Ration Planning Tool User Manual: Poultry and Swine

Loïc Labidalle, Antoine Roinsard, Muhammad Sani Ahmad, Barbara Frueh, Lauren Dietemann

Should corrections and updates become necessary, they will be published at https://organic-farmknowledge.org/

This manual is available for download at https://organic-farmknowledge.org
Any inquiries regarding this book and its contents should be sent to either:

- Antoine Roinsard, ITAB, 9, rue André Brouard, BP 70510, 49105 Angers Cedex 02, France, antoine.roisard@itab.asso.fr, or
- Barbara Frueh, FiBL, Ackerstrasse 113, 5070 Frick, Switzerland, barbara.frueh@fibl.org

This user manual and the tool should be cited as:
Loïc Labidalle, Antoine Roinsard, Muhammad Sani Ahmad, Barbara Frueh, Lauren Dietemann (2020): Ration Planning Tool and User's Manual: Poultry and Swine. Organic Food and Farming Institute ITAB, Angers, Research Institute of Organic Agriculture FiBL, Frick and IFOAM Organics Europe, Brussels. Permalink: https://orgprints.org/38690

Cover picture: "Finishing broiler on a free range area" by Rémi Chazerault

Permalink for ration planning tool and manual: https://orgprints.org/38690

Table of Contents

Table directory

List of Figures

1. Genesis and development of the ration planning tool

1.1 Creation of the tool

Work is underway to provide a solution for farmers to formulate their feed themselves using calculation software. The objective is to reduce the cost of feed production and satisfying consumer expectation for traceability of production. An internship led by the Organic Food and Farming Institute ITAB made it possible to re-evaluate the objectives and assess the current situation on the subject. Many feed production software's already exist, but do they meet the needs of organic animal producers? Does the software provide 100% organic feed for monogastric animals? Does the software have enough regional and organic feedstuffs listed? Is the software easy to manage and operate by end-users?. These are the challenging questions that were intended to be addressed by this tool.

The tools analysed did not provide adequate answers to the questions asked above, hence the necessity to improve the format of feed formulations software to meet the needs of organic producers. That being said, in order not to start from scratch, the development was based on an existing tool (used by Les Bios du Gers). This particular software was chosen as the bases for development because of its ease of use.

The new version of the software improves the feed database to meet the needs of organic farmers. The tools objective is to help farmers achieve a 100% organic diet for monogastric animals by improving the feed database programme. This aligns with the feed objectives for the coming years, the goals of farm autonomy, as well as the general aims of the OK-Net Ecofeed project.[1]

1.2 Conditions of use and installation

The use of Microsoft Office Excel is required. All versions since 2010 will work, but if you want to use the ration optimisation option, you will need at least the 2016 version.

Although the tool is easy to use, you will need a minimum of technical knowledge in monogastric feeding and ration composition as well as computer skills.

The feed rations formulated using this tool, and results are the responsibility of the user. It is an aid that makes it easier for the user to understand and plan rations but does not guarantee the successful ration implementation. Hence, the importance of a minimum level of competence or training provided by authorised persons.

---

[1] The project OK-Net EcoFeed – Organic Knowledge Network on Monogastric Animal Feed, running from 2018 to 2021, aims at helping organic pig and poultry farmers in achieving the goal of 100% use of organic and regional feed. More information is available at https://organic-farmknowledge.org/about/partner-projects/ok-net-ecofeed.

2. Overview of the tool

2.1 Objectives

The tool allows the user to compose rations for pig and poultry farming based on two entries:

- Production objectives (Types of animals, age, slaughter weight, laying potential...) and
- Usable organic feedstuffs.

The objective is, therefore, to be able to benefit from well identified parameters so that users can formulate their rations and judge whether or not they are species-appropriate. For this purpose, a base of nutritional needs of animals and organically produced raw materials are already listed in the tool. It will thus be possible for the user to formulate their own rations, judge the usefulness of a feedstuff according to its nutritional qualities or its price, test compositions, adjust nutritional needs and use an optimisation tool allowing to create coherent rations at the lowest cost.

2.2 Excel sheets and their functions

The Excel tool consists of 8 spreadsheets, three of which can be modified, as seen in Figure 1:

The spreadsheet that allows you to formulate your rations and which will be detailed in the following chapters.

A database composed of more than 80 organic feedstuffs as well as the possibility to analyse raw materials or nutritional data (cannot be modified).

A database with different production scenarios referenced and technically validated in different European countries by technical institutes and detailed species-specific nutritional requirements. Here, it is possible to add scenarios based on personal experience or expertise (according to the specificities of regional production, local practices...).

The roughage feeding sheet offers the possibility to calculate a feed ration including roughage or forage feeding.

A sheet summarising the ration performed and the results obtained (cannot be modified).

Figure 1. Excel sheets available on the software and their description. Sheets highlighted in yellow are modifiable

In this user manual, an example is provided within the poultry tool. As the poultry and swine tool are the same in their functionality, the example used also applies to the swine tool.

When the tool is downloaded a feed ration example is present, to clear this example and bring with entering your own figures for calculation, click on the button 'Reset all' in the 'Tool' sheet.
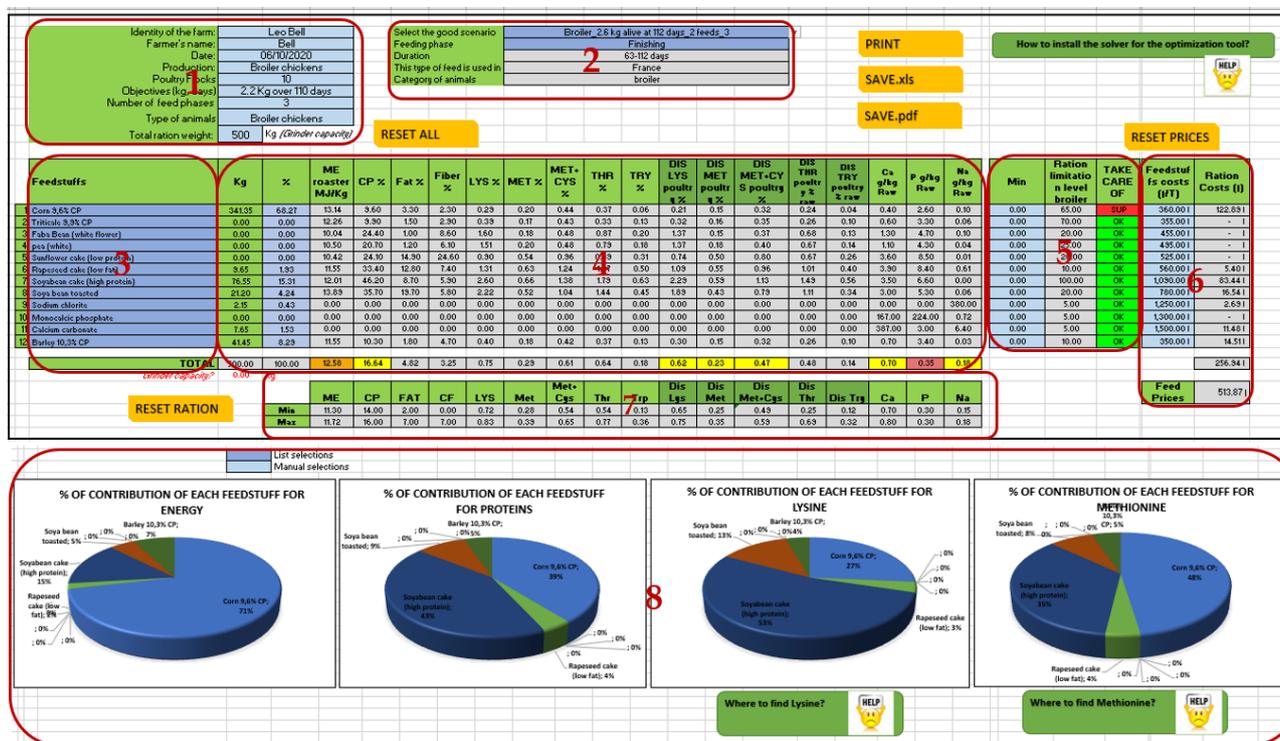
Figure 2. 'Tool' sheet broken into eight zones, indicated in red

