

# Dynamic Simulation of Grain Storage Facilities

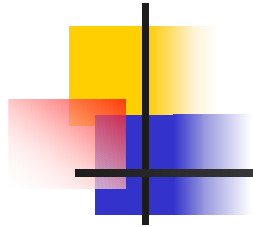
Part # 2

Grain Facility Library Application

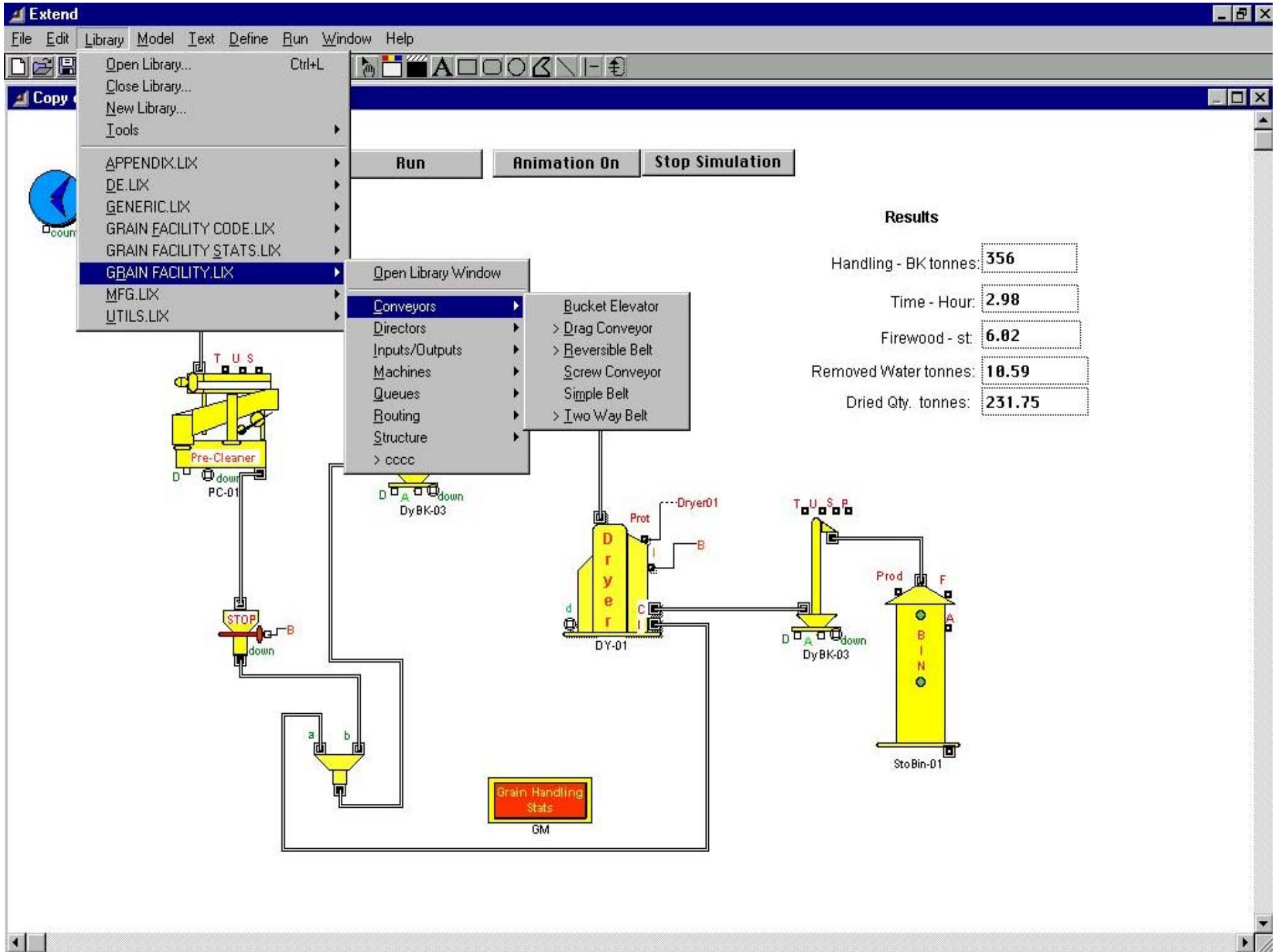
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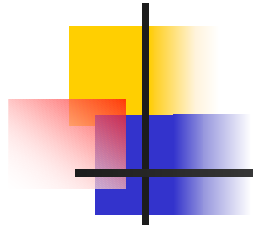
**By**

**Dr. Luís César da Silva**



# Modeling a Small Grain Facility





# Modeling a Commercial Grain Facility



# Type of Information Required

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- Flowcharts of grain storage facilities;
- Daily quantities of received products;
- Monthly quantities of dispatched products;
- Technical information about processing machines, conveyors and structures;
- Monthly electric energy consumption; and
- Firewood consumption.

