822.90	112.91%	2.40	2.13
2011	9900	1980.90	20.01%	0.00	0.00
2010	8800	1927.90	21.91%	0.00	0.00
2009	8800	1745.90	19.84%	0.80	4.03
2008	6900	508.30	7.37%	0.00	0.00
2007	6600		Average		
2006	7300		55.78%		
2005	7300				
2004	7100				
2003	7100				
2002	6900				
2001	6500				
2000	6300				
1999	6200				
1998	6200				
1997	6100				
1996	6000				
1995	6000				

Table B-40. Strawberry Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 100 km of Kennedy Space Center.

Strawberries					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 100 km KSC Weighting Factor	Cropscape 100 km KSCWeighted Yield (kg / m ²)
2014	2.13E+00	0.44%	9.29E-03	1.21E-04	2.58E-04
2013	2.47E+00	0.49%	1.21E-02	3.66E-04	9.05E-04
2012	2.36E+00	0.35%	8.37E-03	7.19E-05	1.70E-04
2011	2.81E+00	0.49%	1.39E-02	0.00E+00	0.00E+00
2010	2.47E+00	0.43%	1.06E-02	0.00E+00	0.00E+00
2009	3.03E+00	0.47%	1.43E-02	1.24E-04	3.76E-04
2008	2.92E+00	0.36%	1.04E-02	0.00E+00	0.00E+00
2007	3.59E+00	0.44%	1.56E-02		
2006	3.14E+00	0.41%	1.30E-02		
2005	2.75E+00	0.39%	1.06E-02		
2004	2.58E+00	0.27%	6.96E-03		
2003	2.47E+00	0.25%	6.18E-03		
2002	2.87E+00	0.26%	7.57E-03		
2001	2.92E+00	0.27%	7.80E-03		
2000	3.93E+00	0.33%	1.30E-02		
1999	3.37E+00	0.31%	1.04E-02		
1998	2.92E+00	0.24%	6.88E-03		
1997	3.26E+00	0.27%	8.95E-03		
1996	2.92E+00	0.27%	7.85E-03		
1995	3.14E+00	0.28%	8.83E-03		

B.2.3. Blueberries

Table B-41. Blueberry Acreage by year for USDA Land Truth and Cropscape within 200 km of Kennedy Space Center.

Blueberries					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	200 km KSC Cropscape Acreage	200 km Corrected Cropscape Acreage
2014	4300	653.80	15.20%	454.10	2986.59
2013	4300	285.80	6.65%	28.90	434.81
2012	4500	379.20	8.43%	219.70	2607.20
2011	3800	73.80	1.94%	1.30	66.94
2010	3500	242.40	6.93%	90.10	1300.95
2009	3200	91.40	2.86%	0.00	0.00
2008	3000	829.20	27.64%	7.00	25.33
2007	2600		Average		
2006	2600		9.95%		
2005	2500				
2004	2300				
2003	1900				
2002	1600				
2001	1400				
2000	1400				
1999	1200				
1998	1200				
1997	1200				
1996	1300				
1995	1300				

Table B-42. Blueberry Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 200 km of Kennedy Space Center.

Blueberries					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 200 km KSC Weighting Factor	Cropscape 200 km KSC Weighted Yield (kg / m ²)
2014	4.94E-01	0.04%	1.97E-04	1.97%	9.74E-03
2013	5.05E-01	0.04%	2.06E-04	0.28%	1.43E-03
2012	4.27E-01	0.03%	1.42E-04	1.80%	7.69E-03
2011	6.29E-01	0.04%	2.67E-04	0.04%	2.57E-04
2010	5.27E-01	0.04%	1.91E-04	0.79%	4.16E-03
2009	4.74E-01	0.03%	1.27E-04	0.00%	0.00E+00
2008	3.67E-01	0.02%	7.14E-05	0.01%	5.24E-05
2007	3.37E-01	0.02%	5.42E-05		
2006	3.02E-01	0.01%	4.26E-05		
2005	2.34E-01	0.01%	2.62E-05		
2004	2.74E-01	0.01%	2.53E-05		
2003	2.07E-01	0.01%	1.16E-05		
2002	2.03E-01	0.00%	8.84E-06		
2001	2.48E-01	0.00%	1.21E-05		
2000	2.25E-01	0.00%	9.45E-06		
1999	1.36E-01	0.00%	3.29E-06		
1998	1.88E-01	0.00%	5.49E-06		
1997	1.88E-01	0.00%	5.84E-06		
1996	1.99E-01	0.00%	7.88E-06		
1995	2.16E-01	0.00%	8.99E-06		