3.   Formulating rations using the 'Tool' sheet

 Following this general presentation, we will focus mainly on the 'Tool' sheet.

The tool sheet can be broken down into eight zones as seen in Figure 2 (plus specific macro features and optimisation possibilities). The majority of the cells are automatic calculations. The user can modify only the blue cells; light blue for manual entries and dark blue for list selection. Here an overview of each zone is provided:

- Zone 1 is the area for the information on the farm, the type of animal and the feeding type. The total ration weight is used to calculate the feed component quantity.

- Zone 2 shows relevant calculation information on feeding are given. The feeding scenario and the feeding phase are selected.

- Zone 3 the feed components can be selected. The feed components are listed alphabetically in the selection function.

- Zone 4 the percentage quantities of the feed components are entered. This transfers the contents of the components from the feed database, displays them and sums them up.

- Zone 5 shows whether and how high a possible feed restriction exists for a component.

- Zone 6 a cost calculation of the ration is made possible by entering the component prices.

- Zone 7, the minimum and maximum values of relevant feed ingredients or contents are shown.

- Zone 8 graphically represents the importance of the individual feed component for the supply of protein, energy and relevant amino acids.

3.1 Zone 1: Identity of the farm and description of its objectives

Identity of the farm:	Leo Bell	
Farmer's name:	Bell	
Date:	10/6/2020	
Production:	Broiler chickens	
Poultry Flocks	10	
Objectives(Kg, days)	2,2 Kg over 110 days	
Number of feeding phases	3	
Type of animals	Broiler chickens	
Total ration weight:	500	Kg (Grinder capacity)

Table 1. Zone 1 from tool sheet, identify farm and animals

The part in the upper left corner of the tool, as seen in Table 1, is used to identify the farm and the animals that will be receiving the feed ration. The information will be displayed in the export of the results to be integrated into the monitoring file or farm records.

The columns objectives, number of feeding phases and type of animals allow the software to associate the objectives of the farm to an existing scenario in the database.

It is essential to enter the total ration weight of feed produced (often corresponding to the capacity of the grinder) because the composition is entered in % of feed.

3.2 Zone 2 and 'Poultry_Needs' Sheet: Selection of feeding goals and nutritional needs

The appropriate definition of the breeding objectives is essential. The database can display nutritional requirements for a specific scenario and feeding phase. However, it is often necessary to adapt the nutritional requirements to the local context or to define the minimum and maximum requirements according to the desired flexibility relative to one's objectives.

Table 2. Zone 2 of 'Tool' sheet, objective table. Case 1 on left, case 2 on right

Select the good scenario	Broiler_2,6 kg alive at 126 days_3 feeds_3
Select the phases	Finishing
Duration	63-126 days
This type of feed is used in	France
Category of animals	broiler

Select the good scenario	Broiler_2,6 kg alive at 126 days_3 feeds_3
Select the phases	Single feed
Duration	#REF!
This type of feed is used in	#REF!
Category of animals	#REF!
	SCENARIO NOT AVAILABLE

3.2.1 Zone 2: Selection of listed objectives

To capitalise on the existing nutritional requirements, select the scenario corresponding or closer to its objectives from the drop-down list, then assign the feeding phase corresponding to your animals' age.

If the scenario does not exist (case 2 in Table 2 above) a red error message appears, 'Scenario not available' and the objective table under the calculator is not completed.

In the case where the combination scenario/feeding phase exists (case 1 in Table 2) elements on the origin of the data appear (the country where its objectives are used, feed distribution period, animals concerned...),

3.2.2 'Poultry_Needs' sheet: Create your own objective scenario

In case a scenario does not exist, is not listed or needs to be adjusted, you have the possibility to incorporate your own materials. The data you enter, as well as the responsibility of defining new objectives, belongs to the users.

To do this, go to the poultry needs sheet, as shown in Figure 3. A list of scenarios is already referenced (Column: Obj_reference), a row corresponding to the physiological stage and therefore minimum and maximum needs. This existing list cannot be changed.

| 🔒 Impressum | **Tool** | 🔒 Database_Feedstuffs | 🔒 Poultry_Needs | Roughage_Forage | 🔒 PDF_Export | 🔒 About | 🔒 References |

Figure 3. Software sheet navigation to 'Poultry_Needs' sheet.

Before you enter your new objective elements, get the production details and the minimum and maximum objectives (or average if you want to get closer to these objectives) and fill in the information from column J to AQ:

> The metabolisable energy requirements (in megajoules), the global objective of protein (%), fat (%), fiber (%), the protein's breakdown in total and digestible amino acids (Lysine, Methionine, Threonine, Methionine+Cysteine, Tryptophan) with the corresponding units in the tool (% or g/Kg) and finally the main minerals to be always monitored in the corresponding units (Calcium, Sodium and Phosphorus).

