Crop Rotation Documentation

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Synopsis

The Crop Rotation model attempts to allocate crops to fields such that the consumption needs of the user are satisfied while adhering to a set of constraints, described below.

Elements of the model

There are some basic components of the model that are required for the model to exist. These are:

- A **Farm**, which is a collection of Fields
- **Fields** in the farm. A field is defined, in this model, as the unit of land that will be planted, as a whole, with a single crop. Thus it is the minimal, indivisible, planting unit. The fields can be used in the determination of the rotation or can be set aside. The fields have a *measure*, which is under user control and there is an amount of that *measure* in each field. In a vegetable crop setting, the measure will likely be *length* of row (feet or meters of beds or rows, depending on setup); in a farm crop setting, the measure will likely be *surface* of each field (acres or hectares in each field).
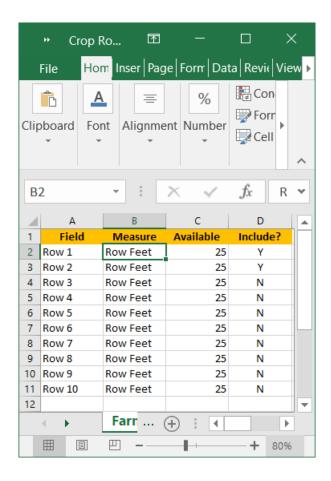
Importing Farm Data

The model accepts its data from an Excel spreadsheet with tab names that identify the elements of the model and tab columns that identify the attributes of the element. Both tab names and column structure must adhere to the standard format that follows. Three tabs are required in the model:

- Farmland
- Demand
- Crops

The spreadsheet must have at least three tabs named with the labels listed; without them the data import will fail.
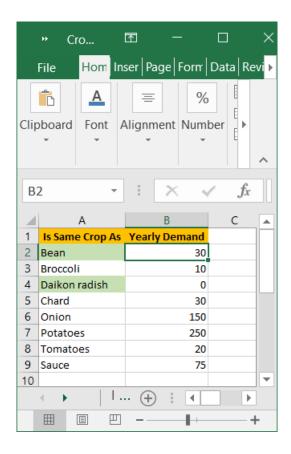
Farmland

The **Farmland** tab identifies the **Fields** in the **Farm** by name, their *Measure* and how much land is *Available*, and whether or not they should be *Included* in the rotation (acceptable values are Y or N). The contents of the **Farmland** tab looks like this:

Demand

The **Demand** tab identifies the Crop using a measure called **Is Same Crop As** (described under the Crop tab) and the amount of the crop required for a year or **Yearly Demand**. The unit of measure of the **Yearly Demand** is determined by the user and it requires consistency with the measure of yield in the Crop and by reference to the **Field** unit of measure; i.e., if the crop yields are expressed in pounds per foot of row then the demand should be expressed in pounds per year and the fields should be measured in row feet. The contents of the **Demand** Tab looks like follows:

Crops

The **Crops** tab identifies the crops the user considers planting and a large collection of attributes about those crops. It also indicates whether a crop is to be planted or not in column **Plant?**. The contents of the **Crops** tab that follows shows the columns of the spreadsheet in three images for clarity.

Crop	Family	Is Annual or Perennial?	Is Same Crop As
Asparagus	Asparagaceae	P	Asparagus
Barley	Poaceae/Graminaceae	A	Winter Hardy Grasses
Beans (bush)	Leguminoseae/Fabaceae	A	Bean
Beans (pole)	Leguminoseae/Fabaceae	A	Bean
Broccoli (early season)	Cruciferae	A	Broccoli
Broccoli (late season)	Cruciferae	A	Broccoli
Brussels Sprouts	Cruciferae	A	Brussels Sprouts
Buckwheat	Polygonaceae	A	Frost Kill Grasses
Clover, Red	Leguminoseae/Fabaceae	A	Winter Hardy Legumes
Daikon radish	Cruciferae	A	Daikon radish
Cabbage (early season)	Cruciferae	A	Cabbage
Cabbage (late season)	Cruciferae	A	Cabbage
Carrots (early season)	Apiaceae/Umbelliferae	A	Carrot
Carrots (late season)	Apiaceae/Umbelliferae	A	Carrot

The tab above collects the name of the **Crop**, its botanical **Family**, whether the crop **Is Annual or Perennial?**, although the model currently excludes perennial crops from the rotation and whether the crop contributes to meet the user demand as other crops, column **Is Same Crop As**. In the image you can see how both bush beans and pole beans produce the same product: bean.

J3 = 0.25

Crop	Is Heavy Feeder?	Is Weed Contributor?	Is Nitrogen Fixer?	Is Cover Crop?	Years between plantings on same field	Yield per Unit of Field
Asparagus	Y	Y	N	N		0.25
Barley	N	N	N	Y		
Beans (bush)	N	N	Y	N		0.75
Beans (pole)	N	N	Y	N		0.75
Broccoli (early season)	Y	N	N	N	2	0.5
Broccoli (late season)	Y	N	N	N	2	0.5
Brussels Sprouts	Y	N	N	N	2	0.5
Buckwheat	N	N	N	Y		
Clover, Red	N	N	Y	Y		
Daikon radish	N	N	Y	Y		
Cabbage (early season)	Y	N	N	N	2	1
Cabbage (late season)	Y	N	N	N	2	1
Carrots (early season)	Y	N	N	N		1
Carrots (late season)	Y	N	N	N		1

Farmland | **Crops** | Demand

The tab above repeats the **Crop**, as well as adding some attributes of the crop itself (**Is Heavy Feeder?, Is Weed Contributor?, Is Cover Crop?**, which the model will attempt to plant to keep the soil from laying bare) and constraints that the user wants to impose on the crop (**Years between plantings on the same field**). Finally, column J identifies **Yield per Unit of Field**, which represents the amount of product that the field will produce of the crop in the same units of measure as in the **Demand** tab and the **Farmland** tab.

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Days To Maturity	Plant?
Planting Times														
Asparagus			Y										7000	N
Barley									Y	Y	Y		100	N
Beans (bush)				Y	Y								50	Y
Beans (pole)				Y	Y								70	N
Broccoli (early season)			Y	Y									80	Y
Broccoli (late season)							Y						80	Y
Brussels Sprouts							Y						155	N
Buckwheat						Y	Y						80	N
Clover, Red									Y	Y	Y		90	N
Daikon radish							Y	Y					120	Y
Cabbage (early season)			Y	Y									100	N
Cabbage (late season)							Y						100	N
Carrots (early season)			Y	Y									90	N
Carrots (late season)							Y	Y					90	N

The tab above repeats the **Crop**, as well as adding attributes related to the planting season of the crop in your plant zone (columns K throuhg V), in this example Zone 7.The **Days to Maturity** identifies how long the specific crop the user has selected will stay in the ground before harvest, thus releasing the field for the next crop. The last column, **Plant?** identifies whether the crop is to be included in the rotation or excluded from it.