



vegIMPACT

User Manual

PermVeg: a generic tool to design and assess crop rotations for permanent vegetable production systems

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Improved Vegetable Production and Marketing for small farmers to Increase the Food Security status and to promote Private Sector Development in Indonesia



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User Manual

PermVeg: a generic tool to design and assess crop rotations for permanent vegetable production systems

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1. Introduction

Open field vegetable production by smallholders is globally an important activity contributing to food and nutrition security, private sector development and rural income. The identification and ex-ante assessment of alternative vegetable rotations is increasingly important to develop vegetable systems that are able to fulfil multiple and potentially conflicting objectives.

This manual describes a generic tool to design and assess alternative vegetable rotations. The model combines vegetable crops to generate all possible crop rotations for a given period, based on a number of explicit criteria (objectives and restrictions) controlled by the user. The criteria eliminate in early stages those crop rotations that are undesirable. The criteria relate among others to the most important socio-economic and environmental factors in vegetable production, i.e. profitability, labor requirements and costs of pesticide use.

The tool has been developed for the Red River Delta in Vietnam but has a generic functionality, which allows applying the tool to design and assess vegetable rotations also for other conditions. The research article that describes the model (Pham Thi Thu Huong et al., 2014) is available through the key combination "Shift+F1" in the PermVeg application. The model is a part of the PhD thesis of Pham Thi Thu Huong, which is available from: <http://edepot.wur.nl/298049>. In this manual we use and refer to the data file that has been developed for the Red River Delta. Some of these data can be used as default values for other conditions. However, other data (e.g. planting dates and crop profits) are location-specific and therefore need to be collected to design and assess crop rotations for given locations.

The model was originally programmed in GenStat software, but to make it available for a wider group of users it has been rewritten in Visual Basic.NET. This document describes the functionalities and use of this model. Programming of the model software was financed by the vegIMPACT project (www.vegimpact.com), which aims at improving vegetable production and marketing for small farmers in Indonesia.

2. PermVeg model

After installation of the PermVeg model on your computer an icon will be created at your desktop. After clicking the icon the model will open and the following opening screen (or similar screen with crop data) will appear:

The model has a number of icons to perform the following functions:

Button	Description
	Open a New PermVeg file Shortcut key: Ctrl+N
	Open an existing PermVeg file Shortcut key: Ctrl+O
	Save PermVeg file Shortcut key: Ctrl+S
	Save PermVeg file under a different location/filename Shortcut key: Ctrl+Shift+S
	Open <u>Properties</u> Collection Editor (see Chapter 3) Shortcut key: Ctrl+P
	Open <u>Properties</u> Filter Editor , see Chapter 4 (red square indicates active filter) Shortcut key: Ctrl+F
	Open <u>Botanical Families</u> Collection Editor (see Chapter 5)
	<u>Generate crop</u> with submitted data

You can exit the tool any time by closing the window through clicking the white cross in the red square in the upper right corner.

2.1 Crop rotation characteristics

The model requires the definition of a number of crop rotation characteristics, which are used as restrictions in the generation of alternative rotations. These user-defined characteristics are visible at the top of the opening screen:

Characteristic	Description
Start date	The date at which the first crop in a rotation is planted Format: month/day/ year
End date	The date at which the last crop in a rotation preferably has to be harvested Format: month/day/ year
Days around end date (+/-)	The number of days before and after the end date during which the harvest of the last crop in the rotation is acceptable
Consecutive crop interval	The number of days between the harvest of a crop and the planting of the next crop (e.g. to cultivate the plot)
Minimum sequence profit (visible only with some scenarios)	Crop rotations with a profit (/ha/day) below the minimum profit are discarded

The definition of the rotation characteristics is stored in the Windows registry. These settings are automatically reset the next time you start PermVeg.