Table 3. 'Poultry_Needs' sheet example of entering a new objective scenario

Obj_reference	Scenarios_reference	Production	Scenarios	Nb phasis	Formula_Name	Duration	Country	Type of animals to select inclusing levels	F1_ME Min	F1_CP Min	F1_FAT Min
Broiler_2,6 kg alive at 126 days_4 feeds_4_Finishing 1	Broiler_2,6 kg alive at 126 days_4 feeds_4	Broiler	2,6 kg alive at 126 days_4 feeds	4	Finishing 1	63-98 days	France	broiler	11.3	14	2
Broiler_2,6 kg alive at 126 days_4 feeds_4_Finishing 2	Broiler_2,6 kg alive at 126 days_4 feeds_4	Broiler	2,6 kg alive at 126 days_4 feeds	4	Finishing 2	98 - 126 jours	France	broiler	10.5	14	2
Broiler_2,6 kg alive at 126 days_4 feeds_4_Growing	Broiler_2,6 kg alive at 126 days_4 feeds_4	Broiler	2,6 kg alive at 126 days_4 feeds	4	Growing	28-63 days	France	broiler	11.7	17	2
Broiler_2,6 kg alive at 126 days_4 feeds_4_Starter	Broiler_2,6 kg alive at 126 days_4 feeds_4	Broiler	2,6 kg alive at 126 days_4 feeds	4	Starter	0-28 days	France	< 28 day broiler	11.5	19	2.2
Broiler_2,6 kg alive at 98 days_2 feeds_2_Single feed	Broiler_2,6 kg alive at 98 days_2 feeds_2	Broiler	2,6 kg alive at 98 days_2 feeds	2	Single feed	28-98 day	France	broiler	11.7	17	2
Broiler_2,6 kg alive at 98 days_2 feeds_2_Starter	Broiler_2,6 kg alive at 98 days_2 feeds_2	Broiler	2,6 kg alive at 98 days_2 feeds	2	Starter	0-28 day	France	< 28 day broiler	11.5	19	2.2
Broiler_2,6 kg alive at 98 days_3 feeds_3_Finishing	Broiler_2,6 kg alive at 98 days_3 feeds_3	Broiler	2,6 kg alive at 98 days_3 feeds	3	Finishing	63-98 day	France	broiler	11.9	15	2
Broiler_2,6 kg alive at 98 days_3 feeds_3_Growing	Broiler_2,6 kg alive at 98 days_3 feeds_3	Broiler	2,6 kg alive at 98 days_3 feeds	3	Growing	28-63 day	France	broiler	11.7	17	2
Broiler_2,6 kg alive at 98 days_3 feeds_3_Starter	Broiler_2,6 kg alive at 98 days_3 feeds_3	Broiler	2,6 kg alive at 98 days_3 feeds	3	Starter	0-28 day	France	< 28 day broiler	11.5	19	2.2
Broiler_2,4 kg alive 84 days_2_Fattening	Broiler_2,4 kg alive 84 days_2	Broiler	2,4 kg alive 84 days	2	Fattening	28-63 days	Germany	broiler	11.2	17	4
Broiler_2,4 kg alive 84 days_2_Starter	Broiler_2,4 kg alive 84 days_2	Broiler	2,4 kg alive 84 days	2	Starter	0-21 days	Germany	< 28 day broiler	11.2	21	4
Grower_Growers_2_Growing	Grower_Growers_2	Grower	Growers	2	Growing	42-140/161 days	France	broiler	10.9	16	2
Grower_Growers_2_Starter	Grower_Growers_2	Grower	Growers	2	Starter	0-42 days	France	< 28 day broiler	11.5	19	2
Laying Hen_High level 250 to 300 eggs per year_2 Feeds_2_Laying	Laying Hen_High level 250 to 300 eggs per year_2 Feeds_2	Laying Hen	High level 250 to 300 eggs per year_2 Feeds	2	Laying	>42 weeks	France	Hen	11.1	15	4
Laying Hen_High level 250 to 300 eggs per year_2 Feeds_2_Starter laying	Laying Hen_High level 250 to 300 eggs per year_2 Feeds_2	Laying Hen	High level 250 to 300 eggs per year_2 Feeds	2	Starter laying	<42 weeks	France	Hen	11.3	15	4
Laying Hen_High level 250 to 300 eggs per year_3 Feeds_2_Laying	Laying Hen_High level 250 to 300 eggs per year_3 Feeds_2	Laying Hen	High level 250 to 300 eggs per year_3 Feeds	2	Laying	41-80 weeks	Germany	Hen	10.9	17.95	4
Laying Hen_High level 250 to 300 eggs per year_3 Feeds_2_Laying	Laying Hen_High level 250 to 300 eggs per year_3 Feeds_2	Laying Hen	High level 250 to 300 eggs per year_3 Feeds	2	Laying	19-40 weeks	Germany	Hen	11.40	17.02	
Laying Hen_High level 250 to 300 eggs per year_3 Feeds_2_Starter laying	Laying Hen_High level 250 to 300 eggs per year_3 Feeds_2	Laying Hen	High level 250 to 300 eggs per year_3 Feeds	2	Starter laying	19-40 weeks	Germany	Hen	10.9	18.7	4
Laying Hen_Low level 170 eggs per year_2 Feeds_2_Laying	Laying Hen_Low level 170 eggs per year_2 Feeds_2	Laying Hen	Low level 170 eggs per year_2 Feeds	2	Laying	>42 weeks	France	Hen	11.1	15	4
Laying Hen_Low level 170 eggs per year_2 Feeds_2_Starter laying	Laying Hen_Low level 170 eggs per year_2 Feeds_2	Laying Hen	Low level 170 eggs per year_2 Feeds	2	Starter laying	<42 weeks	France	Hen	11.3	15	4
Laying hens_One feed ans grains_no Min Max_1_Single feed	Laying hens_One feed ans grains_no Min Max_1	Laying hens	One feed ans grains_no Min Max	1	Single feed	42 weeks	Switzerland	Hen		20	
	Ducks										

Position yourself in column C on a new row with empty cells below the existing table and fill in the elements in the corresponding row, as indicated by the arrow in Table 3. Perform the process for as many lines as you want to add feed phases.

A list is proposed for the column type of animals to be selected according to the parameters of incorporation.

3.3 Zone 3: Feedstuffs selection

3.3.1 Selection of listed feeds

Table 4. Tool sheet, selecting feedstuffs in zone 3

Once the objectives have been defined and the nutritional requirements displayed at the bottom of the calculator, you can select the feedstuffs. A list of more than 80 standardised organic feedstuffs is available for selection, as seen in Table 4. Tool sheet, selecting feedstuffs in zone 3.

Select the ones you wish to use for your composition.

If you select a feedstuff twice, the cells concerned will turn red to avoid handling problems.

For each selection, the nutritional data of the feed will appear in the calculator. These data cannot be modified.

3.3.2 Add a feedstuff

Two situations will lead you to consider adding a feedstuff:

- The feedstuff I want to use does not have the same nutritional values as the one listed (cereals with more or less proteins, for example).

- It is not listed in the tool.

