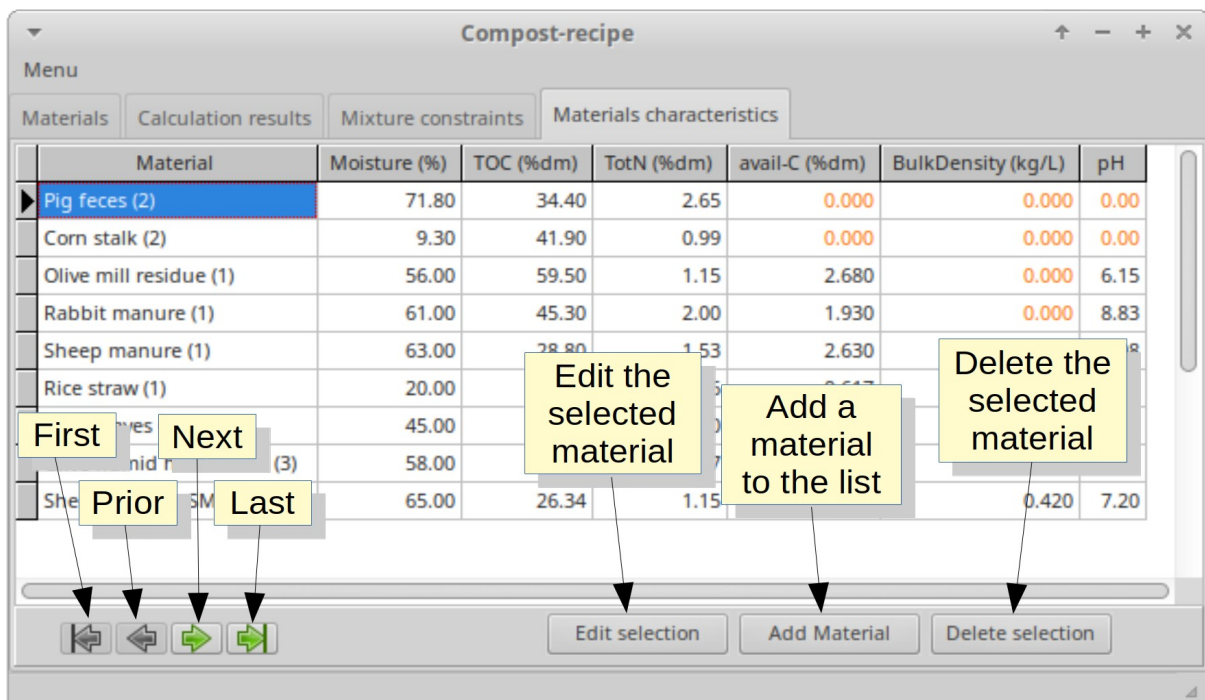# Compost-recipe help

Software configuration

At this stage, the parameters for Compost-recipe operative use must be defined.
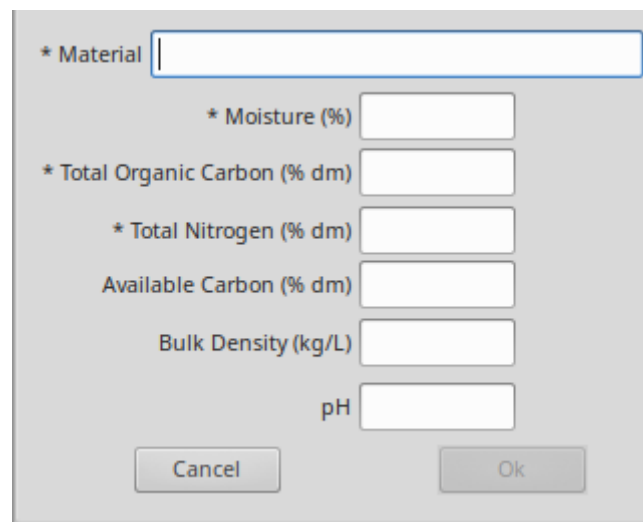
List of raw materials

The first step is to populate the list of organic materials susceptible to composting. There are many examples of lists of this kind available on the Internet, from which it is possible to draw the parameters useful for populating. It is known, however, that for each material these parameters are subject to considerable variability depending on the place and time in which the material was obtained, so it is appropriate to determine with appropriate analysis the chemical-physical characteristics of the available materials, to obtain more realistic values than those available in the databases. So, the list contained in the *Materials characteristics* tab of Compost-recipe can be easily updated and expanded at any time.

There you can insert new materials or modify the data of existing ones.