Table B-43. Blueberry Acreage by year for USDA Land Truth and Cropscape within 100 km of Kennedy Space Center.

Blueberries					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	100 km KSC Cropscape Acreage	100 km Corrected Cropscape Acreage
2014	4300	653.80	15.20%	300.00	1973.08
2013	4300	285.80	6.65%	2.90	43.63
2012	4500	379.20	8.43%	0.00	0.00
2011	3800	73.80	1.94%	0.00	0.00
2010	3500	242.40	6.93%	0.00	0.00
2009	3200	91.40	2.86%	0.00	0.00
2008	3000	829.20	27.64%	0.00	0.00
2007	2600		Average		
2006	2600		9.95%		
2005	2500				
2004	2300				
2003	1900				
2002	1600				
2001	1400				
2000	1400				
1999	1200				
1998	1200				
1997	1200				
1996	1300				
1995	1300				

Table B-44. Blueberry Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 100 km of Kennedy Space Center.

Blueberries					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 100 km KSC Weighting Factor	Cropscape 100 km KSC Weighted Yield (kg / m ²)
2014	4.94E-01	0.04%	1.97E-04	6.22E-02	3.07E-02
2013	5.05E-01	0.04%	2.06E-04	1.50E-03	7.57E-04
2012	4.27E-01	0.03%	1.42E-04	0.00E+00	0.00E+00
2011	6.29E-01	0.04%	2.67E-04	0.00E+00	0.00E+00
2010	5.27E-01	0.04%	1.91E-04	0.00E+00	0.00E+00
2009	4.74E-01	0.03%	1.27E-04	0.00E+00	0.00E+00
2008	3.67E-01	0.02%	7.14E-05	0.00E+00	0.00E+00
2007	3.37E-01	0.02%	5.42E-05		
2006	3.02E-01	0.01%	4.26E-05		
2005	2.34E-01	0.01%	2.62E-05		
2004	2.74E-01	0.01%	2.53E-05		
2003	2.07E-01	0.01%	1.16E-05		
2002	2.03E-01	0.00%	8.84E-06		
2001	2.48E-01	0.00%	1.21E-05		
2000	2.25E-01	0.00%	9.45E-06		
1999	1.36E-01	0.00%	3.29E-06		
1998	1.88E-01	0.00%	5.49E-06		
1997	1.88E-01	0.00%	5.84E-06		
1996	1.99E-01	0.00%	7.88E-06		
1995	2.16E-01	0.00%	8.99E-06		

B.3 Grains

B.3.1. Peanuts

Table B-45. Peanut Acreage by year for USDA Land Truth and Cropscape within 200 km of Kennedy Space Center.

Peanuts					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	200 km KSC Cropscape Acreage	200 km Corrected Cropscape Acreage
2014	167000	247520.60	148.22%	458.80	309.55
2013	131000	194113.80	148.18%	633.60	427.59
2012	200000	283633.90	141.82%	677.20	477.52
2011	157000	234258.10	149.21%	28.00	18.77
2010	135000	194617.30	144.16%	144.80	100.44
2009	105000	127631.90	121.55%	33.30	27.40
2008	140000	223475.80	159.63%	423.10	265.06
2007	119000		Average		
2006	120000		144.68%		
2005	152000				
2004	130000				
2003	115000				
2002	86000				
2001	82000				
2000	86000				
1999	94000				
1998	90000				
1997	84000				
1996	82000				
1995	81000				

Table B-46. Peanut Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 200 km of Kennedy Space Center.