In this case, go to the Database_Feedstuffs sheet and get at least the same information as the criteria used for nutritional requirements: The metabolisable energy intake (in megajoules), protein (%), fat (%), fiber (%), the protein's breakdown in total and digestible amino acids (lysine, methionine, threonine, methionine+cysteine, tryptophan) with the corresponding units in the tool (% or g/Kg) and finally the main minerals to be monitored at the corresponding units (calcium, sodium and phosphorus).

Table 5. Database_Feedstuffs sheet example.

Feedstuffs	Category	DM %	CP %	Fiber %	Fat %	Ash %	LYS %	THR %	MET %	CYS %	MET+CYS %	TRY %	C16:0 g/Kg Fat	C18:0 g/Kg Fat	C18:1 g/Kg Fat (Oleic)	C18:2 g/Kg Fat (linolei)	C18:3 g/Kg Fat (Alpha linolen)
Sunflower cake (high protein)	Oilseeds (Cake)	94.20	33.30	18.90	8.60	6.00	1.20	1.20	0.75	0.56	1.31	0.42	6.40	4.30	20.20	65.20	0.30
Sunflower cake (low protein)	Oilseeds (Cake)	92.30	24.10	24.60	14.90	5.30	0.90	0.89	0.54	0.41	0.96	0.31	6.40	4.30	20.20	65.20	0.30
Sunflower oil	Oil	99.30	0.00	0.00	99.50	0.05	0.00	0.00	0.00	0.00	0.00	0.00	6.30	4.30	20.30	64.90	0.30
Triticale 10,9% CP	Cereals	87.00	10.90	2.90	1.50	1.70	0.43	0.36	0.19	0.29	0.47	0.14	17.00	0.90	13.50	60.80	7.10
Triticale 7,9% CP	Cereals	87.00	7.90	2.90	1.50	1.70	0.31	0.26	0.14	0.21	0.34	0.10	17.00	0.90	13.50	60.80	7.10
Triticale 8,9% CP	Cereals	87.00	8.90	2.90	1.50	1.70	0.35	0.30	0.15	0.23	0.39	0.12	17.00	0.90	13.50	60.80	7.10
Triticale 9,9% CP	Cereals	87.00	9.90	2.90	1.50	1.70	0.39	0.33	0.17	0.26	0.43	0.13	17.00	0.90	13.50	60.80	7.10
Vetch common	Legume seeds	90.90	27.20	5.90	1.00	2.90	1.75	1.02	0.22	0.44	0.66	0.24	19.90	4.80	8.90	61.50	2.60
Vetch common leaves	Dehydrated forage	19.30	23.00	25.40	2.50	9.80	0.53	0.58	0.09	0.00	0.00	0.00					
Wheat 10,5% CP	Cereals	86.90	10.90	2.40	1.40	1.50	0.31	0.33	0.18	0.25	0.42	0.13	1.80	0.08	1.60	5.80	0.60
Wheat 11,5% CP	Cereals	86.90	11.50	2.40	1.40	1.50	0.34	0.36	0.20	0.27	0.46	0.14	1.80	0.08	1.60	5.80	0.60
Wheat 9,5% CP	Cereals	86.90	9.50	2.40	1.40	1.50	0.28	0.30	0.16	0.23	0.38	0.12	1.80	0.08	1.60	5.80	0.60
Wheat bran	Wheat by-products	87.50	10.50	2.60	1.60	1.60	0.31	0.32	0.17	0.24	0.41	0.13	17.80	0.80	15.20	56.40	5.90
Wheat middlings, all types except durum	Wheat by-products	86.60	15.20	6.60	3.90	4.40	0.60	0.49	0.23	0.31	0.54	0.20	17.80	0.80	15.20	56.40	5.90
Whey dreid (Full fat)	Dairy productcts	96.20	13.30	0.00	18.80	8.20	0.99	0.75	0.20	0.24	0.44	0.19	52.40	22.90	38.80	72.00	1.80
Whey dried (low fat)	Dairy productcts	95.70	14.40	0.00	9.90	8.50	1.07	0.82	0.22	0.26	0.48	0.20	27.70	12.10	21.70	3.80	0.90
Whey, acid or sweet, dehydrated	Dairy productcts	96.70	11.80	0.00	2.50	8.00	0.88	0.66	0.18	0.21	0.39	0.16	29.30	12.80	21.70	4.00	1.00
White Lupine	Legume seeds	87.50	32.90	11.80	6.70	3.40	1.61	1.23	0.26	0.55	0.81	0.23	7.40	2.00	49.10	14.70	8.30
Yeast dried	Other plant product	93.30	46.50	1.80	3.60	7.10	0.69	0.39	0.15	0.33	0.48	0.05					

Place your cursor in the first empty cell in column A (Feedstuffs sheet), as highlighted in yellow in Table 5, and fill in the corresponding columns one by one. Each row corresponds to an individual feedstuff.

> **ATTENTION:** For all new feedstuff, include an incorporation level (% maximum) if you know it or can find it.

3.4 Zone 3 and 4: Calculation of rations

Once the databases are complete, your nutritional needs are displayed according to the value for each nutrient (at least the main ones that we will use for the realisation of the ration and already mentioned in this manual).

3.4.1 Calculation areas

Table 6 is the display obtained in the calculator area. In order to obtain the ration composition below, you just have to fill in the % content of each raw material in the feed. Automatically, according to the expected total feed weight, the kg column will show you what this will mean for your feed (grinder).

Table 6. Zone 3 and 4 of Tool sheet, Calculator area. Red area is the % content of each raw material

