

DietaryBurdenCalculator

A tutorial

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1 <u>Overview</u>

1.1 Introducing DietaryBurdenCalculator

- DietaryBurdenCalculator is based on a realistic dietary optimization scenario
- A flexible database is included in DietaryBurdenCalculator
- It is simple to use
- DietaryBurdenCalculator represents a fully transparent process

1.2 Installing DietaryBurdenCalculator

Open Setup File and follow further instructions (see Annex II).

2 Introduction

The uptake of pesticides by fish and their resulting presence in fish products can occur following the ingestion of feed containing a pesticide residue. It is therefore necessary to evaluate residues in products of fish origin (EU Directive EC 1107/2009). Fish metabolism data can determine total residue levels and the chemical nature of residues in the edible tissues of fish exposed to pesticides. According to the working document on the Nature of Residues in Fish (European Commission, 2013), fish metabolism studies are required when pesticide use may lead to significant residues in fish feed, generally considered to be $\geq 0.1 \text{ mg/kg}$ of the total diet. Fish in intensive aquaculture production systems are fed according to a maximum reasonably balanced diet (MRBD) approach. Therefore, the maximum dietary burden of a pesticide in fish feed needs to be calculated based on the formulation of MRBD, taking into account the specific residue values in all feedstuffs, based on supervised trials where available. The procedure described in the working document can only provide an approximation of the dietary burden in aquaculture diets. In practice, the MRBD should be calculated by linear programming to optimize the dietary burden estimates.

3 <u>Working with DietaryBurdenCalculator</u>

3.1 Start DietaryBurdenCalculator

After installing and starting *DietaryBurdenCalculator*, you will see the startup window. For continuing the program press "START".



You will now see the graphical user interface which is divided into three sections: The substances database (1), components (2) and optimization options (3). We will work our way from the left to the right.



3.2 Obtaining help

To bring up the help menu, press the help tab or F1 on your keyboard. The help menu opens in a separate window. Further information can also be obtained by pressing **2**.

3.3 Substances database

In the left section, the substances database (1) can be found. Customize the substances database by following these steps.

То	Do this
Add substances.	Click on "Add substance" to bring up the
	database window.
Edit residue values for selected substances.	Click on "Edit" to bring up the database
	window and enter residue values.
Copy a substance including all its entries.	Click on "Copy" and the copied substance
	appears at the end of the list.
Delete a substance from the list.	Click on a substance to select it. Then press
	"Del".

etanoos databass					Search	L Gio	
Starices database	C	c					
Lategory		Lommodity	IFN Lode	residue input value	residue value (mg/kg)	× 1	
By-Products	Distiller's grain	aried	5-00-518	HR	0		
By-Products	Leucaena	leat meal		HB	U		
By-Products	Linseed	meal	5-02-048	HR	U		
By-Products	Lupin seed white	meal (treated)	5-27-717	HB	0		
By-Products	Mustard	meal		HR	0		
By-Products	Olive	cake		HR	0		
By-Products	Palm kernel meal	meal	5-03-486	HR	0		
By-Products	Peanut	meal decorticated	5-03-649	HB	0.09		
By-Products	Potato	protein		HR	0		Cano
By-Products	Rape seed	meal (toxic)	5-26-093	HB-P	0		
By-Products	Canola	meal	5-08-136	MRL	0		
By-Products	Rice	Bran de-oiled		STMR	0		
By-Products	Rice	polishing		STMR-P	0		
By-Products	Rice	hulls	1-08-075	HB	0		
By-Products	Sesame seed	meal	5-04-220	HB	0		
By-Products	Safflower	meal decorticated	5-26-095	HB	0		
By-Products	Sovbean	meal decorticated	5-20-638	HB	0.05		
By-Products	Soybean	protein	5-24-811	НВ	0		
By-Products	Sunflower	meal decorticated	5-26-098	HB	0		
Du Deaduate	A dia ant	Futural and main	410.000	L MDI		▼	

The substances database window offers the possibility to enter different classes of residue values (HR, HR-P, MRL, STMR, STMR-P). The residue values (mg/kg) are inserted in the right column.

То	Do this
Change class of residue value	Select a residue value class from the drop
	down menu.
Change residue value.	Enter residue value and press enter.

To return to the user interface, press "Done" (after modifying a value class or value).

3.4 Select components

The middle section (2) is divided into two boxes: "Available components" and "Components in optimization".

The "Available components" box contains all components with a residue value greater than zero (based on entries in substances database) for the selected substance.