Peanuts					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 200 km KSC Weighting Factor	Cropscape 200 km KSC Weighted Yield (kg / m ²)
2014	4.49E-01	1.40%	6.31E-03	0.20%	9.18E-04
2013	4.44E-01	1.09%	4.82E-03	0.28%	1.24E-03
2012	4.38E-01	1.51%	6.63E-03	0.33%	1.45E-03
2011	3.93E-01	1.10%	4.31E-03	0.01%	4.50E-05
2010	3.93E-01	1.05%	4.11E-03	0.06%	2.40E-04
2009	3.59E-01	0.67%	2.40E-03	0.02%	6.04E-05
2008	3.59E-01	0.89%	3.19E-03	0.15%	5.36E-04
2007	3.03E-01	0.66%	2.01E-03		
2006	2.81E-01	0.61%	1.70E-03		
2005	3.03E-01	0.89%	2.68E-03		
2004	3.14E-01	0.60%	1.89E-03		
2003	3.37E-01	0.55%	1.86E-03		
2002	2.58E-01	0.30%	7.67E-04		
2001	3.43E-01	0.40%	1.35E-03		
2000	2.79E-01	0.32%	8.96E-04		
1999	3.11E-01	0.43%	1.35E-03		
1998	2.91E-01	0.34%	9.91E-04		
1997	3.05E-01	0.35%	1.08E-03		
1996	3.23E-01	0.41%	1.32E-03		
1995	2.68E-01	0.32%	8.68E-04		

Table B-47. Peanuts Acreage by year for USDA Land Truth and Cropscape within 100 km of Kennedy Space Center.

Peanuts					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	100 km KSC Cropscape Acreage	100 km Corrected Cropscape Acreage
2014	167000	247520.60	148.22%	28.20	19.03
2013	131000	194113.80	148.18%	2.40	1.62
2012	200000	283633.90	141.82%	0.90	0.63
2011	157000	234258.10	149.21%	0.00	0.00
2010	135000	194617.30	144.16%	0.00	0.00
2009	105000	127631.90	121.55%	0.00	0.00
2008	140000	223475.80	159.63%	0.00	0.00
2007	119000		Average		
2006	120000		144.68%		
2005	152000				
2004	130000				
2003	115000				
2002	86000				
2001	82000				
2000	86000				
1999	94000				
1998	90000				
1997	84000				
1996	82000				
1995	81000				

Table B-48. Peanut Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 100 km of Kennedy Space Center.

Peanuts					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 100 km KSC Weighting Factor	Cropscape 100 km KSC Weighted Yield (kg / m ²)
2014	4.49E-01	1.40%	6.31E-03	6.00E-04	2.69E-04
2013	4.44E-01	1.09%	4.82E-03	5.56E-05	2.47E-05
2012	4.38E-01	1.51%	6.63E-03	2.15E-05	9.41E-06
2011	3.93E-01	1.10%	4.31E-03	0.00E+00	0.00E+00
2010	3.93E-01	1.05%	4.11E-03	0.00E+00	0.00E+00
2009	3.59E-01	0.67%	2.40E-03	0.00E+00	0.00E+00
2008	3.59E-01	0.89%	3.19E-03	0.00E+00	0.00E+00
2007	3.03E-01	0.66%	2.01E-03		
2006	2.81E-01	0.61%	1.70E-03		
2005	3.03E-01	0.89%	2.68E-03		
2004	3.14E-01	0.60%	1.89E-03		
2003	3.37E-01	0.55%	1.86E-03		
2002	2.58E-01	0.30%	7.67E-04		
2001	3.43E-01	0.40%	1.35E-03		
2000	2.79E-01	0.32%	8.96E-04		
1999	3.11E-01	0.43%	1.35E-03		
1998	2.91E-01	0.34%	9.91E-04		
1997	3.05E-01	0.35%	1.08E-03		
1996	3.23E-01	0.41%	1.32E-03		
1995	2.68E-01	0.32%	8.68E-04		

B.3.2. Soybeans

Table B-49. Soybean Acreage by year for USDA Land Truth and Cropscape within 200 km of Kennedy Space Center.