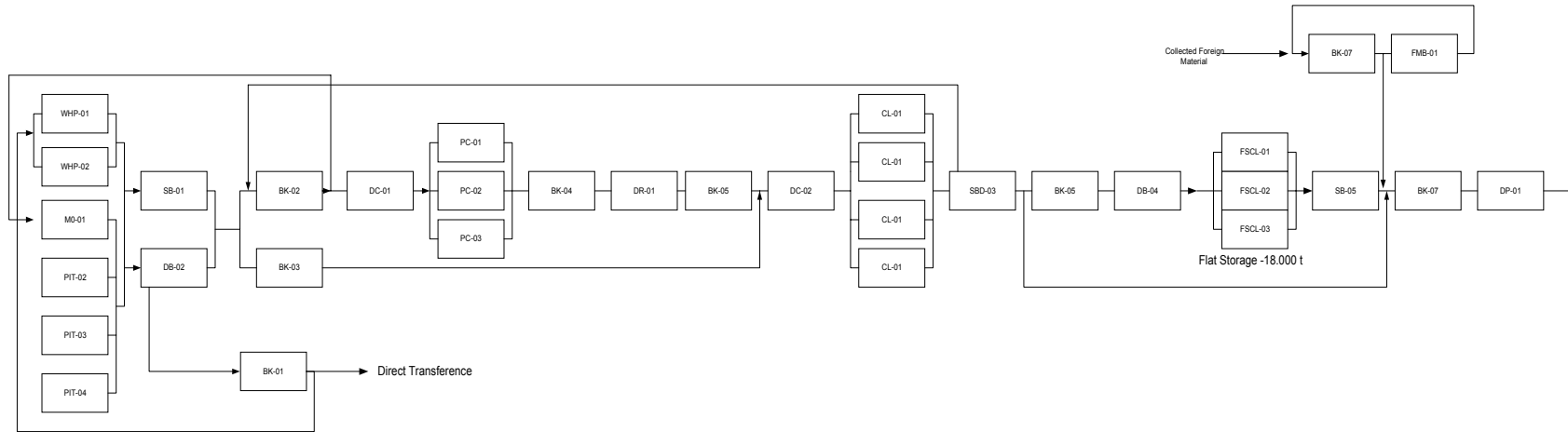
# Example: Modeling of Grain Facility A

(Technical Information)

Structure	Quantity	Static capacity (t)
Receiving Pit	4	300
Wet Holding Bin	2	300
Flat Storage		
Cell-01	2	5,000
Cell-02	1	8,000
Cell-03		5,000
Processing machines	Quantity	Hourly capacity (t/h)
Pre-Cleaner	3	40
Dryer	1	80
Cleaner	4	30
Conveyors	Quantity	Hourly capacity (t/h)
Belt	4	120
Two way belt	1	120
Bucket elevator	7	120
Drag conveyor	2	120

# Example: Modeling of Grain Facility A

(Flowchart)

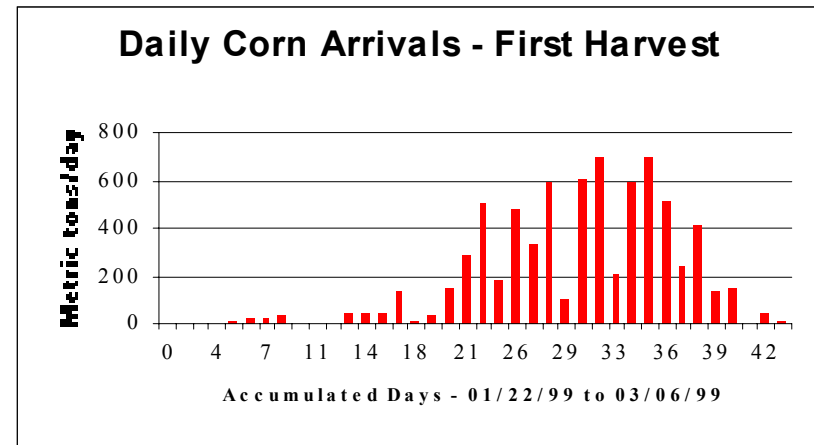
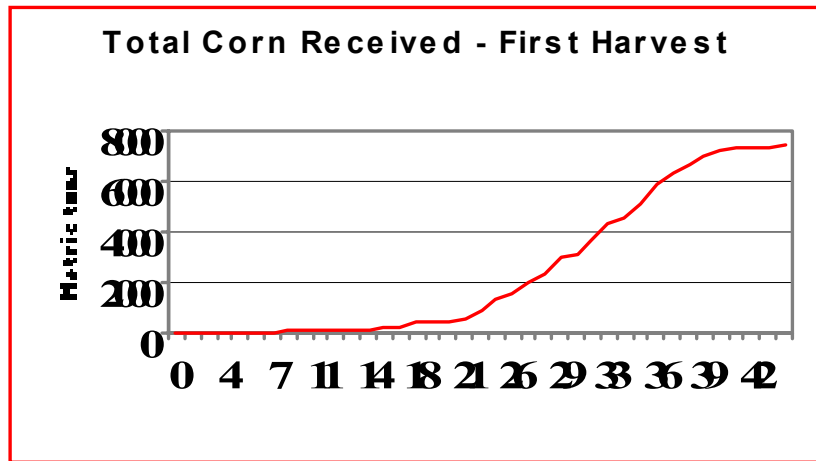