	Feedstuffs	Kg	%	ME roaster MJ/Kg	CP % raw	FAT % raw	Fiber % raw	LYS % raw	MET % raw	MET+CYS % raw	THR % raw	TRY % raw	DIS LYS poultry % raw	DIS MET poultry % raw	DIS MET+CYS poultry % raw	DIS THR poultry % raw	DIS TRY poultry % raw	Ca g/kg Raw	P g/kg Raw	Na g/kg Raw
1	Corn 9,6% CP	341.36	68.27	13.14	7.60	3.30	2.30	0.29	0.20	0.44	0.37	0.06	0.21	0.15	0.32	0.24	0.04	0.40	2.60	0.10
2	Triticale 9,9% CP	0.00	0.00	12.26	9.90	1.50	2.90	0.39	0.17	0.43	0.33	0.13	0.32	0.16	0.35	0.26	0.10	0.60	3.30	0.06
3	Faba Bean (white flower)	0.00	0.00	10.04	24.40	1.00	8.60	1.60	0.18	0.48	0.87	0.20	1.37	0.15	0.37	0.68	0.13	1.30	4.70	0.10
4	pea (white)	0.00	0.00	10.50	20.70	1.20	6.10	1.51	0.20	0.48	0.79	0.18	1.37	0.18	0.40	0.67	0.14	1.10	4.30	0.04
5	Sunflower cake (low protein)	0.00	0.00	10.42	24.10	14.90	24.60	0.90	0.54	0.96	0.89	0.31	0.74	0.50	0.80	0.67	0.26	3.60	8.50	0.01
6	Rapeseed cake (low fat)	9.63	1.93	11.55	33.40	12.80	7.40	1.31	0.63	1.24	1.27	0.50	1.09	0.55	0.96	1.01	0.40	3.90	8.40	0.61
7	Soyabean cake (high protein)	76.54	15.31	12.01	46.20	8.70	5.90	2.60	0.66	1.38	1.79	0.63	2.29	0.59	1.13	1.49	0.56	3.50	6.60	0.00
8	Soya bean toasted	21.22	4.24	13.89	35.70	19.70	5.80	2.22	0.52	1.04	1.44	0.45	1.89	0.43	0.79	1.11	0.34	3.00	5.30	0.06
9	Sodium chlorite	2.13	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	380.00
10	Monocalcic phosphate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	167.00	224.00	0.72
11	Calcium carbonate	7.66	1.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	387.00	3.00	6.40
12	Barley 10,3% CP	41.46	8.29	1.15	10.30	1.80	4.70	0.40	0.18	0.42	0.37	0.13	0.30	0.15	0.32	0.26	0.10	0.70	3.40	0.03

3.4.2 Interpretation of results

The overall ration result will be displayed below this Table 7 and will move each time you change a feed or % incorporation. The aim is, of course, to achieve the nutritional benefits shown below employing these manual modifications:

Table 7. Tool sheet, zone 4 on top and zone 7 below. With color codes, red: corrections needed. Yellow: equal to min or max needs

			ME	CP	FAT	CF	LYS	Met	Met+Cys	Thr	Trp	Dis Lys	Dis Met	Dis Met+Cys	Dis Thr	Dis Try	Ca	P	Na
TOTAL	500.00	100.00	11.72	15.27	4.82	3.25	0.75	0.29	0.61	0.64	0.18	0.62	0.23	0.47	0.48	0.14	0.70	0.35	0.18
Grinder capacity?	0.00	kg																	
			ME	CP	FAT	CF	LYS	Met	Met+Cys	Thr	Trp	Dis Lys	Dis Met	Dis Met+Cys	Dis Thr	Dis Try	Ca	P	Na
RESET RATION		Min	10.88	14.00	2.00	0.00	0.69	0.26	0.52	0.49	0.12	0.62	0.23	0.47	0.23	0.11	0.70	0.30	0.15
		Max	11.72	16.00	7.00	7.00	0.80	0.37	0.63	0.71	0.34	0.72	0.33	0.57	0.64	0.31	0.80	0.35	0.18

The first two cells in Table 7 to the right of 'TOTAL', allow you to confirm that you have entered a sufficient % total. The rest corresponds chronologically to the energy provided in MJ/kg, the protein %, the fat %, the fibre %, the breakdown of the five main limiting amino acids in total, then digestible and finally the calcium, phosphorus and sodium intakes.

3.5   Zone 4: Feeding ration limitations

Table 8. Tool sheet, left column % from zone 4, remaining zone 5 Example of alert column color coding

%	Min	Ration limitation levels	TAKE CARE OF
53,04	0,00	65,00	OK
0,00	0,00	70,00	OK
0,00	0,00	20,00	OK
0,00	0,00	25,00	OK
3,32	0,00	20,00	OK
12,00	0,00	10,00	SUP
35,26	0,00	100,00	OK
0,00	0,00	20,00	OK
5,00	0,00	5,00	MAX
2,26	0,00	0	
0,00	0,00	0	
0,71	0,00	0	

Table 8 shows you the ration limitation zone 5, on the right side of the calculator these three columns appear, from left to right: 'Min' (the minimum required ration), 'Ration limitation levels' (the % of the ration according to the category of animals selected) and 'Take care of' (alert column).

If your % respects the ration limits, which are automatically displayed according to the selected feedstuff, the last cell will be green. When the limit is reached, this cell will display MAX and will be orange. If you exceed the limit, the cell will display SUP and turn red, indicating that there is a small risk of exceeding your ration objectives.

The 'Min', minimum required ration, column will be especially useful when using the 'Optimisation' option. You can then prompt Excel to compose a ration within the maximum intake limits already displayed and the minimum intake limits according to the availability of feedstuff on your farm (manual entry).

3.6   Zone 3, 4 and 6: Ration costs

Table 9. Tool sheet, zone 3, 4 and the two columns on the right the ration cost zone 6

	Feedstuffs	Kg	%	Feedstuffs costs (€/T)	Ration Costs (€)
1	Corn 9,6% CP	341.36	68.27	360.00 €	122.89 €
2	Triticale 9,9% CP	0.00	0.00	350.00 €	- €
3	Faba Bean (white flower)	0.00	0.00	455.00 €	- €
4	pea (white)	0.00	0.00	495.00 €	- €
5	Sunflower cake (low protein)	0.00	0.00	525.00 €	- €
6	Rapeseed cake (low fat)	9.63	1.93	560.00 €	5.39 €
7	Soyabean cake (high protein)	76.54	15.31	1,090.00 €	83.43 €
8	Soya bean toasted	21.22	4.24	780.00 €	16.55 €
9	Sodium chlorite	2.13	0.43	150.00 €	0.32 €
10	Monocalcic phosphate	0.00	0.00	400.00 €	- €
11	Calcium carbonate	7.66	1.53	400.00 €	3.06 €
12	Barley 10,3% CP	41.46	8.29	350.00 €	14.51 €
					246.16 €
				Feed Prices (€/T)	492.31 €

You also have the possibility to calculate the cost of your ration in zone 6 and show in Table 9. To do so, indicate the price for each raw material (in €/Tonne).

The 'Ration cost' column will automatically adjust itself according to the total weight of the ration and each feedstuff (in order to have an idea of the cost for each feed produced in a specific context).

To be able to compare rations, the 'Feed Prices' cell below will indicate the price of the compound feed (in €/Tonne).

3.7   Zone 7: Minimum and maximum values of feed ingredients

The minimum and maximum objectives to be respected are shown in zone 7, below the calculator (as shown in table 10 below).