DietaryBurdenCalculator			
1. Substances database	2. Available components	Components in optimization	 Options Criteria Maximum Fish species Common carp Common carp Rainbow trout Imaximum reasonable balanced diet (MRBD)* add fish meal as feed component (PC) ¿
Edit Copy Del	Show details		add starch as feed component (CC) Image: Component (CC) Optimize all Scenarios add oil as feed component (F) Image: Component (F) Image: Component (F)

You can choose single or multiple components for optimization by following these steps.

То	Do this
Get more information on the available	Press the "Show details" button.
components.	
Select all available components for optimization.	Press>>
Select individual components from the list of available components.	Select the desired component for optimization. Press . Repeat for each component that you want to choose for optimization.
Remove all selected components from optimization list.	Press <
Remove individual components from the list of components selected for optimization.	Select the desired component from the optimization list and press

3.5 Optimization

The "Options" section on the right (3) gives you different possibilities to calculate the maximum dietary burden.

Program Edit ?		
1. 2. 3. Substances database Available components Components in optimization Op Substance A Com field (Grain meal) Com field (Grain	bitions isimum isimu	3. Options Criteria Criteria Choose the fish species Image: Criteria Fish species Image: Criteria Common carp; Maximum content diretary burden based on Substance A is 0,143 mg/kg. Image: Transmum reasonable balanced det (MRBD)* Image: Criteria mg/substance A is 0,143 mg/kg. Image: Transmum reasonable balanced det (MRBD)* Image: Criteria mg/substance A is 0,143 mg/kg. Image: Transmum reasonable balanced det (MRBD)* Image: Criteria mg/substance A is 0,143 mg/kg. Image: Transmum reasonable balanced det (MRBD)* Image: Criteria mg/substance A is 0,143 mg/kg. Image: Transmum reasonable balanced det (MRBD)* Image: Criteria mg/substance A is 0,143 mg/kg. Image: Transmum reasonable balanced det (MRBD)* Image: Criteria mg/substance A is 0,143 mg/kg. Image: Transmum reasonable balanced det (MRBD)* Image: Criteria mg/substance A is 0,143
Show details	is feed component (F)	I add oil as feed component (F) E xit

То	Do this
Select a fish species for which optimization	Select between common carp and rainbow
should be conducted.	trout. Press "Optimize".
Consider the maximum reasonable balanced	Select "Maximum reasonable balanced diet".
diet (MRBD) in optimization (See Chapter 3.7).	Press "Optimize".
Add protein concentrate (PC) as additional	Select "Add fish meal as feed component
feed component (uncontaminated).	(PC)". Press "Optimize".
Add carbohydrate concentrate (CC) as	Select "Add starch as feed component (CC)".
additional feed component (uncontaminated).	Press "Optimize".
Add fat (F) as additional feed component	Select "Add oil as feed component (F)". Press
(uncontaminated).	"Optimize".
Include all possible scenarios in optimization.	Select a fish species and press the "Optimize
	all scenarios" button.

Inclusion of additional feed components (uncontaminated) might be necessary in case the available/ selected components cannot be mixed in a way to reach the target composition of the test diet (depending on fish species) (See Chapter 4).

3.6 Output

Below the "Optimize" button, the calculated maximum dietary burden (in mg/kg) appears in a box. By clicking on the "Report" button, the report opens. It is divided into two sections, input and report.

Report	
INPUT =====	^
Target content for Common carp: Crude fat 10,00% Crude protein 35,00%	
Maximum principal content of components in the diet: Corn field (Grain meal) 100,00% Peanut (meal decorticated) 100,00% Soybean (meal decorticated) 100,00% Rice (Broken grains) 100,00% Vegetable oil (oil) 100,00%	ш
CC (0.1% protein,0.1 % lipid) 100,00% F (100 % lipid) 100,00%	
Percent dry matter of components: Corn field (Grain meal) 87,8% Peanut (meal decorticated) 90,2% Soybean (meal decorticated) 89,5% Rice (Broken grains) 88,0% Vegetable oil (oil) -	
Substance A residues in the components: Corn field (Grain meal)0,300 mg/kg (HR)Peanut (meal decorticated)0,090 mg/kg (HR)Soybean (meal decorticated)0,050 mg/kg (HR)	Ŧ
Draw pie Convert Copy into Chart Done Draw pie chart	

In	nut
	put.

Paragraph	Gives you information on	Can be modified by
Target content for selected	Target composition of test	Choosing other fish species in
fish species.	diet (% dry matter) of	optimization options.
	selected fish species	
Maximum principal content of	The maximum possible	Selecting maximum
components in the diet.	inclusion rate (%; no	reasonable balanced diet
	restrictions applied) of	(MRBD) in optimization
	selected components in diet.	options (see Chapter 3.7).
Percent dry matter of	Dry matter content of each	
components.	selected commodity.	-
Substance residues in the	Substance residues in each	
components.	selected commodity.	-
Substance residues in the	Substance residues (dry	
components.	matter) in each selected	-
	commodity.	