# Harvest Data – Facility A

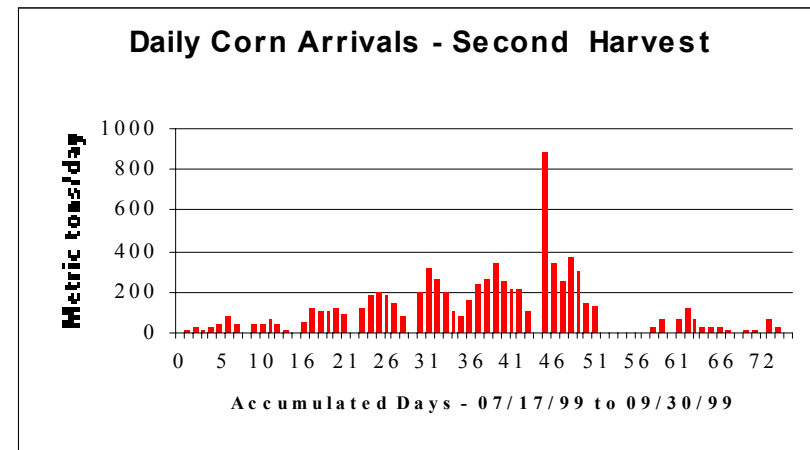
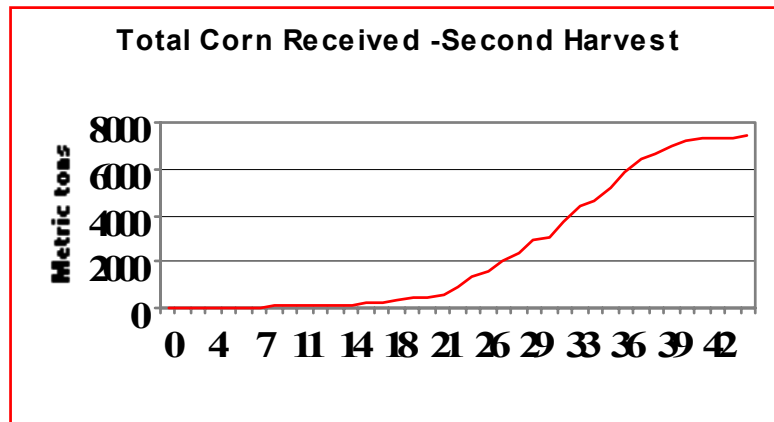
Total Quantities

Corn – Summer

Daily Quantities



Corn - Winter

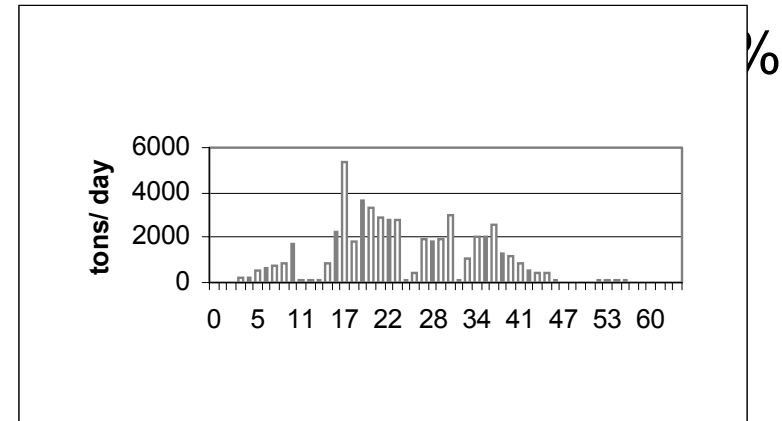
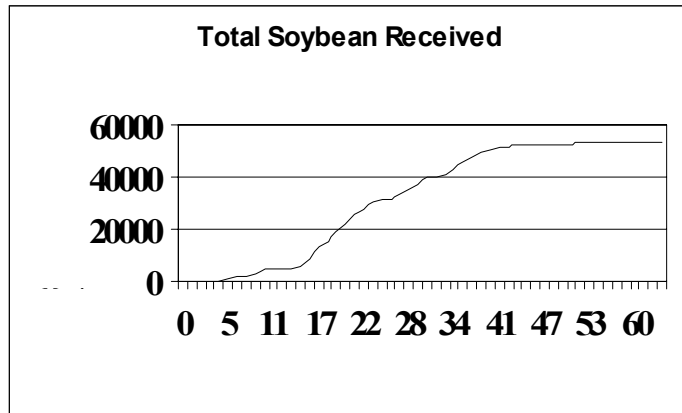