Soybeans					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	200 km KSC Cropscape Acreage	200 km Corrected Cropscape Acreage
2014	37000	33309.80	90.03%	0.90	1.00
2013	30000	19855.60	66.19%	0.00	0.00
2012	20000	12322.40	61.61%	5.80	9.41
2011	16000	8020.90	50.13%	0.00	0.00
2010	23000	13254.30	57.63%	0.00	0.00
2009	34000	16048.60	47.20%	0.00	0.00
2008	29000	20156.50	69.51%	0.00	0.00
2007	12000		Average		
2006	5000		57.22%		
2005	8000				
2004	17000				
2003	12000				
2002	9000				
2001	9000				
2000	15000				
1999	19000				
1998	30000				
1997	45000				
1996	33000				
1995	28000				

Table B-50. Soybean Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 200 km of Kennedy Space Center.

Soybeans					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 200 km KSCWeighting Factor	Cropscape 200 km KSC Weighted Yield (kg / m ²)
2014	2.90E-01	0.20%	5.82E-04	0.00%	1.91E-06
2013	2.76E-01	0.16%	4.29E-04	0.00%	0.00E+00
2012	2.63E-01	0.09%	2.39E-04	0.01%	1.71E-05
2011	1.82E-01	0.05%	9.40E-05	0.00%	0.00E+00
2010	2.02E-01	0.09%	1.85E-04	0.00%	0.00E+00
2009	2.56E-01	0.15%	3.94E-04	0.00%	0.00E+00
2008	2.56E-01	0.13%	3.36E-04	0.00%	0.00E+00
2007	1.62E-01	0.04%	5.76E-05		
2006	1.82E-01	0.02%	2.97E-05		
2005	2.16E-01	0.03%	7.15E-05		
2004	2.29E-01	0.06%	1.31E-04		
2003	2.02E-01	0.03%	6.99E-05		
2002	2.22E-01	0.03%	5.95E-05		
2001	1.95E-01	0.02%	4.84E-05		
2000	1.28E-01	0.03%	3.29E-05		
1999	2.16E-01	0.06%	1.31E-04		
1998	1.55E-01	0.06%	9.38E-05		
1997	1.68E-01	0.10%	1.77E-04		
1996	2.16E-01	0.11%	2.35E-04		
1995	1.75E-01	0.07%	1.28E-04		

Table B-51. Soybean Acreage by year for USDA Land Truth and Cropscape within 100 km of Kennedy Space Center.

Soybeans					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	100 km KSC Cropscape Acreage	100 km Corrected Cropscape Acreage
2014	37000	33309.80	90.03%	0.00	0.00
2013	30000	19855.60	66.19%	0.00	0.00
2012	20000	12322.40	61.61%	0.00	0.00
2011	16000	8020.90	50.13%	0.00	0.00
2010	23000	13254.30	57.63%	0.00	0.00
2009	34000	16048.60	47.20%	0.00	0.00
2008	29000	20156.50	69.51%	0.00	0.00
2007	12000		Average		
2006	5000		57.22%		
2005	8000				
2004	17000				
2003	12000				
2002	9000				
2001	9000				
2000	15000				
1999	19000				
1998	30000				
1997	45000				
1996	33000				
1995	28000				

Table B-52. Soybean Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 100 km of Kennedy Space Center.