2.2. Scenarios

The PermVeg model allows generating crop rotations for five default scenarios, which represent different objectives:

Scenario	Criteria for the selection of crops in rotations
Maximize income	Crops are selected that provide the highest profit
Minimize labor requirements	Crops are selected that minimize labor requirements of rotations while the minimum profit \geq user-defined minimum profit
Minimize costs of pesticide use	Crops are selected that minimize the cost of pesticide use while the minimum profits \geq user-defined minimum profit.
Maximize biodiversity	A maximum of only one member of a botanical family in a crop rotation is allowed, while profit is maximized
Minimize the selection of (crop) products with a high perishability	Only crops with perishability class 1, 2 or 3 (which represent low perishability, see section 2.3) are selected while profit is maximized.



You can define more scenarios by creating user-defined properties (see Properties Collection Editor in Chapter 3).

The last scenario is automatically retrieved the next time you start PermVeg.

2.3. Crop properties

The crops are quantitatively characterized by so-called crop properties, i.e. planting time during the year, profit, host species of pests and diseases common in a region, etc. Typically, information on crop properties is based on (local) expert knowledge.


The following crop properties need to be specified:

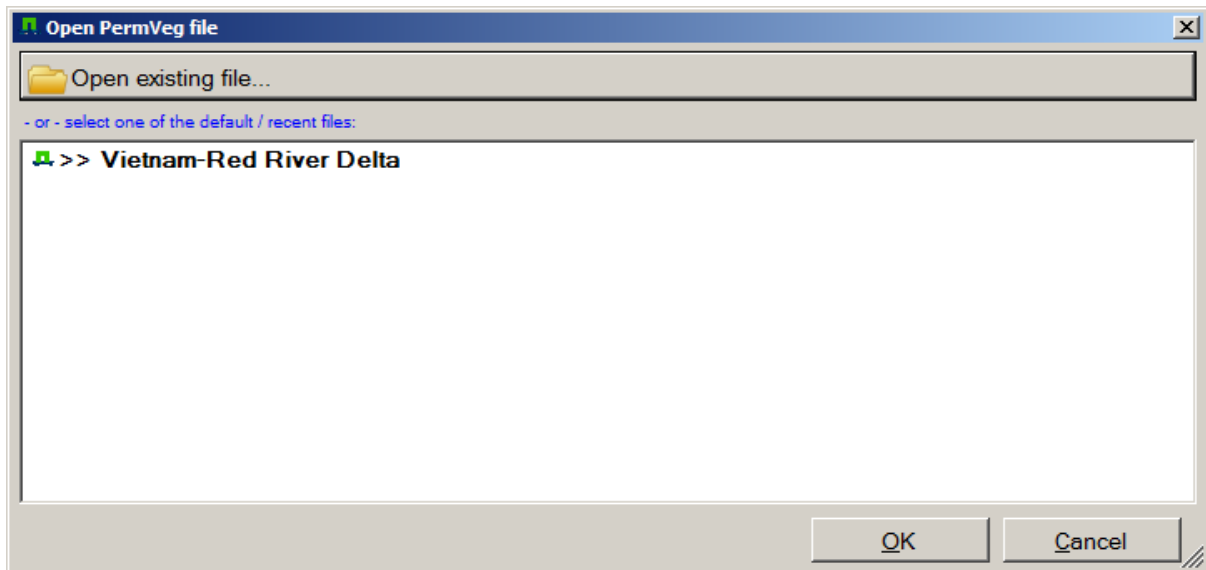
Property	Description
	Remove the crop from the list
<input checked="" type="checkbox"/>	If checked, the crop is available for generation of rotations
Crop	Name of the crop
Family	Botanical family of the crop This is used to define crops of distinct botanical families to reduce the risk of family-specific soil-borne pests and diseases (see also Chapter 5).
	Botanical Families Collection Editor (see Chapter 5)
Planting date - from	Starting date of the period in which the crop can be planted entered as day number and month number
Planting date - till	Last date at which the crop can be planted entered as day number and month number
Growth duration	Number of days from planting till harvest of the crop
Net profit	Nett profit per hectare (ha) per growing day (Gday)
Labor	Labor requirements per day (8 h) per hectare (ha) per growing day (Gday)
Pesticides	Pesticide costs per hectare (ha) per growing day (Gday)
Perishability	Perishability class indicating the maximum duration (in days) from harvest to selling: class 1: ≥ 180 days class 2: 21 days class 3: 4 days class 4: 2 days class 5: 1 day

User-defined properties can be added to this list, see the Properties Collection Editor in Chapter 3.