F (100% lipid) 0,000 mg/kg. RESULTS ************************************	Report		X
F (100% lipid) 0,000 mg/kg. RESULTS			
F (100% lipid) 0,000 mg/kg. RESULTS			
RESULTS Maximum content dietary burden based on Substance A is 0,143 mg/kg (dry matter). The respective composition of the feed is: Corn field (Grain meal) 21,07% Peanut (meal decorticated) 70,65% Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% Vegetable oil (oil) 8,28% CC (0.1% protein, 0.1% lipid) 0,00% F(100% lipid) 0,00% Rice (Broken grains) 0,00% Corn field (Grain meal) 50,24% Peanut (meal decorticated) 0,00% Rice (Broken grains) 0,00% Response (meal decorticated) 0,00% Rice (Broken grains) 0,00% F (100% lipid) 0,00% F (100% lipid) 0,00% F (100% lipid) 0,00% F (100% lipid) 0,00%	F (100% lipid) 0,000 m	g/kg.	*
Maximum content dietary burden based on Substance A is 0,143 mg/kg (dry matter). The respective composition of the feed is: Corn field (Grain meal) 21,07% Peanut (meal decorticated) 70,65% Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% Vegetable oil (oil) 8,28% CC (0.1% protein, 0.1% lipid) 0,00% F(100% lipid) 0,00% The dietary load of Substance A caused by the individual components is: Corn field (Grain meal) Soybean (meal decorticated) 49,19% Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% F (100% lipid) 0,00% F F (100% lipid) 0,00% F The wpie Convert Copy into Chart into table Cipboard Print	RESULTS ======		
The respective composition of the feed is: Corn field (Grain meal) 21,07% Peanut (meal decorticated) 70,65% Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% Vegetable oil (oil) 8,22% CC (0.1% protein, 0.1% lipid) 0,00% F(100% lipid) 0,00% The dietary load of Substance A caused by the individual components is: Corn field (Grain meal) 50,24% Peanut (meal decorticated) 49,19% Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% Vegetable oil (oil) 0,58% CC (0.1 % protein, 0.1% lipid) 0,00% F (100% lipid) 0,00% Convert Copy into Done	Maximum content dietary burden	based on Substance A is 0,143 mg/kg (dry matter).	
Corn field (Grain meal) 21,07% Peanut (meal decorticated) 70,65% Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% Vegetable oil (oil) 8,28% CC (0.1% protein, 0.1% lipid) 0,00% F(100% lipid) 0,00% The dietary load of Substance A caused by the individual components is: Corn field (Grain meal) 50,24% Peanut (meal decorticated) 49,19% Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% Rice (Broken grains) 0,00% Vegetable oil (oil) 0,58% CC (0.1 % protein, 0.1% lipid) 0,00% F (100% lipid) 0,00% Toraw pie Convert Copy into Chart Into table Clipboard Print Done The table Clipboard Print	The respective composition of t	he feed is:	
Peanut (meal decorticated) 70,65% Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% Vegetable oil (oil) 8,28% CC (0.1% protein, 0.1% lipid) 0,00% F(100% lipid) 0,00% The dietary load of Substance A caused by the individual components is: Corn field (Grain meal) 50,24% Peanut (meal decorticated) 49,19% Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% Vegetable oil (oil) 0,58% CC (0.1 % protein, 0.1% lipid) 0,00% F (100% lipid) 0,00% The dietary pie convert into table Copy into Cipboard Print Done	Corn field (Grain meal)	21,07%	
Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% Vegetable oil (oil) 8,28% CC (0.1% protein, 0.1% lipid) 0,00% F(100% lipid) 0,00% The dietary load of Substance A caused by the individual components is: Corn field (Grain meal) 50,24% Peanut (meal decorticated) 49,19% Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% Vegetable oil (oil) 0,58% CC (0.1% protein, 0.1% lipid) 0,00% F (100% lipid) 0,00% Draw pie Convert Copy into Chart into table Clipboard Print Done	Peanut (meal decorticated)	70,65%	