# Harvest Data – Facility A

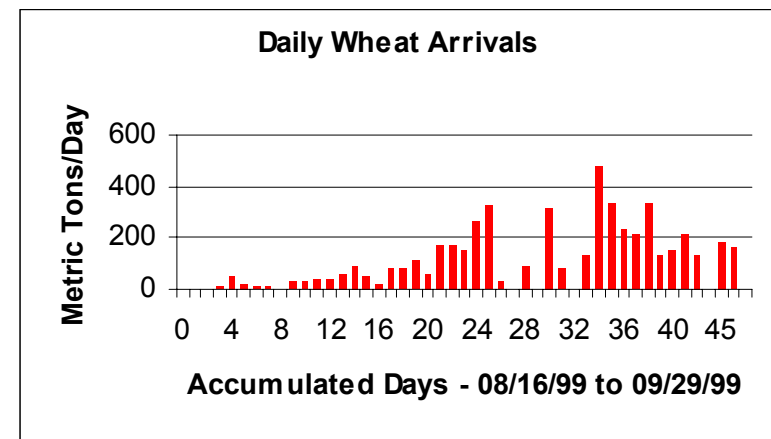
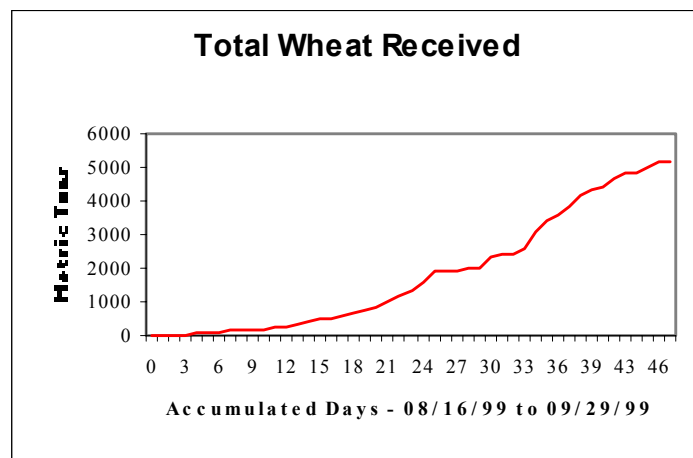
## Total Quantities

Soybean

## Daily Quantities



Wheat



# Annual Harvest Seasons



# Example: Modeling of Grain Facility A

(Harvest and Electric Energy Consumption)

- **Total Quantities of Received Products**

- Corn-Summer: 43 days - 7,376 tonnes
- Soybean: 63 days – 53 -179 tonnes
- Corn-Winter: 75 days - 7,804 tonnes
- Wheat: 44 days - 5,118 tonnes

- **Electric Energy Consumption**

- Total - On- Peak = 19,539 kWh Off-Peak 297,918 kWh
- R\$ 35,796.00 – US\$ 21,056.47

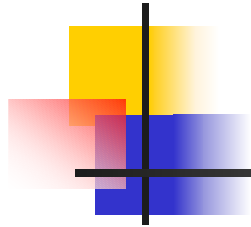
- **Firewood Consumption**

- 1,890 m<sup>3</sup> – R\$ 26, 460.00 - US\$ 15,564.70

# Example: Modeling of Grain Facility A

(Annual Dispatch Plan)

Month	Stock portions to be dispatched (%)		
	Corn	Soybean	Wheat
1	0	0	0
2	20.35	0	0
3	29.82	47.18	0
4	0.15	14.52	0
5	0	20.58	0
6	0	0.67	0
7	0	6.52	0
8	20.45	7.81	0
9	0.55	0.54	69.96
10	0.55	0	0
11	7.03	1.32	0
12	21.10	0.86	30.04



# Model of Grain Facility A



Powered by



# Dynamic Simulation of Grain Storage Facility

Current Time

Check List

*This model was developed by Luis Cesar as a part of his Ph. D. thesis.*

**Give a Double Click Here and See the Whole Model - Grain Storage Facility - A**

*20 types of reporters*

### Commands

- Run Simulation
- Stop Simulation
- Animation
- About This Model
- Close

### Inputs

- Arrival Data
- Dispatch Data
- Arrival Management
- Dispatch Management
- Economic Inputs