Soybeans					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 100 km KSC Weighting Factor	Cropscape 100 km KSC Weighted Yield (kg / m ²)
2014	2.90E-01	0.20%	5.82E-04	0.00E+00	0.00E+00
2013	2.76E-01	0.16%	4.29E-04	0.00E+00	0.00E+00
2012	2.63E-01	0.09%	2.39E-04	0.00E+00	0.00E+00
2011	1.82E-01	0.05%	9.40E-05	0.00E+00	0.00E+00
2010	2.02E-01	0.09%	1.85E-04	0.00E+00	0.00E+00
2009	2.56E-01	0.15%	3.94E-04	0.00E+00	0.00E+00
2008	2.56E-01	0.13%	3.36E-04	0.00E+00	0.00E+00
2007	1.62E-01	0.04%	5.76E-05		
2006	1.82E-01	0.02%	2.97E-05		
2005	2.16E-01	0.03%	7.15E-05		
2004	2.29E-01	0.06%	1.31E-04		
2003	2.02E-01	0.03%	6.99E-05		
2002	2.22E-01	0.03%	5.95E-05		
2001	1.95E-01	0.02%	4.84E-05		
2000	1.28E-01	0.03%	3.29E-05		
1999	2.16E-01	0.06%	1.31E-04		
1998	1.55E-01	0.06%	9.38E-05		
1997	1.68E-01	0.10%	1.77E-04		
1996	2.16E-01	0.11%	2.35E-04		
1995	1.75E-01	0.07%	1.28E-04		

B.3.3. Sugarcane

Table B-53. Sugarcane Acreage by year for USDA Land Truth and Cropscape within 200 km of Kennedy Space Center.

Sugarcane					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	200 km KSC Cropscape Acreage	200 km Corrected Cropscape Acreage
2014	412000	488108.70	118.47%	141.20	119.18
2013	416000	541663.30	130.21%	1060.40	814.39
2012	413000	477186.00	115.54%	1640.60	1419.92
2011	397000	473611.60	119.30%	983.70	824.58
2010	392000	556813.30	142.04%	3243.40	2283.37
2009	387000	402884.20	104.10%	118.60	113.92
2008	401000	501105.50	124.96%	582.70	466.29
2007	393000		Average		
2006	400000		121.19%		
2005	401000				
2004	406000				
2003	438000				
2002	461000				
2001	465000				
2000	454000				
1999	460000				
1998	447000				
1997	440000				
1996	438000				
1995	437000				

Table B-54. Sugarcane Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 200 km of Kennedy Space Center.

Sugarcane					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 200 km KSC Weighting Factor	Cropscape 200 km KSC Weighted Yield (kg / m ²)
2014	8.67E+00	66.87%	5.80E+00	0.08%	6.82E-03
2013	7.77E+00	60.49%	4.70E+00	0.53%	4.13E-02
2012	8.29E+00	59.16%	4.90E+00	0.98%	8.14E-02
2011	8.45E+00	59.53%	5.03E+00	0.50%	4.25E-02
2010	7.44E+00	57.44%	4.27E+00	1.39%	1.03E-01
2009	8.09E+00	55.29%	4.47E+00	0.07%	5.65E-03
2008	7.44E+00	52.62%	3.91E+00	0.26%	1.95E-02
2007	8.11E+00	58.47%	4.74E+00		
2006	8.06E+00	57.94%	4.67E+00		
2005	7.14E+00	55.01%	3.93E+00		
2004	7.91E+00	47.14%	3.73E+00		
2003	8.83E+00	55.14%	4.87E+00		
2002	8.60E+00	53.00%	4.56E+00		
2001	7.88E+00	51.60%	4.07E+00		
2000	8.42E+00	51.14%	4.31E+00		
1999	7.86E+00	53.61%	4.22E+00		
1998	9.01E+00	52.40%	4.72E+00		
1997	8.29E+00	50.43%	4.18E+00		
1996	7.44E+00	49.94%	3.71E+00		
1995	7.77E+00	50.52%	3.93E+00		

Table B-55. Sugarcane Acreage by year for USDA Land Truth and Cropscape within 100 km of Kennedy Space Center.

Sugarcane					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	100 km KSC Cropscape Acreage	100 km Corrected Cropscape Acreage
2014	412000	488108.70	118.47%	37.60	31.74
2013	416000	541663.30	130.21%	164.10	126.03
2012	413000	477186.00	115.54%	148.60	128.61
2011	397000	473611.60	119.30%	82.50	69.15
2010	392000	556813.30	142.04%	262.90	185.08
2009	387000	402884.20	104.10%	61.20	58.79
2008	401000	501105.50	124.96%	55.80	44.65
2007	393000		Average		
2006	400000		121.19%		
2005	401000				
2004	406000				
2003	438000				
2002	461000				
2001	465000				
2000	454000				
1999	460000				
1998	447000				
1997	440000				
1996	438000				
1995	437000				

Table B-56. Sugarcane Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 100 km of Kennedy Space Center.