The properties in the list above are stored in a PermVeg file. A PermVeg file contains all properties,
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botanical families and crops in your current dataset. These files can be shared (e.g. by email) with other users of the application.

You can load predefined crop properties from a (default) PermVeg file by clicking the  button:




Default PermVeg files are shown in the list as bold items, starting with ">>".

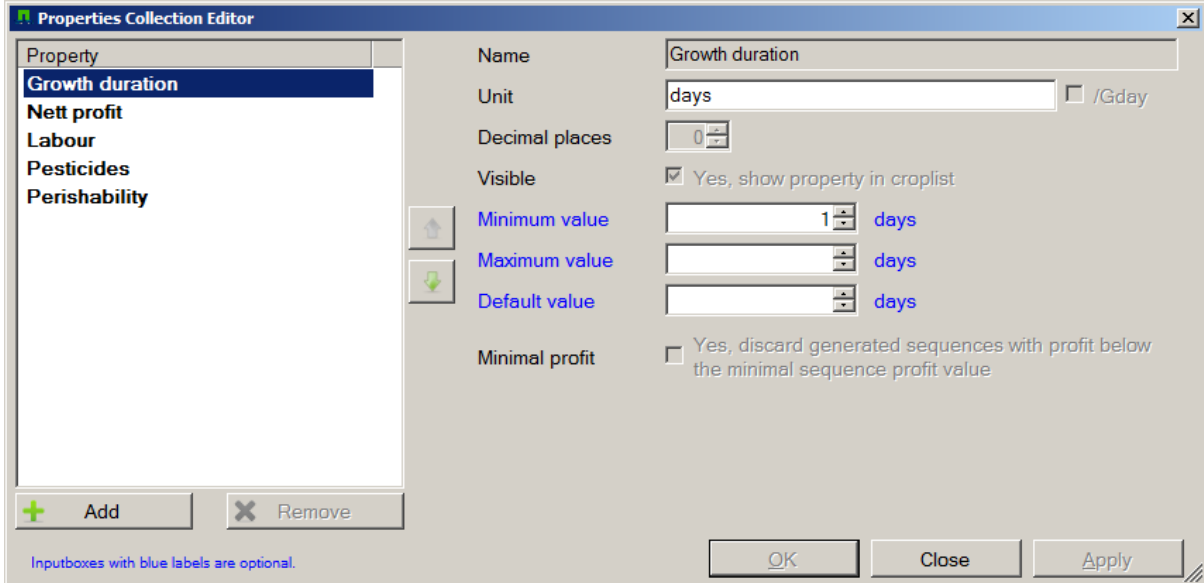
Recently opened or saved files are appended to this list.

You can save the PermVeg file by clicking , or save it under a different location/filename by clicking .

The last PermVeg file you use is automatically reloaded the next time you start PermVeg.

3. Properties Collection Editor

You can open the crop properties collection editor by clicking  :