- To insert a new material click on the **Add Material** button.
- To modify the existing data, select with the mouse or with the arrow keys the row to be modified and click on the **Edit selection** button.

In both cases the window below opens, where you can enter new data or modify existing data. Data marked with an asterisk are mandatory and not zero; instead, if you don't know the value of the other parameters, you can insert the value zero (which in the list is highlighted with the orange color). <u>Units of measurement</u>: the values for carbon and nitrogen are expressed as a percentage of the dry matter; the Bulk Density is expressed in kilograms per liter.
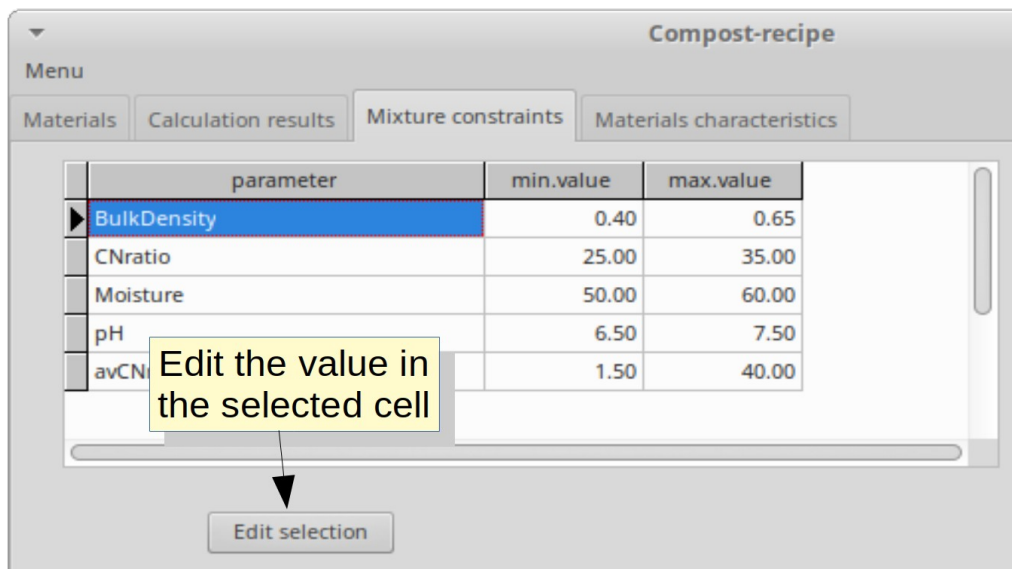

To delete a material select with the mouse or with the arrow keys the row to be deleted and click on the **Delete selection** button.

Chemical and physical constraints

The second configuration operation concerns the definition of the minimum and maximum acceptable limits in the mixture to be composted, for each of the chemical or physical parameters taken into account by the application. These data are reported in the *Mixture constraints* tab and can be modified at any time the user deems appropriate.

To change a value, select the cell to be changed with the mouse or arrow keys and click on the **Edit selection** button; a window opens, where you can modify the current value.

The units of measurement are the same as in the *Materials characteristics* tab.

Software operative use

Compost-recipe has the tab *Materials* for data input and the tab *Calculation results* for the output.

Data input

The tab *Materials* allows choosing the materials to be included in the composting mixture through selection within the list on the left; with the *Add* button you can add a selected material to the *List of available materials*, that reports all the data of the materials (just for viewing). With the *Remove* button you can delete a material from the list.

Following selection, a list of materials is formed for which it is necessary to indicate the maximum quantity available; all quantities must be expressed in the same unit of measurement (kilograms or tonnes).

For each material in the list, you can indicate the unit cost of supply, so that the software can calculate the total cost of the mixture. The costs are needed only in the case you want to minimize the total cost of the mixture, otherwise, you can omit it. You can express the costs in the currency you prefer.

For each material added to the list you can indicate, with a tick, if it is one of the main materials, that is a mandatory material for composting. Instead, the calculation procedure considers as potential additional materials (bulking materials) those without tick, taking them into account in the calculation only if necessary.

Constraints and objectives

The calculation can be performed taking into account different constraints and objectives, at the user choice.

Carbon parameters to consider

It is possible to choose which carbon content parameters to consider in the calculation, i.e. whether to take into account the total carbon or just the available carbon or both; it is appropriate to consider the available carbon rather than total carbon, but it has been decided to include this choice, because it is not always possible to have data on available carbon for all the materials considered and also to allow a comparison based on total carbon, which is still by far the most widely used parameter.

Calculation objectives

With the selection box *Objectives for main materials*, one of the three calculation criteria (objectives) is selected, as below reported.