Rice (Broken grains) 0,00% Vegetable oil (oil) 8,28% CC (0.1% protein, 0.1% lipid) 0,00% F(100% lipid) 0,00% The dietary load of Substance A caused by the individual components is: Corn field (Grain meal) 50,24% Peanut (meal decorticated) 49,19% Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% Vegetable oil (oil) 0,58% CC (0.1 % protein, 0.1% lipid) 0,00% F (100% lipid) 0,00% Vegetable oil (oil) 0,58% CC (0.1 % protein, 0.1% lipid) 0,00% F (100% lipid) 0,00%	Soybean (meal decorticated)	0,00%	
Vegetable oil (oil) 0,28% CC (0.1% protein, 0.1% lipid) 0,00% F(100% lipid) 0,00% The dietary load of Substance A caused by the individual components is: Corn field (Grain meal) 50,24% Peanut (meal decorticated) 49,19% Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% Vegetable oil (oil) 0,58% CC (0.1 % protein, 0.1% lipid) 0,00% F (100% lipid) 0,00% Vegetable oil (oil) 0,00% Draw pie Convert into table Copy into Cipboard Print Done	Rice (Broken grains) 0,00%		
CC (0.1% protein, 0.1% lipid) 0,00% F(100% lipid) 0,00% The dietary load of Substance A caused by the individual components is: Corn field (Grain meal) 50,24% Peanut (meal decorticated) 49,19% Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% Vegetable oil (oil) 0,58% CC (0.1 % protein, 0.1% lipid) 0,00% F (100% lipid) 0,00% T Draw pie Convert Copy into Print Done	Vegetable oil (oil) 8,28%		
F(100% lipid) 0,00% The dietary load of Substance A caused by the individual components is: Corn field (Grain meal) 50,24% Peanut (meal decorticated) 49,19% Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% Vegetable oil (oil) 0,58% CC (0.1 % protein, 0.1% lipid) 0,00% F (100% lipid) 0,00% Draw pie Convert Copy into Chart into table Clipboard	CC (0.1% protein, 0.1% lipid)	0,00%	
The dietary load of Substance A caused by the individual components is: Corn field (Grain meal) 50,24% Peanut (meal decorticated) 49,19% Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% Vegetable oil (oil) 0,58% CC (0.1 % protein, 0.1% lipid) 0,00% F (100% lipid) 0,00% Toraw pie Convert Copy into Print Done	F(100% lipid) 0,00%		
The dietary load of Substance A caused by the individual components is: Corn field (Grain meal) 50,24% Peanut (meal decorticated) 49,19% Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% Vegetable oil (oil) 0,58% CC (0.1 % protein, 0.1% lipid) 0,00% F (100% lipid) 0,00% Toraw pie Convert Copy into Print Done			
Corn field (Grain meal) 50,24% Peanut (meal decorticated) 49,19% Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% Vegetable oil (oil) 0,58% CC (0.1 % protein, 0.1% lipid) 0,00% F (100% lipid) 0,00% Draw pie Convert Copy into Chart into table Clipboard	The dietary load of Substance A	caused by the individual components is:	
Peanut (meal decorticated) 49,19% Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% Vegetable oil (oil) 0,58% CC (0.1 % protein, 0.1% lipid) 0,00% F (100% lipid) 0,00% Draw pie Convert Copy into Chart into table Clipboard Print	Corn field (Grain meal)	50.24%	
Soybean (meal decorticated) 0,00% Rice (Broken grains) 0,00% Vegetable oil (oil) 0,58% CC (0.1 % protein, 0.1% lipid) 0,00% F (100% lipid) 0,00% Draw pie Convert Copy into Chart into table Clipboard Print Done	Peanut (meal decorticated)	49.19%	
Rice (Broken grains) 0,00% Vegetable oil (oil) 0,58% CC (0.1 % protein, 0.1% lipid) 0,00% F (100% lipid) 0,00% Draw pie Convert Copy into chart into table Clipboard Print	Soybean (meal decorticated)	0,00%	
Vegetable oil (oil) 0,58% CC (0.1 % protein, 0.1% lipid) 0,00% F (100% lipid) 0,00% Draw pie Convert Copy into Clipboard Draw pie Convert Clipboard	Rice (Broken grains) 0,00%		E
CC (0.1 % protein, 0.1% lipid) 0,00% F (100% lipid) 0,00% Draw pie Convert Copy into chart into table Cipboard Print	Vegetable oil (oil) 0,58%		
F (100% lipid) 0,00% The second sec	CC (0.1 % protein, 0.1% lipid)	0,00%	
Draw pie Convert Copy into Chipboard Print Done	F (100% lipid) 0,00%		
Draw pie Convert Copy into Chipboard Print Done			
Draw pie Convert Copy into chart into table Copy into Clipboard Print Done			T
chart into table Clipboard Print Done	Draw nie	Convert Convinto	
	obort	Linta table Cliphoard Print	Done
	Chart		