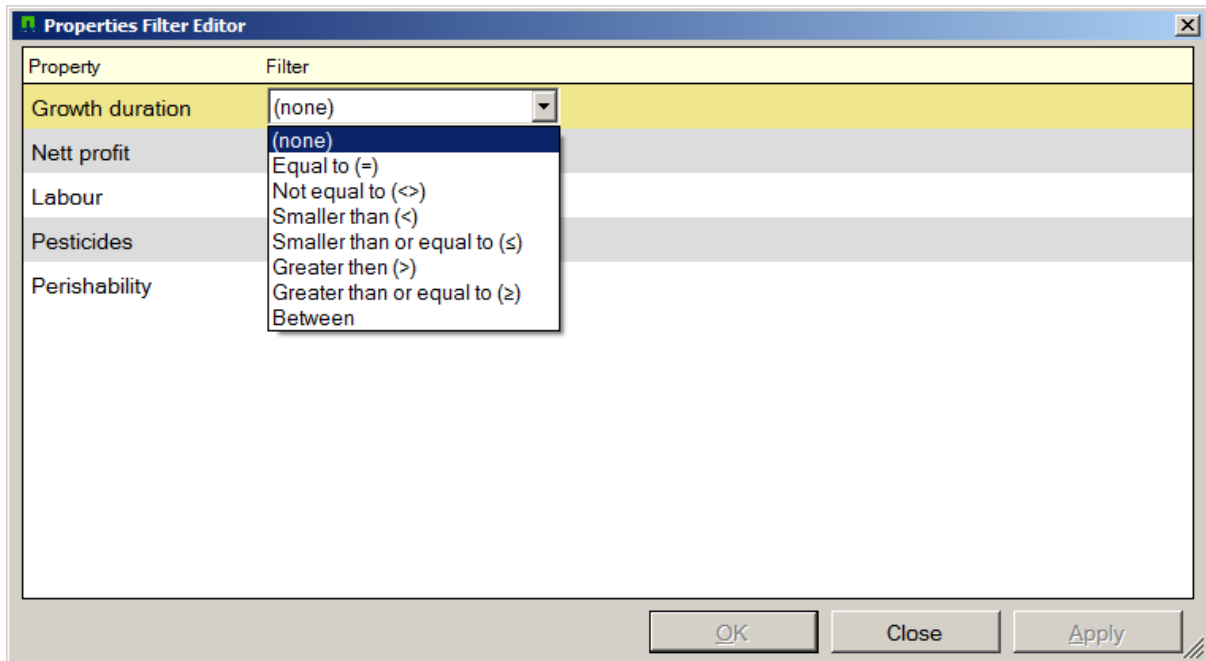
The PermVeg default crop properties are shown in the list as bold items. They cannot be deleted, and some of their values are locked.

Value	Description
Name	Name of the property
Unit	Unit of the property
/Gday	Indicates if the unit is per growing day (Gday)
Decimal places	Number of decimal places shown in the crop list
Visible	If checked, this property is shown in the crop list Mostly applies to user-defined properties
Minimum value (optional)	Minimum value that can be submitted to this property
Maximum value (optional)	Maximum value that can be submitted to this property
Default value (optional)	Default value that is used for this property (if no value is submitted in the crop list)
Minimum profit	If checked, the sequence generation process discards crop rotations with profits below the minimum profit restriction as shown in the main window

In this editor you can create your own user-defined crop properties, that can be used to filter crops available for generating crop rotations (see Properties Filter Editor, Chapter 4), or to create new scenarios. The properties are stored in a PermVeg file.

4. Properties Filter Editor


You can open the crop properties filter editor by clicking  or .



With this editor you can edit the crop property filters.

Only crops that match your filter criteria are used for generating crop rotations. Hence, these filters act as a constraint in the generation of crop rotations. For example: If you want to generate crop rotations that require over the entire growing season on average less than 3 workers per day, you can set the labor filter to 'Smaller than 3 day/ha/Gday'.

After you click OK or Apply, the crop list will discard/hide all crops with a labor requirement of 3 day/ha/Gday or more.

When a property filter is active, the filter button is shown with a red square: .

The property filters are stored in a PermVeg file.

5. Botanical Families Collection Editor

With this editor you can edit the botanical families of the crops in your dataset.

Value	Description
Name	Name of the botanical family
Crop interval	To reduce the accumulation of host-specific soil-borne diseases, you can specify the number of crops of different botanical families that need to be grown between crops of this family

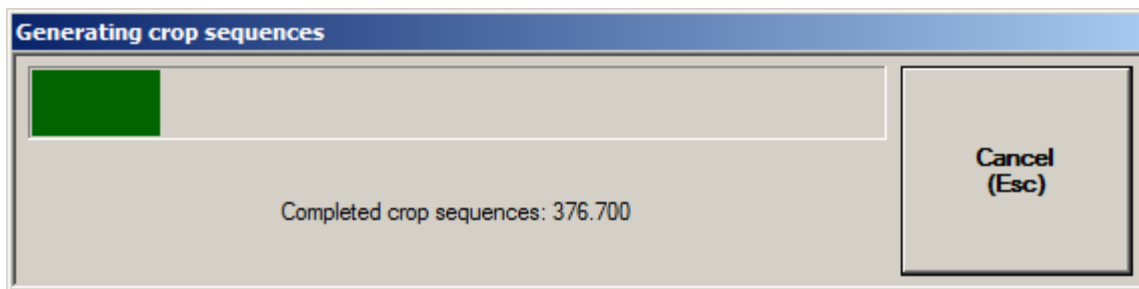
The botanical families are stored in a PermVeg file.