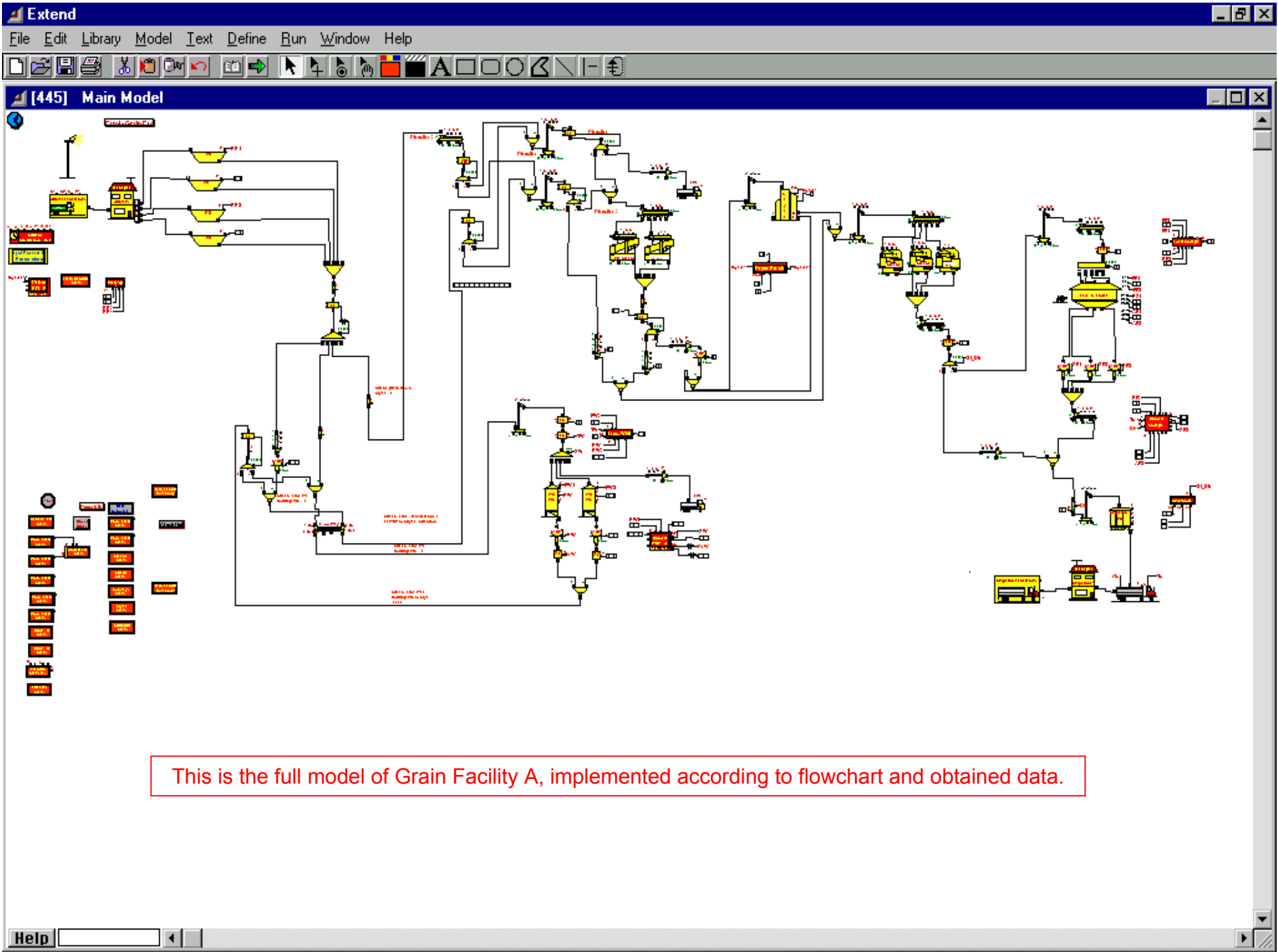
### Outputs

- Receiv. Grain Stats
- Proc. Grain Stats
- Stored Grain Stats
- Disp. Grain Stats
- Direct Transference
- Transference Dryer
- Transference - WHB
- Arrival - Trucks
- Dispatch - Trucks
- Electric Energy Use
- Fuel Use Stats
- Water Removed Stats
- Dried Grain Stats
- Grain Handling Stats
- Cleaner Stats
- Queue Stats
- Conveyor Stats
- Dryer Stats
- Structure Stats
- Load Delivered

#### Advisory Committee

Prof. Daniel Marçal de Queiroz, Ph. D., UFV  
 Prof. Rolando A. Flores, Ph. D., KSU  
 Prof. Evandro Castro de Melo, D. S., UFV  
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# Model Reports

## Received Grain Stats

[1751][328] Received Grain Stats

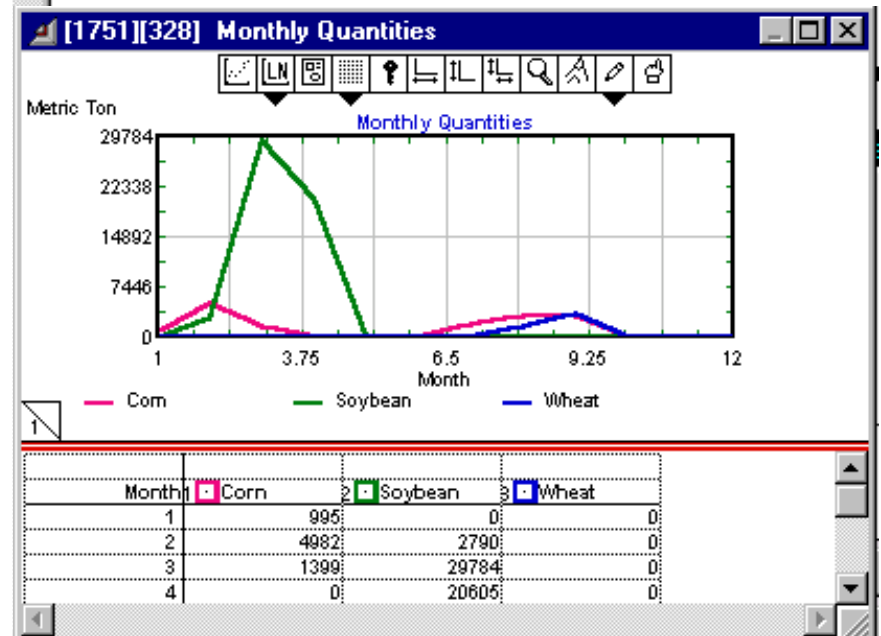
Item Stats | Grain Stats Acum. | Seek | Monthly Grain Stats