Results:

Paragraph	Gives you information on
Maximum content dietary burden.	Result of dietary burden calculation.
Respective composition of the feed.	Feed composition leading to the maximum dietary burden.
Dietary load of substance caused by individual	Percent contribution of each commodity to
components.	maximum dietary burden.

To proceed, the following options are available.

То	Do this
Create a pie chart.	Click on "Draw pie chart".
Create a table.	Click on "Convert into table".
Copy results into clipboard.	Click on the "Copy into Clipboard" button.
Print the results.	Click on the "Print" button.
Close the report.	Press the "Done" button.

Szenario	Description	Maximum Residue Value	
1	Without PC, CC, F	0,143	Details
2	Without PC, CC, F - "maximum reasonable balanced diet (MRBD)"	0,136	Details
3	PC	0,190	Details
4	PC - "maximum reasonable balanced diet (MRBD)"	0,160	Details
5	CC used	0,143	Details
6	CC used with - "maximum reasonable balanced diet (MRBD)"	0,136	Details
7	Fused	0,143	Details
8	F used with - "maximum reasonable balanced diet (MRBD)"	0,136	Details
9	PC and CC used	0,190	Details
10	PC and CC used - "maximum reasonable balanced diet (MRBD)"	0,160	Details
11	PC and F used	0,190	Details
12	PC and F used - "maximum reasonable balanced diet (MRBD)"	0,160	Details
13	CC and F used	0,143	Details
14	CC and F used - "maximum reasonable balanced diet (MRBD)"	0,136	Details
15	PC, CC and F used	0,190	Details
16	PC, CC and F used - "maximum reasonable balanced diet (MRBD)"	0,160	Details

"Optimize all scenarios" gives you the following report:

By clicking on the "Details" button, a report as previously described can be produced for each of the 16 scenarios. All scenarios are summarized in one report by clicking on "Open Full Report File".

The scenarios cover all possible combinations including addition of uncontaminated feed components (PC, CC, F) and the consideration of maximum inclusion rates for selected commodities (MRBD; see Chapter 3.7).

The following scenarios are available:

Scenario	Explanation
1	Without PC, CC; F (only selected commodities)
2	Without PC, CC; F – maximum reasonable
	balanced diet (MRBD) with selected
	commodities
3	Selected commodities plus uncontaminated
	fish meal (PC) with 75% protein, 5% lipid
4	Selected commodities plus fish meal (PC) -
	maximum reasonable balanced diet (MRBD)
5	Selected commodities plus uncontaminated
	starch (CC)
6	Selected commodities plus CC - maximum
	reasonable balanced diet (MRBD)
7	Selected commodities plus uncontaminated oil
	(F)
8	Selected commodities plus F - maximum
	reasonable balanced diet (MRBD)
9	Selected commodities plus fish meal and CC
10	Selected commodities plus fish meal and CC -
	maximum reasonable balanced diet (MRBD)
11	Selected commodities plus fish meal and F
12	Selected commodities plus fish meal and F -
	maximum reasonable balanced diet (MRBD)
13	Selected commodities plus CC and F
14	Selected commodities plus CC and F -
	maximum reasonable balanced diet (MRBD)
15	Selected commodities plus fish meal, CC and F
16	Selected commodities plus fish meal, CC and F
	- maximum reasonable balanced diet (MRBD)

3.7 Consider maximum reasonable balanced diet (MRBD)

To open the list of feed components, pull down the "Edit" menu and select "Feed components". The list of feed components opens.

Liop	Commodity	IFN Code	CP(%) of DM	CL(%) of DM	DM(%)	Carp (max % of diet)	Trout (max % of diet)	▲	Search
arley	bran fractions	4-00-515	16,4	66	88	35	15		
rewer's grain	dried	5-00-516	25,9	7	92	35	15		
loconut/Copra	meal decorticated	5-01-572	44,2	1,2	91	25	15		
Corn field	Grain meal	4-12-208	10,2	4,8	87,8	35	20		Del Record
Corn field	bran	5-28-235	15	5,7	87,5	20	5		
Corn field	hominy meal	4-03-010	8,9	5,4	90,1	35	20		
Corn gluten	feed	5-28-243	24,7	3,5	90,1	20	10		New Record
Corn gluten	meal	5-28-242	59,9	3,6	91,3	20	15		New Necolu
Corn	starch	4-02-889	0,4	0,4	90,2	35	15		
Cottonseed	meal	5-01-617	32,9	1,7	90	35	15		
)istiller's grain	dried	5-00-518	28,5	10,2	92	10	10		
eucaena	leaf meal		24,5	5,4	90,5	10	100		Print
inseed	meal	5-02-048	35	2	90	35	15		
upin seed white	meal (treated)	5-27-717	34,5	6,1	89,5	15	15		
lustard	meal		42,4	1,8	89,9	10	10		Copy to
live	cake		13,3	3,6	92,4	10	10		Clipboard
alm kernel meal	meal	5-03-486	16,3	1,4	90	10	8		
eanut	meal decorticated	5-03-649	46,5	1	90,2	35	15		
otato	protein		81,8	2,8	89,4	3	100		Save
lape seed	meal (toxic)	5-26-093	37,3	1,9	91	5	5		
anola	meal	5-08-136	37,3	1,9	91	35	20		
lice	Bran de-oiled		15,1	1,7	100	35	15		
lice	polishing		13,6	14,5	100	50	10		
lice	hulls	1-08-075	3,1	1	100	5	0		Cancel
esame seed	meal	5-04-220	45	4,8	92,4	35	15		
afflower	meal decorticated	5-26-095	45,2	6,9	91	7	7		
oybean	meal decorticated	5-20-638	49,8	0,8	89,5	40	25		Done
oubean	protein	5-24-811	72	1	92	20	20	•	Done