6. Generate crop rotations

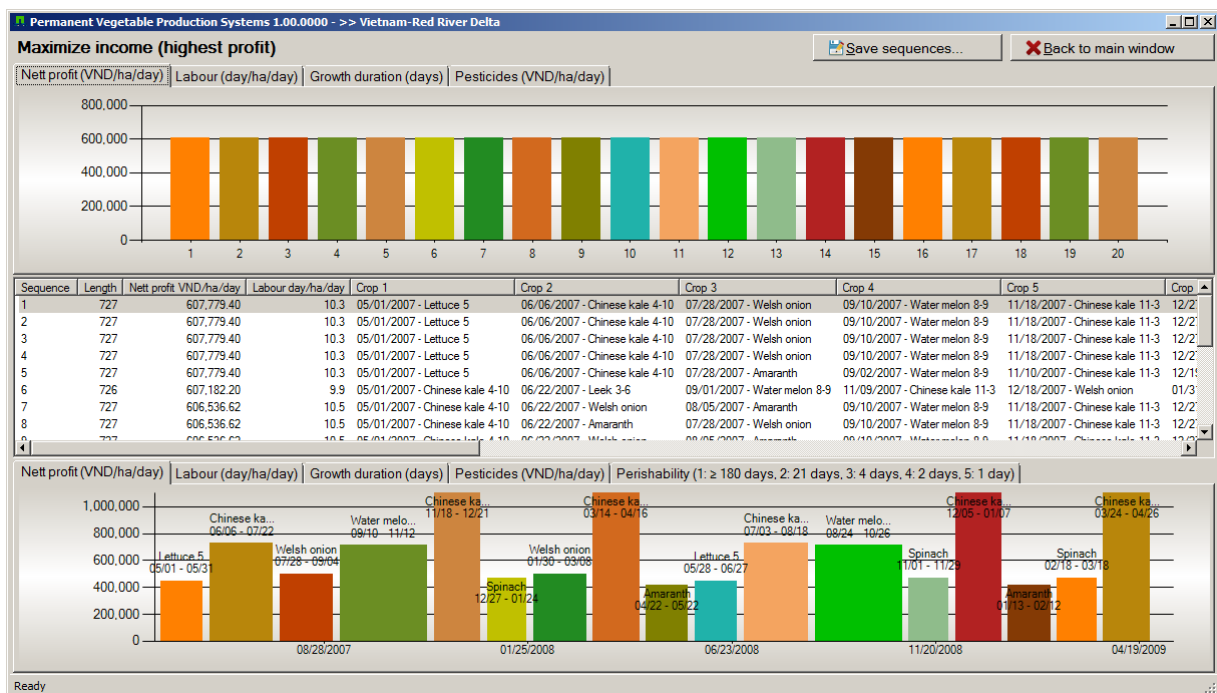
Generation of the crop rotations may take several minutes, depending on the submitted data and the capacity of your computer.



You can cancel the process at any time.

The progress is made visible with a progress window:



The results used in this manual are based on the default PermVeg file "Vietnam-Red River Delta".



Control	Description
 Save sequences...	<p>Export the crop rotation sequences as a csv-file (character-separated values).</p> <p>This file type can usually be opened with a spreadsheet program like MS Excel.</p>
 Back to main window	Leave the results view and return to the main window.
Top chart	Shows the property results for the complete crop rotation. Each property is shown in a different tab.
Middle list	Shows the consecutive crops in the sequences.
Bottom Gantt -chart	<p>Shows the property results for each crop in the selected crop rotation. Each property is shown in a different tab.</p> <p>When you hover your mouse over a crop, a tooltip with more detailed info on the crop is shown.</p> <p>The position and width of a crop are based on its planting date and growth duration. This visualizes the cultivation plan for the crop rotation.</p>