Received Grains [Update Now] [Cancel] [OK]

Month	Corn - t	Soybean -	Wheat - t	Total - t
0	1.00	995.00	0.00	995.00
1	2.00	4982.00	2790.00	7772.00
2	3.00	1399.00	29784.00	31183.00
3	4.00	0.00	20605.00	20605.00
4	5.00	0.00	0.00	0.00
5	6.00	0.00	0.00	0.00
6	7.00	1785.00	0.00	1785.00
7	8.00	3060.00	0.00	4671.00
8	9.00	2955.00	0.00	6462.00
9	10.00	0.00	0.00	0.00
10	11.00	0.00	0.00	0.00
11	12.00	0.00	0.00	0.00

[Plot]

Help | Received G



# Model Reports

## Stored Grain Stats

[1746][341] Stored Grain Stats

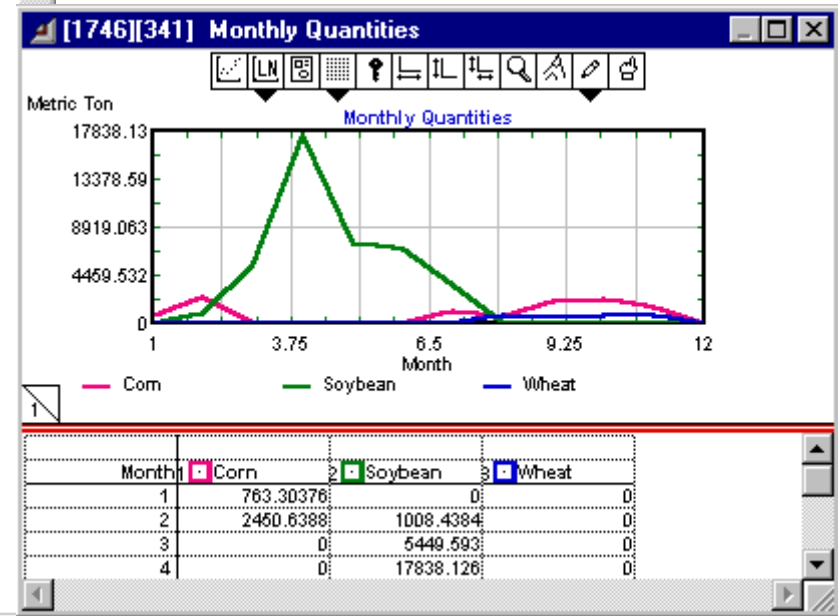
Processed Ac. (1) | Processed Ac. (2) | Dispatched Ac. | **Stored Stats**

Cancel OK

Month	Corn - mt	Soybean - mt	Wheat - m t	Total - mt	
0	1.00	763.30	0.00	0.00	763.30
1	2.00	2450.64	1008.44	0.00	3459.08
2	3.00	0.00	5449.59	0.00	5449.59
3	4.00	0.00	17838.13	0.00	17838.13
4	5.00	0.00	7486.93	0.00	7486.93
5	6.00	0.00	6800.42	0.00	6800.42
6	7.00	1123.75	3517.98	0.00	4641.73
7	8.00	585.23	0.00	751.82	1337.05
8	9.00	2127.72	0.00	628.11	2755.82
9	10.00	2321.64	0.00	655.15	2976.78
10	11.00	1404.90	0.00	655.15	2060.05
11	12.00	0.00	0.00	0.00	0.00

Plot

Help



# Model Reports

## Truck Traffic

### Receiving Sector

[429][299] Truck Traffic Stats

Item Stats Truck Stats Acum. Seek Monthly Truck Stats

Arrival Truck Traffic Stats Update Now Cancel OK

Month	Corn	Soybean	Wheat	Total
1	68	0	0	68
2	345	188	0	533
3	96	1999	0	2095
4	0	1387	0	1387
5	0	0	0	0
6	0	0	0	0
7	119	0	0	119
8	204	0	114	318
9	197	0	248	445
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0