The table contains information on the protein content (CP, % of dry matter), lipid content (CL, % of dry matter) and dry matter (%) of each plant derived feed commodity. The last two columns contain maximum inclusion rates for the commodities used in carp and trout diets. By selecting maximum reasonable balanced diet (MRBD), the limits of selected commodities listed here are considered.

То	Do this
Delete a record.	Click on "Del Record".
Add a new record.	Click on "New Record".
Print the list of feed components.	Click on "Print".
Copy the list to clipboard.	Click on "Copy to Clipboard".
Save changes.	Press "Save".

4 Example

A new substance (Substance B) is added to the substances database by pressing "Add substance".

DietaryBurdenCalculator				
1	2		3	
Substances database	Available components	Components in optimization	Options	(
Substance A	Corn field (Grain meal) Peanut (meal deconticated) Soybean (meal deconticated) Rice (Broken grains) Vegetable oil (oil)		Criteria 2 • Maximum Choose the fish species 2 • Common carp • Rainbow trout 2 • maximum reasonable balanced diet (MRBD)* 2 • maximum reasonable balanced diet (MRBD)* 2 • add fish meal as feed component (PC) 2	Optimize
Edit Copy Del			✓ add starch as feed component (CC)	Optimize all Scenarios
	Show details	,	✓ add oil as feed component (F) 2	Exit

In the substances database, a STMR-P value of 0.9 mg/kg is inserted for potato protein. Then the database is closed by pressing "Done".

Program Edit ?							
					Search		
Substances database					Jean		
Category	Сгор	Commodity	IFN Code	residue input value	residue value (mg/kg)	× 1	- ,
By-Products	Brewer's grain	dried	5-00-516	MRL	0		
By-Products	Coconut/Copra	meal decorticated	5-01-572	MRL	0		
By-Products	Corn field	Grain meal	4-12-208	MRL	0		
By-Products	Corn field	bran	5-28-235	MRL	0		
By-Products	Corn field	hominy meal	4-03-010	MRL	0		
By-Products	Corn gluten	feed	5-28-243	MRL	0		
By-Products	Corn gluten	meal	5-28-242	MRL	0		
By-Products	Corn	starch	4-02-889	MRL	0		
By-Products	Cottonseed	meal	5-01-617	MRL	0		Cancel
By-Products	Distiller's grain	dried	5-00-518	MRL	0		
By-Products	Leucaena	leaf meal		MRL	0		
By-Products	Linseed	meal	5-02-048	MRL	0		
By-Products	Lupin seed white	meal (treated)	5-27-717	MRL	0		
By-Products	Mustard	meal		MRL	0		
By-Products	Olive	cake		MRL	0		
By-Products	Palm kernel meal	meal	5-03-486	MRL	0		
By-Products	Peanut	meal decorticated	5-03-649	MRL	0		
By-Products	Potato	protein		STMR-P	0,9		
By-Products	Rape seed	meal (toxic)	5-26-093	MRL	U	-	
Du Deaduate	Canala		E 00 100	NDI	•		
Substance: Substance	в						Done

Now, the new substance (Substance B) is listed and only one component with a residue value higher than zero (potato protein) is available.

