Four All Seasons Fertilizer

Product Selection and Description

Four All Seasons is a fertilizer composed of corn products, soybean products, and animal by-products with a Nitrogen-Phosphorus-Potassium (NPK) ratio of 10-1-1. According to the manufacturer, it can be used as a substitute for certain petroleum-based fertilizers: for every two applications of the petroleum-based product, only one application of Four All Seasons is necessary.

For the BEES system, the functional unit for fertilizers is applying 10 kg (22 lb) nitrogen per acre for a period of ten years. A typical application of Four All Seasons is approximately 489 kg per hectare (436 lb per acre). Since nitrogen continues to be released in the second year, fertilizer use per acre, per year, is 132 kg (290 lb), assuming the application lasts 1.5 years. To achieve a 10 kg (22 lb) nitrogen per acre requirement, however, this amount is scaled down to 100 kg (220 lb) of fertilizer per acre per year.[1]

Flow Diagram

The flow diagram below shows the major elements of the production of this product, as it is currently modeled for BEES.

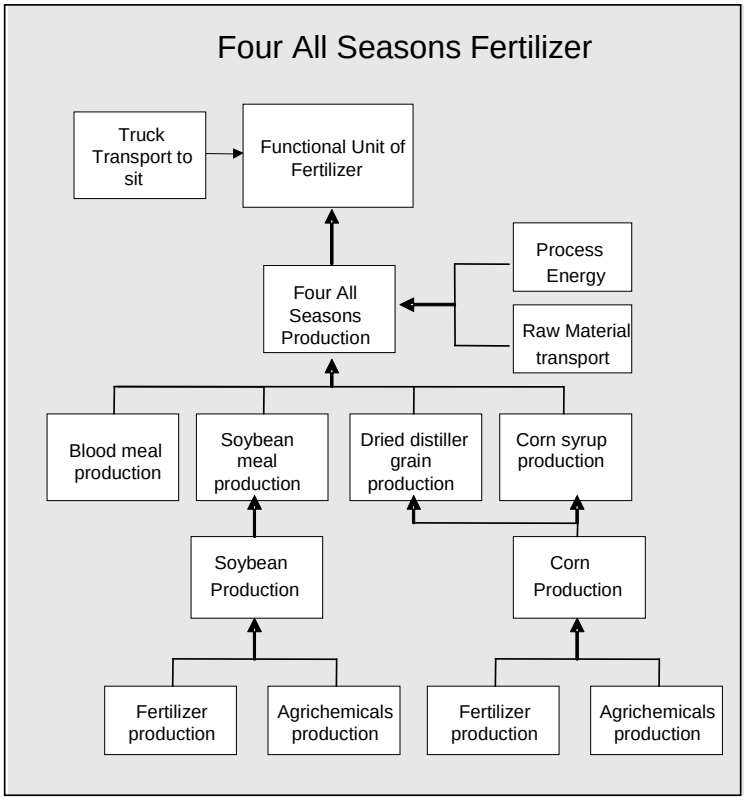

Figure 1: Four All Seasons Fertilizer System Boundaries

Raw Materials

Four All Seasons is composed of several animal- and vegetable-based products and byproducts.

Animal blood meal. Production of animal blood meal is based on European data for slaughterhouse residue production.[2]

[1] While this may not be the manufacturer's suggested rate of use for this product, an adjustment was made to enable comparison of BEES fertilizers on a functionally equivalent performance basis.

[2] Nielsen, H., 2.-0 LCA Consultants, July 2003. Found at: http://www.lcafood.dk.

***Dry distiller grain*.** Production of this product constituent is based on the dry milling process, in which the grain is a coproduct of ethanol. Various sources are used to generate data for the dry milling process.[3]

Corn syrup. This constituent is based on wet milling processes, and modeled with data from several sources.[4]

Soybean meal. Data for this product constituent is based on data from the National Renewable Energy Laboratory's (NREL's) LCA study of biodiesel use in an urban bus.[5]

Manufacturing

Energy Requirements and Emissions. Electricity and steam are used to produce Four All Seasons fertilizer. Four All Seasons provided site data for the amount of each in dollars per ton of fertilizer produced. The Table below translates this data into energy requirements for the production process. Natural gas is assumed to produce the steam.