Plot

Help Truck Arrival

### Dispatch Sector

[427][298] Truck Traffic Stats

Item Stats Truck Stats Acum. Seek Monthly Truck Stats

Dispatch Truck Traffic Stats Update Now Cancel OK

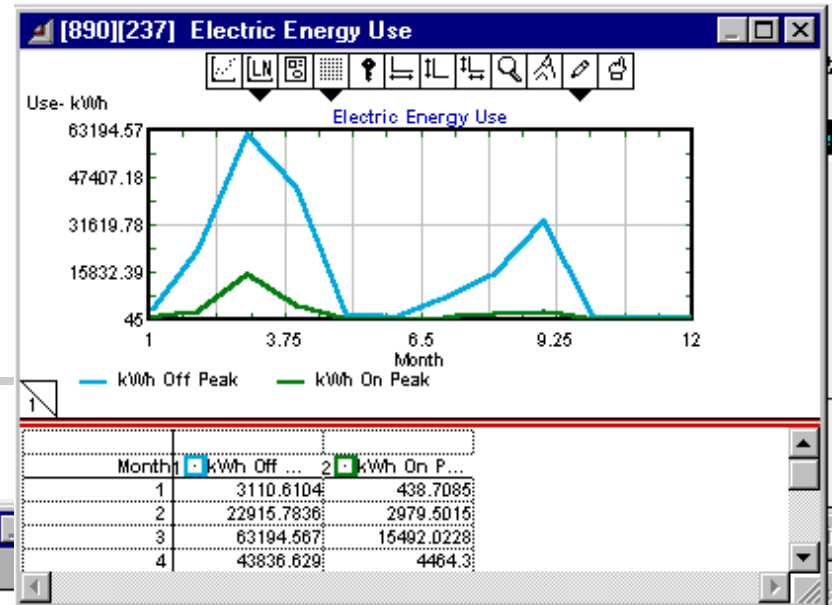
Month	Corn	Soybean	Wheat	Total
1	0	0	0	0
2	150	0	0	150
3	184	1020	0	1204
4	0	323	0	323
5	0	450	0	450
6	0	30	0	30
7	25	150	0	175
8	150	161	25	336
9	30	0	150	180
10	22	0	0	22
11	59	0	0	59
12	78	0	43	121

Plot

Help Truck Dispatch

# Model Reports

## Electric Energy Consumption



**[890][237] Monthly Electric Energy**

Main Results | **Monthly Results** | Annual Results | Seek

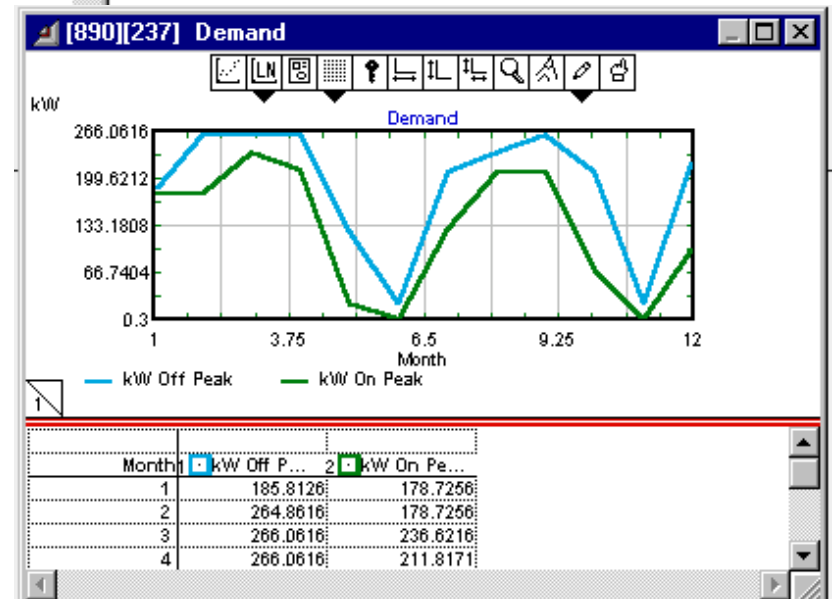
Records statistics on all electrical consumer blocks in the model.

Accumulated Totals per:  Hour  Day  Month

Time	Off kWh	On kWh	Off kW	On kW	Cost R\$	
0	1.00:	3110.61	438.71	185.81	178.73	0.00
1	2.00:	22915.78	2979.50	264.86	178.73	0.00
2	3.00:	63194.57	15492.02	266.06	236.62	0.00
3	4.00:	43836.63	4464.30	266.06	211.82	0.00
4	5.00:	2101.10	175.26	123.71	21.56	0.00
5	6.00:	431.60	45.00	22.76	0.30	0.00
6	7.00:	7033.02	717.52	207.07	126.86	0.00
7	8.00:	15191.13	1935.16	235.42	207.07	0.00
8	9.00:	32994.82	2476.90	266.06	206.73	0.00
9	10.00:	1542.33	182.93	208.27	69.04	0.00
10	11.00:	532.80	45.00	22.76	0.30	0.00
11	12.00:	730.90	45.00	218.83	96.14	0.00