Use the whole quantities:

this criterion formulates a mixture using the whole quantities of all the listed main materials, to avoid that there remain unprocessed materials, that should be treated or disposed of by methods other than composting. This criterion involves the possibility that it is necessary to find other materials, compared to those already listed, to ensure that the mixture to be composted has the needed characteristics; in this case, the calculation output will indicate the physical-chemical characteristics that it is needed to compensate with additional materials.

Maximize the mix quantity:

it formulates a mixture that maximizes the quantity of materials to be processed, choosing from all available materials. This criterion tends to use the maximum quantity of main materials available in the list, trying not to use additional "external" materials.

Minimize procurement cost:

it formulates the mixture that minimizes the procurement costs. Often it is necessary to sustain some costs (transport, shredding, etc.) because the materials available for the composting are effectively ready for the process; in this case the model of calculation optimizes the formulation of the mixture in function of such costs, supplying the percentage composition of the mixture that minimizes the unit cost of the mixture supply.

Running the calculation

When you click the *Run the calculation* button, the calculation is performed. By means of an iterative algorithm that takes into account, one at a time, all the main materials included in the list. This iterative mode allows considering an unlimited number of materials in the calculation.

The mixing hypothesis produced by the algorithm is then empirically assessed about the pH and the Bulk Density values; indeed the algorithm makes a simple estimate of a probable value they will assume in the mixture; this estimate is used just as a generic warning, since actually it is not possible to exactly forecast the value of these two parameters.

The *Calculation results* tab shows the calculation output: the total quantity of the mixture, the quantity of each material that makes up the mixture and the forecast of its chemical-physical characteristics. If the optimization procedure has not found a result consistent with the materials and constraints set, an alert message is written, highlighting which characteristics do not meet the minimum and maximum parameters set in the *Mixture constraints* tab; in this case it is possible to repeat the calculation including the bulking materials already added to the list; if this second attempt does not produce a valid result, a warning is issued on the need to add other suitable bulking materials.

Menu

| Materials | Calculation results | Mixture constraints | Materials characteristics |

It's impossible to find a solution

Description	Quantity or Value	Meas. unit	Cost or Warning
** The mix doesn't respect constraints **	**	**	**
-Mixture composition-			
Olive mill residue (1)	30	kg	
Rabbit manure (1)	100	kg	
Sheep manure (1)	30	kg	
-Mixture characteristics-			
Moisture	**60.44	%	need to add a low moisture material
C:N	26.07		
avail-C:N	**1.27		need to add a high available-C:N ratio material
Bulk Density (very presumed value)	-	kg/L	
pH (very presumed value)	**8.19		verify the mixture pH

[Repeat the calculation]   You can repeat the calculation, including bulking materials

Results of objective "Use the whole quantities"

Menu

| Materials | Calculation results | Mixture constraints | Materials characteristics |

Maximized quantity with the right proportions of main materials

Description	Quantity or Value	Meas. unit	Cost or Warning
-- Maximized composting quantity	95.61	kg	281.22
-- Mixture composition			
Olive mill residue (1)	30.000	kg	150.00
Rabbit manure (1)	38.417	kg	76.83
Sheep manure (1)	27.194	kg	54.39
-- Mixture characteristics			
Moisture	60.00	%	
C:N	28.97		
avail-C:N	1.50		
Bulk Density (very presumed value)	**0.00	kg/L	
pH (very presumed value)	7.78		

Results of objective "Maximize the mix quantity"

Compost-recipe

Menu

Materials | Calculation results | Mixture constraints | Materials characteristics

Right proportions of main materials to minimize the unitary procurement cost

Description	Quantity or Value	Meas. unit	Cost or Warning
-- Composting mixture with minimum cost	**100.00**	**%**	**2.94**
-- Mixture composition			
Olive mill residue (1)	31.377	%	1.57
Rabbit manure (1)	40.181	%	0.80
Sheep manure (1)	28.442	%	0.57
-- Mixture characteristics			
Moisture	60.00	%	
C:N	28.97		
avail-C:N	1.50		
Bulk Density (very presumed value)	****0.00**	**kg/L**	
pH (very presumed value)	7.78		

Results of objective "Minimize procurement cost"

Saving and loading a mixture

The list of materials (mixture) formulated in the *Materials* tab can be saved with the *Save mix to file* command from the Menu. The saved file is a comma delimited text file.

A saved mixture can be reloaded with the *Load mix from file* command from the Menu.

By default, the files are saved in the *mixtures* folder inside the application folder; but you are free to save it in another folder.