Sugarcane					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 100 km KSC Weighting Factor	Cropscape 100 km KSC Weighted Yield (kg / m ²)
2014	8.67E+00	66.87%	5.80E+00	1.00E-03	8.68E-03
2013	7.77E+00	60.49%	4.70E+00	4.32E-03	3.36E-02
2012	8.29E+00	59.16%	4.90E+00	4.35E-03	3.61E-02
2011	8.45E+00	59.53%	5.03E+00	1.80E-03	1.52E-02
2010	7.44E+00	57.44%	4.27E+00	5.54E-03	4.12E-02
2009	8.09E+00	55.29%	4.47E+00	1.81E-03	1.46E-02
2008	7.44E+00	52.62%	3.91E+00	1.38E-03	1.03E-02
2007	8.11E+00	58.47%	4.74E+00		
2006	8.06E+00	57.94%	4.67E+00		
2005	7.14E+00	55.01%	3.93E+00		
2004	7.91E+00	47.14%	3.73E+00		
2003	8.83E+00	55.14%	4.87E+00		
2002	8.60E+00	53.00%	4.56E+00		
2001	7.88E+00	51.60%	4.07E+00		
2000	8.42E+00	51.14%	4.31E+00		
1999	7.86E+00	53.61%	4.22E+00		
1998	9.01E+00	52.40%	4.72E+00		
1997	8.29E+00	50.43%	4.18E+00		
1996	7.44E+00	49.94%	3.71E+00		
1995	7.77E+00	50.52%	3.93E+00		

B.3.4. Wheat

Table B-57. Wheat Acreage by year for USDA Land Truth and Cropscape within 200 km of Kennedy Space Center.

Wheat					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	200 km KSC Cropscape Acreage	200 km Corrected Cropscape Acreage
2014	15000	2673.60	17.82%	0.00	0.00
2013	25000	1904.40	7.62%	0.00	0.00
2012	15000	417.90	2.79%	0.00	0.00
2011	8000	947.40	11.84%	0.00	0.00
2010	7000	308.20	4.40%	0.00	0.00
2009	14000	974.90	6.96%	0.00	0.00
2008	23000	878.80	3.82%	0.00	0.00
2007	9000		Average		
2006	5000		5.96%		
2005	8000				
2004	15000				
2003	12000				
2002	7000				
2001	9000				
2000	9000				
1999	13000				
1998	13000				
1997	17000				
1996	10000				
1995	12000				

Table B-58. Wheat Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 200 km of Kennedy Space Center.

Wheat					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 200 km KSC Weighting Factor	Cropscape 200 km KSC Weighted Yield (kg / m ²)
2014	2.54E-01	0.07%	1.81E-04	0.00%	0.00E+00
2013	3.91E-01	0.18%	7.15E-04	0.00%	0.00E+00
2012	2.76E-01	0.07%	1.98E-04	0.00%	0.00E+00
2011	3.03E-01	0.04%	1.31E-04	0.00%	0.00E+00
2010	2.76E-01	0.04%	1.05E-04	0.00%	0.00E+00
2009	2.90E-01	0.07%	2.08E-04	0.00%	0.00E+00
2008	3.71E-01	0.15%	5.58E-04	0.00%	0.00E+00
2007	3.71E-01	0.06%	2.27E-04		
2006	2.83E-01	0.03%	7.19E-05		
2005	3.03E-01	0.05%	1.41E-04		
2004	3.03E-01	0.07%	2.03E-04		
2003	2.76E-01	0.05%	1.31E-04		
2002	2.36E-01	0.02%	5.20E-05		
2001	2.76E-01	0.03%	9.67E-05		
2000	3.30E-01	0.04%	1.31E-04		
1999	2.70E-01	0.05%	1.40E-04		
1998	2.90E-01	0.05%	1.42E-04		
1997	2.63E-01	0.06%	1.62E-04		
1996	2.56E-01	0.04%	1.01E-04		
1995	2.16E-01	0.04%	8.30E-05		

Table B-59. Wheat Acreage by year for USDA Land Truth and Cropscape within 100 km of Kennedy Space Center.