DietaryBurdenCalculator		
Program Edit ?		
1. Substances database	2. Available components Componer	a. Options
Substance A Substance B	Potato (protein)	Criteria Criteria Choose the fish species
		Fish species Optimize C Common carp C Rainbow trout
Add substance	< <<	''maximum reasonable balanced diet (MRBD)'' add fish meal as feed component (PC)
Edit Copy Del		✓ add starch as feed component (CC) I Optimize all Scenarios ✓ add oil as feed component (F) I
	Show details	Exit

DietaryBurdenCalculator				
Program Edit ?	-		-	
1.	2.		3.	
Substances database	Available components	Components in optimization	Options	 (
Substance A	Potato (protein)	Potato (protein)	Criteria	1
Substance B			Maximum	
			Choose the fish species	
			Tish analis	Ontimize
			- Fish species	
		>	(Common carp	
			C Rainbow trout	
		<	The second	1
			j maximum reasonable balanced diet (MHBD) -	-
		<<	add fish meal as feed component (PC)	3
Add substance				
Edit Copy Del			add starch as feed component (CC)	Optimize all Scenarios
	Chann dataile	1	add oil as feed component (F)	1
	show details	1		Exit

Potato protein is selected for optimization and the "Optimize" button is pressed.

A new window opens with the following comment:

DietaryBurdenCalculator	X
The problem is not solvable. Add more or try different	components.
	ОК

In the optimization options, additional uncontaminated components have to be added to the diet otherwise no maximum dietary burden can be calculated. Because protein is sufficiently provided by potato protein as single component, starch and oil have to be added to the diet to reach the target composition for the selected fish species. Now a maximum burden of pesticide residues can be determined.

DietaryBurdenCalculator							×
Program Edit ?							
1. Substances database	2.	Available components		Components in optimization	3. Options	_	
Substance A Substance B		Potato (protein)	>> >	Potato (protein)	Citeria Maximum Choose the fish species Fish species C <u>Common carp</u> Rainbow trout "maximum reasonable balanced diet (MRBD)"	ž	Optimize Maximum content dietary burden based on Substance B is 0,430 mg/kg.
Add substance					add fish meal as feed component (PC) add starch as feed component (CC)	i i	Report Optimize all Scenarios
		, Show details]	,	✓ add oil as feed component (F)	Z	Exit

By pressing the "Report" button, input and results can be viewed.

Report

INPUT Target content for Common carp: Crude fat 10,00% Crude protein 35,00% Maximum principal content of components in the diet: Potato (protein) 100,00% CC (0.1% protein, 0.1 % lipid) 100,00% Ξ F (100 % lipid) 100,00% Percent dry matter of components: Potato (protein) 89,4% Substance B residues in the components: 0,900 mg/kg (STMR-P) Potato (protein) Substance B residues in the components (dry matter): Potato (protein) 1,007 mg/kg (STMR-P/dry matter) CC (0.1% protein, 0.1% lipid) 0,000 mg/kg. F (100% lipid) 0,000 mg/kg. Draw pie Convert Copy into Print Done chart into table Clipboard

Report Substance B residues in the components: Potato (protein) 0,900 mg/kg (STMR-P) Substance B residues in the components (dry matter): Potato (protein) 1,007 mg/kg (STMR-P/dry matter) CC (0.1% protein, 0.1% lipid) 0,000 mg/kg. F (100% lipid) 0,000 mg/kg. RESULTS Maximum content dietary burden based on Substance B is 0,430 mg/kg (dry matter). The respective composition of the feed is: Potato (protein) 42,73% CC (0.1% protein, 0.1% lipid) 48,52% F(100% lipid) 8,76% Ε The dietary load of Substance B caused by the individual components is: Potato (protein) 100,00% CC (0.1 % protein, 0.1% lipid) 0,00% F (100% lipid) 0,00% Draw pie Convert Copy into Print Done chart into table Clipboard

5 <u>References</u>

- European Union, Regulation (EC) No 1107009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC. OJ L309, 24.11.2009, pp. 1 – 50 (2009).
- [2] European Commission, Working document on 'Nature of Residues in Fish' SANCO/11187/2013 rev.3, 31 January 2013, http://ec.europa.eu/food/plant/pesticides/guidance_documents/docs/app-j_en.pdf, (last opened 2014-11-02).

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6 Annex I: Mathematical Background

Annex 1

The Maximum Dietary Burden Calculation Solved by Linear Programming

In the following section the maximum calculation of residues in fish feed is presented. The program *DietaryBurdenCalculator* considers two fish species with specific requirements (different target nutrition needs) that have to be satisfied.

A possible feed component has three characteristics: a protein content (CP crude protein in % of dry matter (DM)), a lipid content (CL crude lipid in % of dry matter (DM)) and a residue value of a certain substance (for example a STMR value in mg/kg).

This context can be mathematically written as two different linear equations:

Protein content: $P_1x_1 + \dots + P_nx_n = P_{\text{Fish}},$ Lipid content: $L_1x_1 + \dots + L_nx_n = L_{\text{Fish}},$

where

 P_{Fish} : is the target protein concentration of the diet (%),

 L_{Fish} : is the target lipid concentration of the diet (%),

 P_i : is the protein concentration of feed component i (%),

 L_i : is the lipid concentration of feed component i (%) and

 x_i : is the fraction of feed component *i* in the diet (-).