	ME	CP	FAT	CF	LYS	Met	Met+Cys	Thr	Trp	Dis Lys	Dis Met	Dis Met+Cys	Dis Thr	Dis Try	Ca	P	Na
Min	10.88	14.00	2.00	0.00	0.69	0.26	0.52	0.49	0.12	0.62	0.23	0.47	0.23	0.11	0.70	0.30	0.15
Max	11.72	16.00	7.00	7.00	0.80	0.37	0.63	0.71	0.34	0.72	0.33	0.57	0.64	0.31	0.80	0.35	0.18

Table 10. Zone 7 of 'Tool' sheet, minimum and maximum ratio

3.8   Zone 8: Graphics representation

% OF CONTRIBUTION OF EACH FEEDSTUFF FOR LYSINE

Soya bean toasted; 13% · ; 0% · ; 0% · Barley 10,3% CP; ; 0% 4% · ; 0% · ; 0% · ; 0% · ; 0% · Corn 9,6% CP; 27% · Soyabean cake (high protein); 53% · Rapeseed cake (low fat); 3%
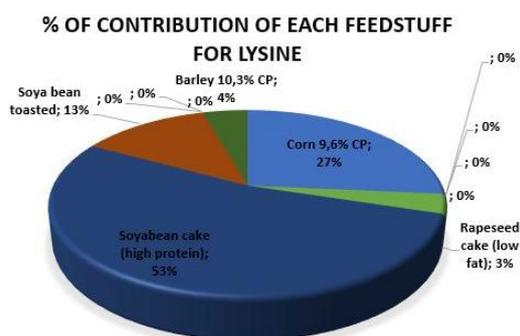
Figure 4. Graphic representation example, % of contribution of each feedstuff for lysine

The graphs at the bottom of the tool, like in Figure 4, have two purposes:

• To visually represent the contribution of each raw material for some important indicators to be monitored (energy, protein, lysine and methionine)

• Help in the choice of feedstuffs quantities corrections to modify the composition if necessary (which raw material already used in my ration could allow me to readjust my balance between amino acids?).

Using the example of lysine, as Figure 4: let's imagine that I have an excess of lysine. I see that soybean cake is the raw material that contributes the most to its intake in the ration (53%) whereas it

represents 35% of my ration. If I substitute the cake by some corn, which only provides 27% of lysine when it represents more than 50% of my ration, I could rebalance this ratio.

3.9   Additional features

Functions have been added to make the tool easier to use. They can be used by clicking directly on them or may require a specific version of the tool (case of the Solver for the 'Optimisation' tool), or even require an internet connection to activate links.

3.9.1   The MACROS button

Macros are simple buttons to enhance the use of the tool:

RESET PRCES • Resets price entries with no return possible

RESET • Resets all calculator entries and prices with no return possible

RESET ALL • Resets all entries with no return possible

PRINT • Prints an export version of the formatted ration

SAVE .xls • Saves the ration tab sheet in Excel out of the tool

SAVE .pdf • Save the export version of the ration in PDF format

3.9.2   Ration optimisation: the Excel solver

3.9.2.1   The solver objectives

The objective of the solver extension is to ask the Excel tool to produce the ration at the lowest possible cost while respecting the formulation rules already stated above (min/max including levels and min/max nutritional requirements). Thus, the calculation is done automatically and avoids the need for trial and error to balance the rations manually.

3.9.2.2   Installation of the Solver

Figure 5. Link to the tutorial video by clicking on the green text box
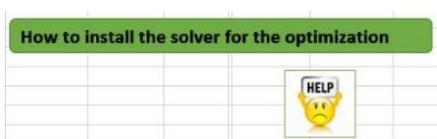
As mentioned before, a recent version of Excel is required to use the Solver (at least 2016). To use it you must load it by going to File>Options>Add-ins. Please refer to the Annex of this manual for a step-by-step guide to install this Solver.

In Figure 5, you see the link to the tutorial video, which shows the steps for installation in just 1 minute (in French).
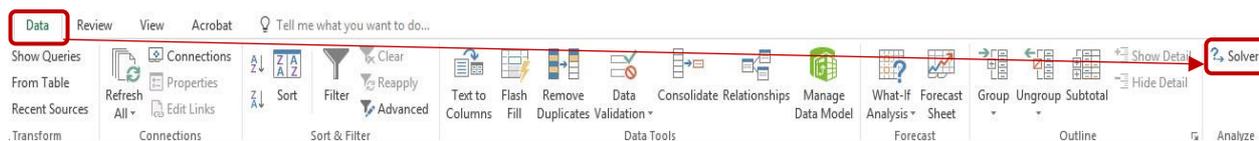
3.9.2.3 Using the Solver

Figure 6. Solver location on Excel

To use the Solver, it is simple enough to enter the objectives, the feedstuffs, their price, and to indicate possible minimums of incorporation. Once the Solver is installed, go to the 'Data' tab, as seen in .

Click on the 'Solver' extension: a filled-in window will appear, like in Figure 7, and the objectives for the optimisation tool are already entered.
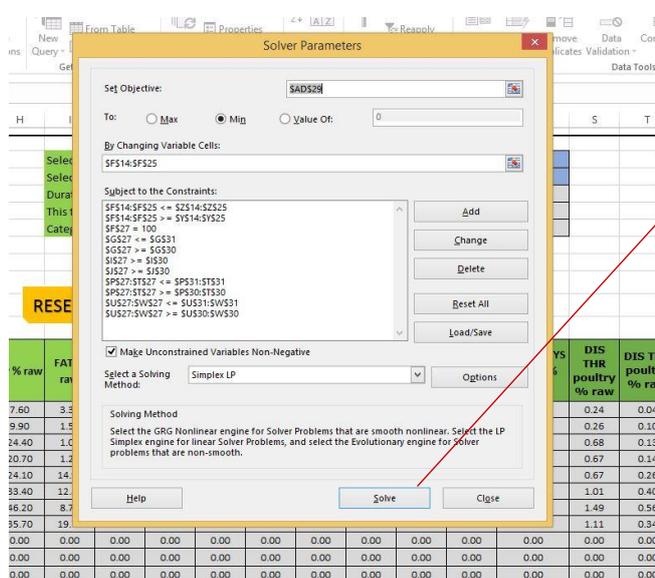
Click on 'Solve'.

A new window will then appear and will tell you whether or not the tool was able to find a satisfactory solution.

If this is the case, you can adjust manually to obtain a practically feasible ration (kg for the grinder).

If no solution is found, you will have to use others feedstuffs or try to get closer to the 'objective values' by making a compromise (a decision is the user's responsibility).

Figure 7. Solver pop-up window

3.9.3 Feeding roughage

3.9.3.1 The "Roughage_Forage" sheet objectives

The roughage feeding sheet offers the possibility to calculate a feed ration including roughage or forage feeding. There is a lack of data concerning nutritional value of roughage/forage for monogastric animals and intake capacity, so there is no data in the database. The value of roughage differs strongly due to climate, soil, previous crops, etc.

To use this sheet and to calculate roughage provision in the ration, the user needs to have their own data (nutritional value and amount of intake).

3.9.3.2 Calculation of feed with roughage

If you want to calculate roughage feeding, please start using the tool on the "Roughage_Forage" sheet.