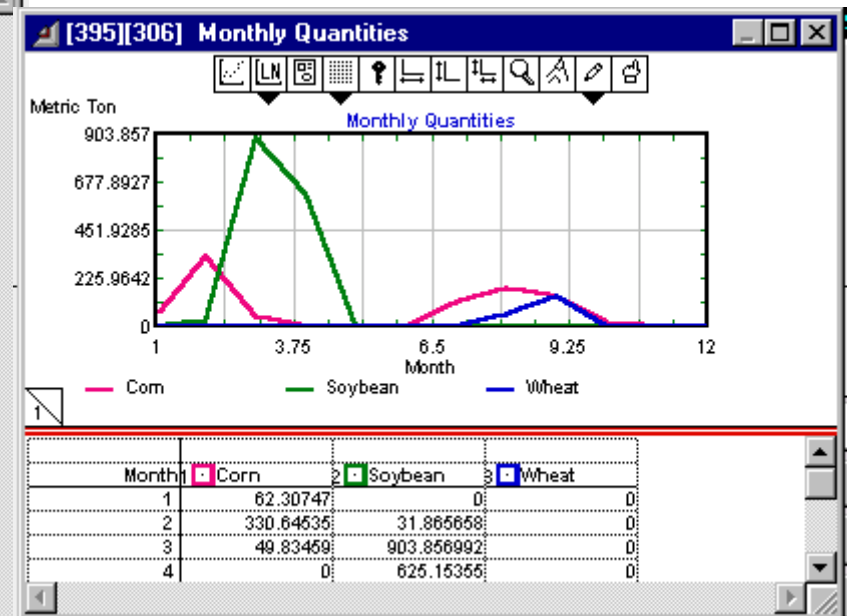
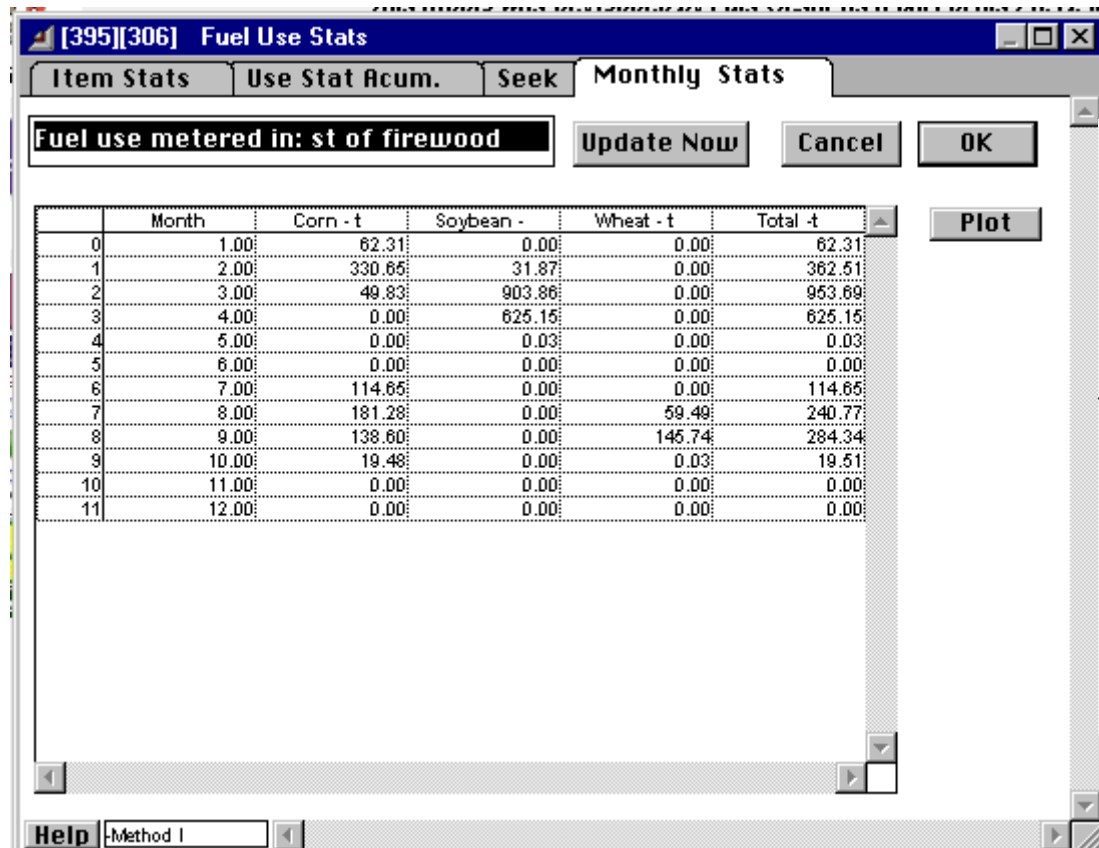
Plot Use - kWh | Plot Demand - kW

Help



# Model Reports

## Firewood Consumption – Warm drying air



## End – Part # 2

# Grain Facility Library Application

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**Please feel free to contact me:**

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