For the actual fish diet problem further (trivial) conditions need to be defined in order to solve the mathematical problem:

- x_i must always be between 0 and 1,
- the sum of all x_i sum always up to 1.

If the idea of a "maximum reasonable balanced" diet (MRBD) is considered, the maximum content of a certain feed may be limited in some cases which can be considered by additional conditions. Therefore the inequalities $x_i \leq 1$, for $i = 1, \dots, n$ are replaced by $x_i \leq (R_{Fish})_i$ for $i = 1, \dots, n$. The restrictions are constant positive numbers smaller than and may diversify between feed components and fish species by reason of the different nutrition habit.

Obviously, the so far obtained expressions are all linear leading to an infinite number of solutions for the problem with infinite different feed compositions which meet the necessary criteria. The set of all possible solutions is called feasible solution set.

However, the desired feed composition is that one which results in the maximum concentration for a given feed composition. That corresponds mathematically to the objective function composed by the sum of the products of the part of feed and residue value of the corresponding component.

 $\max S(x) = S_1 x_1 + \dots + S_n x_n,$

where S: is the maximum substance concentration in the diet (mg/kg) and S_i : is the substance concentration of feed component *i* (mg/kg). Basically, the method is divided into two steps: Step 1, also called Phase I, is to find a start solution of the problem and Phase II is the improvement of an existing feasible solution until the optimal solution. Dependent on the number and settings of variables the method may either solve the problem exactly or assert that the problem is insolvable.

Parameter Setting

The following Table 1 shows the protein and lipid needs of two different important aquaculture species reared for human consumption: Rainbow Trout (*Oncorhynchus mykiss*) and Common Carp (*Cyprinus carpio*). A possible feed component data base of the *DietaryBurdenCalculator*

Table 1: Target composition of test diets (%DM) for carp and rainbow trout

Fish Species	CL(%)	CP(%)
Rainbow Trout	15	42
Carp	10	35

rests upon the Working Document of Pesticide Residues in Fish. The data base contains numerous feed components and their lipid content (CL crude lipid in % of dry matter (DM)), their protein content (CP crude protein in % of dry matter (DM)) and partially suggests a Maximum Reasonable Balanced Diet (MRDB) for fish. In the further document we focus on a exemplary data set of five feed components (Table 2).

A classification of feed components can be represented by CC (carbohydrate concentrate), PC

Table 2: Data of several feed components

Category	Feed	CL(%)	CP(%)	Max. % of diet
By-Products	Peanut (meal decorticated)	1	46.5	35
By-Products	Soybean (meal decorticated)	0.8	49.8	40
By-Products	Corn field (Grain meal)	4.8	10.2	35
Cereal Grains/ Crop Seeds	Rice (Broken grains)	0.6	8.1	50
Fat	Vegetable oil (oil)	100	0	10

(protein concentrate) and F (fat). The *DietaryBurdenCalulator* offers the possibility to add three special feed components: fish meal (PC), starch (CC) and oil(F). Table 3 illustrates their protein and lipid content. Additionally these feed components are treated as unloaded feed components and 100% in diet are allowed.

Table 3: Proximate composition of uncontaminated feed components

Feed Component	CL(%)	CP(%)
Fish Meal(PC)	5	75
Starch(CC)	0.1	0.1
Oil(F)	100	0

Model Functionality

With the program *DietaryBurdenCalculator*, a maximum burden value, the corresponding worst case feed composition and the dietary load of the substance caused by the individual components can be calculated. Further the calculator offers the possibility to modify the residue estimation by adding fish meal (protein concentrate), starch (carbohydrate concentrate), and/or oil (fat) as feed component or by allowing the idea of reasonable diet (MRDB). In general the program offers a high flexibility because the data base of feed components can be changed, two different fish species can be selected and specific residue values can be included. If the dietary burden calculation is not possible, the program informs the user and gives suggestions to solve the problem.

But not only in input but also in output the program offers many possibilities: As a result, the program creates a report that summarizes the input data and results.

7 Annex II: Installation of *DietaryBurdenCalculator*

Installation steps:







Setup - DietaryBurdenCalculator		l	
Select Start Menu Folder			
Where should Setup place the program	's shortcuts?		C
Setup will create the program's	s shortcuts in the follow	wing Start	Menu folder.
To continue, click Next. If you would lik	e to select a different	folder, click	Browse.
DietaryBurdenCalculator			Browse



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