Step 1: Fill in the table with feeding scenario (see page 8).

Step 2: Fill in the nutritional value of your roughage.

Step 3: In this table the animal needs are presented. The needs depend on the feeding scenario which was chosen in step 1. Fill in the amount of concentrate you usually feed. The program calculates the total animal feed requirements in quantity.

Step 4: The program calculates the total concentrated feed needs, by subtracting the roughage intake. This calculation is related to the concentrate intake, and the objective total needs/Kg of concentrate."

Step 5: Related to the feed concentrate intake and the "Total needs covered by concentrate", the line in step 5 shows the nutritional recommendation for the concentrate. Those data have to be copied to the sheet "Tool" as a new formulation scenario and to start with the ration planning.

4. Export of results

Once the ration is finished, you can print or save the results as a PDF, allowing you to export the results obtained to save them or to go directly to your feed mill to test them on the farm.

The output format, as displayed in Table 11 allows you to retrieve the identity of the farm, the feedstuffs used and the results from your ration.

Table 11. PDF_Export sheet displayed the output format

RATION REALIZED ON: 06/10/2020

Context:

Identity of the farm:	Leo Bell
Farmer's name:	Bell
Production:	10/6/2020
Poultry Flocks	Broiler chickens
Objectives(Kg, days)	10
Number of feeding phases	2,2 Kg over 110 days
Type of animals	3

Scenario selected:

Tool scenario:	Broiler_2,6 kg alive at 126 days_3 feeds_3_Finishing

Feedstuff composition: 500 Kg

	%	Kg	% cost	Cost (€/T)	
Corn 9,6% CP	68.3	341.4	49.9	360.00 €	/Tonne
Rapeseed cake (low fat)	1.9	9.6	2.2	560.00 €	/Tonne
Soyabean cake (high protein)	15.3	76.5	33.9	1,090.00 €	/Tonne
Soya bean toasted	4.2	21.2	6.7	780.00 €	/Tonne
Sodium chlorite	0.4	2.1	0.1	150.00 €	/Tonne
Calcium carbonate	1.5	7.7	1.2	400.00 €	/Tonne
Barley 10,3% CP	8.3	41.5	5.9	350.00 €	/Tonne
Number of feeds:	7				
Ration cost:	492.31 €	/Tonne			

Ration results:

	TOTAL		Min	Max
ME	11.72	MJ/Kg	10.88	11.72
CP	15.27	%	14.00	18.00
FAT	4.82	%	2.00	7.00
Fiber	3.25	%	0.00	7.00
LYS raw	0.75	%	0.69	0.80
MET raw	0.29	%	0.26	0.37
MET+CYS raw	0.61	%	0.52	0.63
THR raw	0.64	%	0.49	0.71
TRY raw	0.18	%	0.12	0.34
DIS LYS	0.62	%	0.62	0.72
DIS MET	0.23	%	0.23	0.33
DIS MET+CYS	0.47	%	0.47	0.57
DIS THR	0.48	%	0.23	0.64
DIS TRY	0.14	%	0.11	0.31
Ca	0.70	g/kg	0.70	0.80
P tot	0.35	g/kg	0.30	0.35
Na	0.18	g/kg	0.15	0.18

5. Further information and contacts

This tool was developed within the framework of Organic Knowledge Network on Monogastric Animal Feed (OK-Net EcoFeed), which is aimed at helping organic pig and poultry farmers in achieving the goal of 100% use of organic and regional feed. The 3-year project will extend the OK-Net knowledge platform. It is coordinated by IFOAM EU and consists of 11 partners and 8 third linked parties from 12 countries.

OK-Net EcoFeed is funded through Horizon 2020, the EU's research and innovation programme. The project has been selected for the topic "RUR-10-2016: Thematic Networks compiling knowledge ready for practice" within the call "Rural Renaissance – Fostering Innovation and Business Opportunities" of Societal Challenge 2 "Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy".

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 773911.

The web-based platform organic-farmknowledge.org aimed at filling the gap in the exchange of information between farmers across Europe was launched in October 2016 within the project OK-Net Arable. The complexity of organic farming requires farmers to have a very high level of knowledge and skills. But exchange on organic farming techniques remains limited. OK-Net Ecofeed project has therefore been working together with partners across Europe to bring new tools and further develop the web-based platform.

The Organic Farm Knowledge platform provides access to a wide range of tools and resources about organic farming that can help improve production. It also aims to serve as a virtual meeting place for cross-border learning. The platform promotes the exchange of knowledge among farmers, farm advisers, and scientists, with the aim of increasing productivity and quality in organic farming across Europe.

When you have further questions please contact:

- Antoine Roinsard, ITAB, 9, rue André Brouard, BP 70510, 49105 Angers Cedex 02, France, antoine.roisard@itab.asso.fr
- Barbara Frueh, FiBL, Ackerstrasse 113, 5070 Frick, Switzerland, barbara.frueh@fibl.org
- Ambra Desimone, IFOAM Organics Europe, IFOAM Organics Europe, Rue du Commerce 124-4, 1000 Brussels, Belgium, ambra.desimone@organicseurope.bio;
- Bram Moeskops, IFOAM Organics Europe, IFOAM Organics Europe, Rue du Commerce 124-4, 1000 Brussels, Belgium, bram.moeskops@organicseurope.bio

6.   References

Roinsard, A., Heuze, V., H. Juin, D. Renaudeau, D. (2018). Chemical and Nutritional Value of Organic Feedstuffs: A Need to Address in Monogastric Feeding. 69th Annual Meeting of the European Federation of Animal Science (EAAP).

Tran G., Heuzé V., Roinsard A., (2019). Composition et valeur nutritionnelle des matières premières biologiques à destination des porcs et des volailles. CASDAR SECALIBIO (2015-2019).

ISA Dual Organic System (2020). ISA Dual Product Guide. Retrieved on 23, May 2020: https://www.integrazabcice.cz/en/product/isa-dual/

Tables INRA, 2002 : Tables INRA 2002 : SAUVANT D., PEREZ J.M. et TRAN D., 2002. Tables de composition et de valeurs nutritives des matières premières destinées aux animaux d'élevage. Paris: Ed. INRA, 2002, 301 p.