Wheat					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	100 km KSC Cropscape Acreage	100 km Corrected Cropscape Acreage
2014	15000	2673.60	17.82%	0.00	0.00
2013	25000	1904.40	7.62%	0.00	0.00
2012	15000	417.90	2.79%	0.00	0.00
2011	8000	947.40	11.84%	358.10	3023.85
2010	7000	308.20	4.40%	0.00	0.00
2009	14000	974.90	6.96%	0.00	0.00
2008	23000	878.80	3.82%	0.00	0.00
2007	9000		Average		
2006	5000		5.96%		
2005	8000				
2004	15000				
2003	12000				
2002	7000				
2001	9000				
2000	9000				
1999	13000				
1998	13000				
1997	17000				
1996	10000				
1995	12000				

Table B-60. Wheat Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 100 km of Kennedy Space Center.

Wheat					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 100 km KSC Weighting Factor	Cropscape 100 km KSC Weighted Yield (kg / m ²)
2014	2.54E-01	0.07%	1.81E-04	0.00E+00	0.00E+00
2013	3.91E-01	0.18%	7.15E-04	0.00E+00	0.00E+00
2012	2.76E-01	0.07%	1.98E-04	0.00E+00	0.00E+00
2011	3.03E-01	0.04%	1.31E-04	7.89E-02	2.39E-02
2010	2.76E-01	0.04%	1.05E-04	0.00E+00	0.00E+00
2009	2.90E-01	0.07%	2.08E-04	0.00E+00	0.00E+00
2008	3.71E-01	0.15%	5.58E-04	0.00E+00	0.00E+00
2007	3.71E-01	0.06%	2.27E-04		
2006	2.83E-01	0.03%	7.19E-05		
2005	3.03E-01	0.05%	1.41E-04		
2004	3.03E-01	0.07%	2.03E-04		
2003	2.76E-01	0.05%	1.31E-04		
2002	2.36E-01	0.02%	5.20E-05		
2001	2.76E-01	0.03%	9.67E-05		
2000	3.30E-01	0.04%	1.31E-04		
1999	2.70E-01	0.05%	1.40E-04		
1998	2.90E-01	0.05%	1.42E-04		
1997	2.63E-01	0.06%	1.62E-04		
1996	2.56E-01	0.04%	1.01E-04		
1995	2.16E-01	0.04%	8.30E-05		

B.4 Citrus

Table B-61. Citrus Acreage by year for USDA Land Truth and Cropscape within 200 km of Kennedy Space Center.

Citrus					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	200 km KSC Cropscape Acreage	200 Km Corrected Cropscape Acreage
2014	476300	1198206.50	251.57%	355050.60	141136.44
2013	489600	977569.00	199.67%	289703.70	145093.52
2012	495100	977255.60	197.39%	259530.80	131484.23
2011	503600	1192879.10	236.87%	359867.00	151925.72
2010	517100	1151972.20	222.78%	346730.90	155641.38
2009	530900	1075744.90	202.63%	320702.10	158272.42
2008	538900	1361744.50	252.69%	419025.00	165825.95
2007	554400		Average		
2006	576400		222.47%		
2005	641400				
2004	679000				
2003	718100				
2002	727600				
2001	756000				
2000	762400				
1999	777100				
1998	785900				
1997	815100				
1996	773500				
1995	731700				

Table B-62. Citrus Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 200 km of Kennedy Space Center.