Table 1: Four All Seasons Energy Requirements

Energy Carrier	*Quantity per kg*
Electricity[6]	0.065 MJ (0.018 kWh)
Steam[7]	0.1 kg (0.2 lb)

Transportation. The corn products are transported approximately 16 km (10 mi) to the Four All Seasons facility, and the soybean and blood meal products are transported approximately 97 km (60 mi) to the facility.

Solid Waste. Any solid wastes from manufacturing are reused in the system, so no wastes need to be modeled.

Transportation

A truck is assumed to transport the fertilizer to point of use, and the distance it travels is modeled as a variable in the BEES system.

Installation

Any burdens that may arise from on-site application of fertilizer are not accounted for in BEES.

Use

The nitrogen in the fertilizer is assumed to be released over a 1.5 year period. Four All Seasons fertilizer is fully biodegradable.

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[3] Graboski, Michael S., (National Corn Growers Association, August 2002); Shapouri, H., "The 2001 Net Energy Balance of Corn-Ethanol" (U.S. Department of Agriculture, 2004); U.S. Environmental Protection Agency, "Grain Elevators and Processes," Volume I: Section 9.9.1, *AP-42: Compilation of Air Pollutant Emission Factors* (Washington, DC: US Environmental Protection Agency, May 2003). Found at: http://www.epa.gov/ttn/chief/ap42/ch09/final/c9s0909-1.pdf.

[4] Galitsky, C., Worrell, E., and Ruth, M., LBNL-52307 (Ernest Orlando Lawrence Berkeley National Laboratory, July 2003); U.S. Environmental Protection Agency, "Corn Wet Milling," Volume I: Section 9.9.7, *AP-42: Compilation of Air Pollutant Emission Factors* (Washington, DC: US Environmental Protection Agency, January 1995). Found at: http://www.epa.gov/ttn/chief/ap42/ch09/final/c9s09-7.pdf.

[5] Sheehan, J. et al., NREL/SR-580-24089 (Washington, DC: US Department of Agriculture and US Department of Energy, May 1998).

[6] U.S. Energy Information Administration, Iowa's 2002 average price of electricity. Found at: http://www.eia.doe.gov/cneaf/electricity. The 2002 price corresponds to the date for which the manufacturer supplied data.

[7] U.S. Energy Information Administration, Iowa's 2004 average price of industrial natural gas. Found at: http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_a_EPG0_PIN_DMcf_a.htm. The 2004 price corresponds to the date for which the manufacturer supplied data.

End of Life

There are no end of life burdens for this product since it is fully consumed during use, eliminating the need for waste management.

References

Life Cycle Data

National Renewable Energy Laboratory (NREL): *U.S. Life-Cycle Inventory Database*. 2005. Golden, CO. Found at: http://www.nrel.gov/lci/database.

PRé Consultants: *SimaPro 6.0 LCA Software*. 2005. The Netherlands.

Graboski, Michael S., Fossil Energy Use in the Manufacture of Corn Ethanol (National Corn Growers Association, August 2002).

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Galitsky, C., Worrell, E., and Ruth, M., Energy efficiency improvement and cost saving opportunities for the corn wet milling industry, LBNL-52307 (Ernest Orlando Lawrence Berkeley National Laboratory, July 2003).

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Sheehan, J. et al., Life Cycle Inventory of Biodiesel and Petroleum Diesel for Use in an Urban Bus, NREL/SR-580-24089 (Washington, DC: U.S. Department of Agriculture and U.S. Department of Energy, May 1998).

Industry Contacts

Delayne Johnson, Four All Seasons (2005)