AVIFAF© http://www.avifaf.fr/avifaf/Vue/index.php

Feedipedia - Système d'information sur les ressources en alimentation animale - INRAE CIRAD AFZ et FAO © 2012-2020 : https://www.feedipedia.org

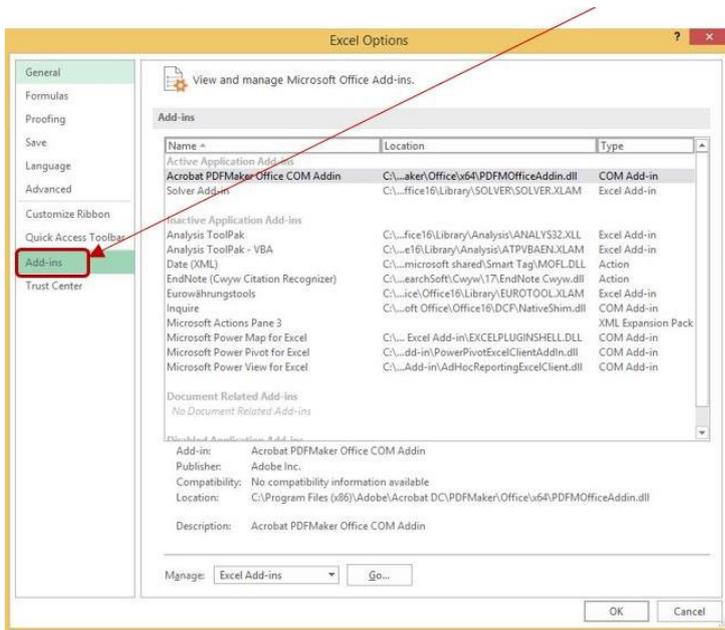# Annex: Installation of the solver manual

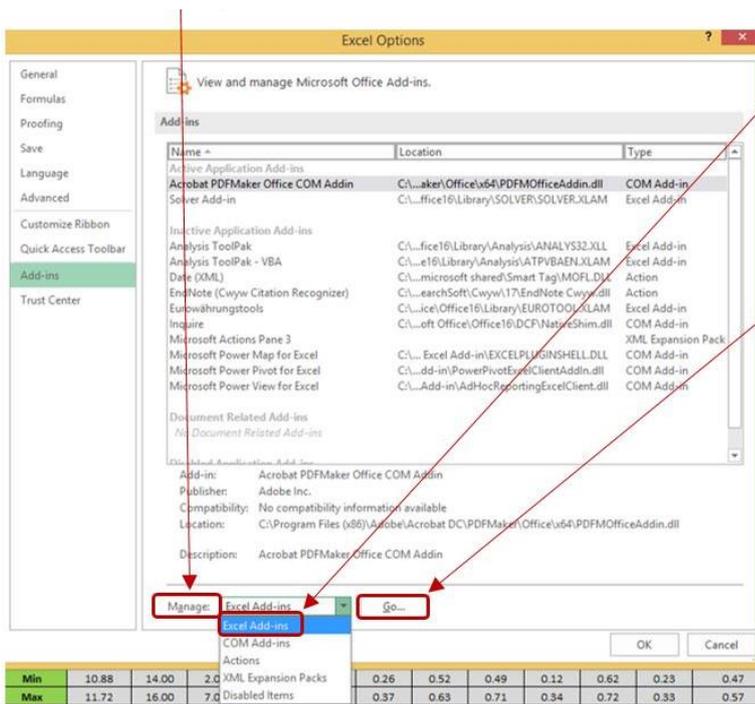1. Click on 'File' in the upper left corner
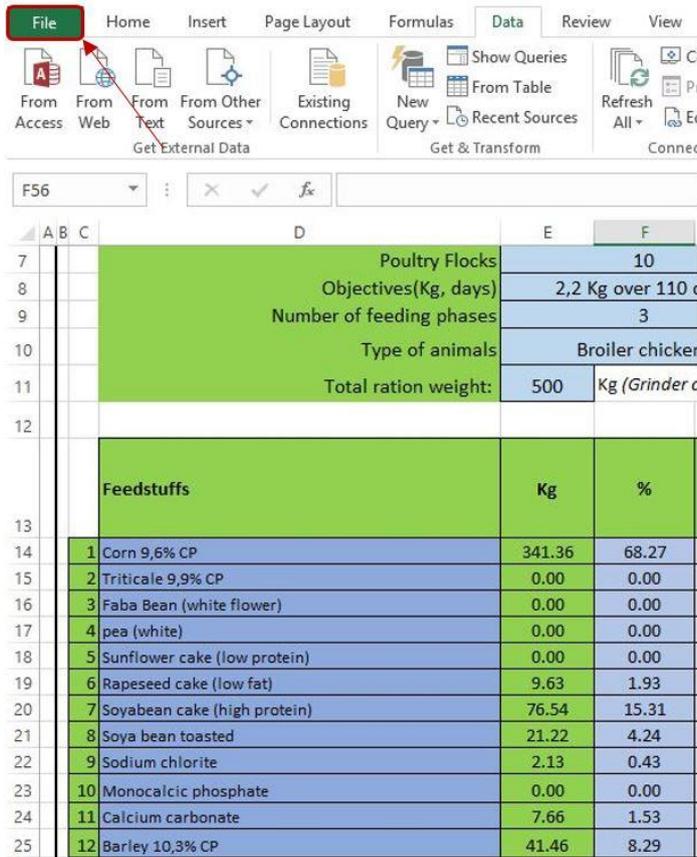
2. Click on 'Options' at the button of the green column you see on the left.
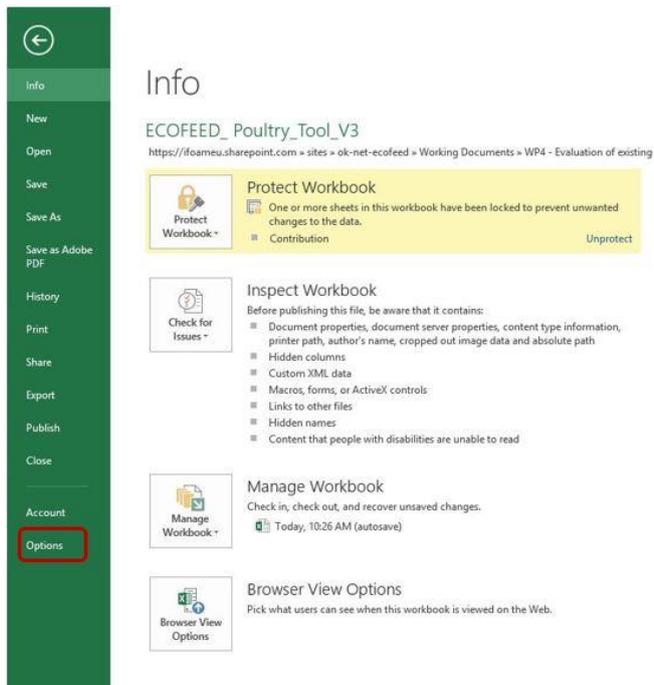
3. The 'Excel Options' will appear. Click on 'Add-ins'

4. Find the 'Manage' zone at the bottom of the window, select 'Excel Add-ins'. Click on 'Go…'.

5. Check the 'Solver Add-ins' option and validate by clicking 'OK'. The Solver is now installed!