Citrus					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 200 km KSC Weighting Factor	Cropscape 200 km KSC Weighted Yield (kg / m ²)
2014	2.62E+00	23.34%	6.11E-01	93.11%	2.44E+00
2013	3.21E+00	29.39%	9.43E-01	94.69%	3.04E+00
2012	3.48E+00	29.73%	1.03E+00	90.92%	3.16E+00
2011	3.32E+00	29.65%	9.83E-01	92.64%	3.07E+00
2010	3.10E+00	31.57%	9.78E-01	94.46%	2.93E+00
2009	3.58E+00	33.61%	1.20E+00	97.11%	3.48E+00
2008	3.80E+00	36.15%	1.37E+00	93.37%	3.55E+00
2007	2.93E+00	29.82%	8.74E-01		
2006	3.05E+00	31.56%	9.62E-01		
2005	2.66E+00	32.78%	8.72E-01		
2004	4.32E+00	43.03%	1.86E+00		
2003	3.51E+00	35.90%	1.26E+00		
2002	3.96E+00	38.50%	1.52E+00		
2001	3.69E+00	39.30%	1.45E+00		
2000	3.92E+00	39.97%	1.57E+00		
1999	3.13E+00	36.05%	1.13E+00		
1998	3.88E+00	39.71%	1.54E+00		
1997	3.63E+00	40.87%	1.48E+00		
1996	3.43E+00	40.70%	1.40E+00		
1995	3.70E+00	40.28%	1.49E+00		

Table B-63. Citrus Acreage by year for USDA Land Truth and Cropscape within 100 km of Kennedy Space Center.

Citrus					
Year	Florida State Wide Land Truth Acreage	Florida State Wide Cropscape Acreage	Acre Ratio (Cropscape / land truth)	100 km KSC Cropscape Acreage	100 km Corrected Cropscape Acreage
2014	476300	1198206.50	251.57%	71009.50	28227.04
2013	489600	977569.00	199.67%	54532.30	27311.64
2012	495100	977255.60	197.39%	55308.20	28020.40
2011	503600	1192879.10	236.87%	78923.40	33319.24
2010	517100	1151972.20	222.78%	72834.30	32694.03
2009	530900	1075744.90	202.63%	64017.90	31594.02
2008	538900	1361744.50	252.69%	76597.20	30312.76
2007	554400		Average		
2006	576400		222.47%		
2005	641400				
2004	679000				
2003	718100				
2002	727600				
2001	756000				
2000	762400				
1999	777100				
1998	785900				
1997	815100				
1996	773500				
1995	731700				

Table B-64. Citrus Yield by year for entire State of Florida and Weighted Yields for entire State of Florida and within 100 km of Kennedy Space Center.

Citrus					
Year	Yield (kg / m ²)	Florida Weighting Factor	Florida Weighted Yield (kg / m ²)	Cropscape 100 km KSC Weighting Factor	Cropscape 100 km KSC Weighted Yield (kg / m ²)
2014	2.62E+00	23.34%	6.11E-01	8.90E-01	2.33E+00
2013	3.21E+00	29.39%	9.43E-01	9.37E-01	3.01E+00
2012	3.48E+00	29.73%	1.03E+00	9.48E-01	3.29E+00
2011	3.32E+00	29.65%	9.83E-01	8.70E-01	2.88E+00
2010	3.10E+00	31.57%	9.78E-01	9.78E-01	3.03E+00
2009	3.58E+00	33.61%	1.20E+00	9.71E-01	3.48E+00
2008	3.80E+00	36.15%	1.37E+00	9.37E-01	3.56E+00
2007	2.93E+00	29.82%	8.74E-01		
2006	3.05E+00	31.56%	9.62E-01		
2005	2.66E+00	32.78%	8.72E-01		
2004	4.32E+00	43.03%	1.86E+00		
2003	3.51E+00	35.90%	1.26E+00		
2002	3.96E+00	38.50%	1.52E+00		
2001	3.69E+00	39.30%	1.45E+00		
2000	3.92E+00	39.97%	1.57E+00		
1999	3.13E+00	36.05%	1.13E+00		
1998	3.88E+00	39.71%	1.54E+00		
1997	3.63E+00	40.87%	1.48E+00		
1996	3.43E+00	40.70%	1.40E+00		
1995	3.70E+00	40.28%	1.49E+00		

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