Nutrient balances as an advisory tool, Case Poland

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Baltic Deal

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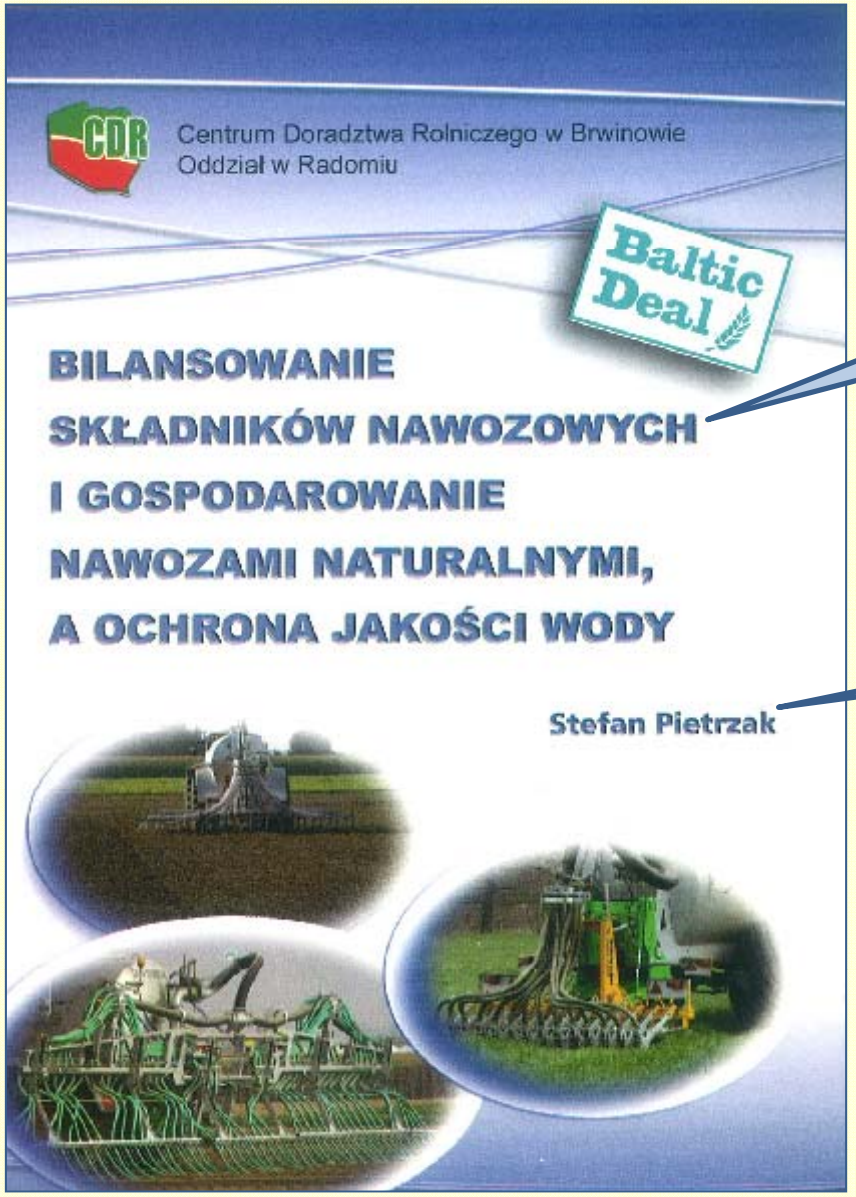

Balancing nutrients and manure management , their impact on water quality

Author: Stefan Pietrzak, professor Institute of Technology and Life Sciences

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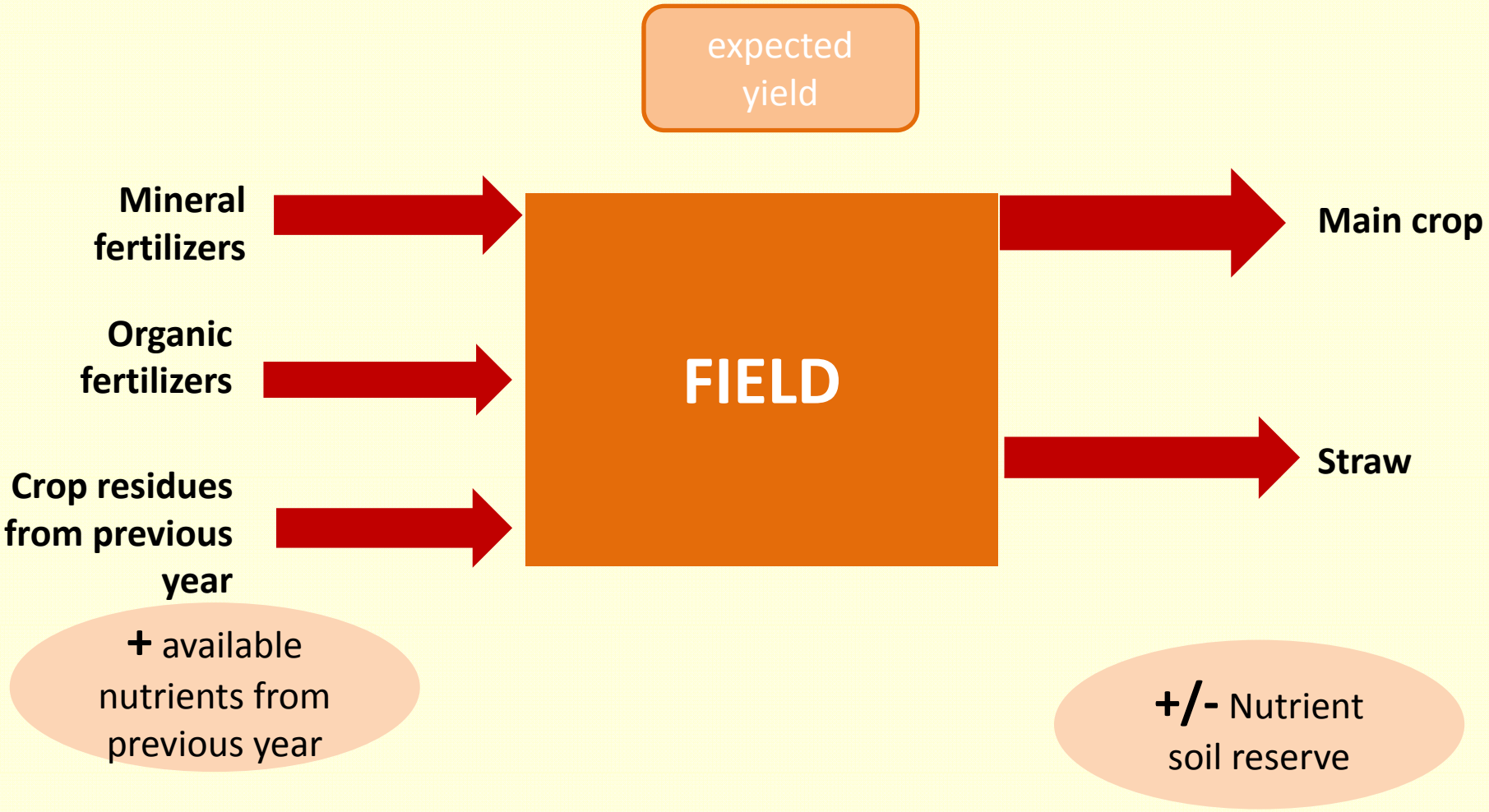
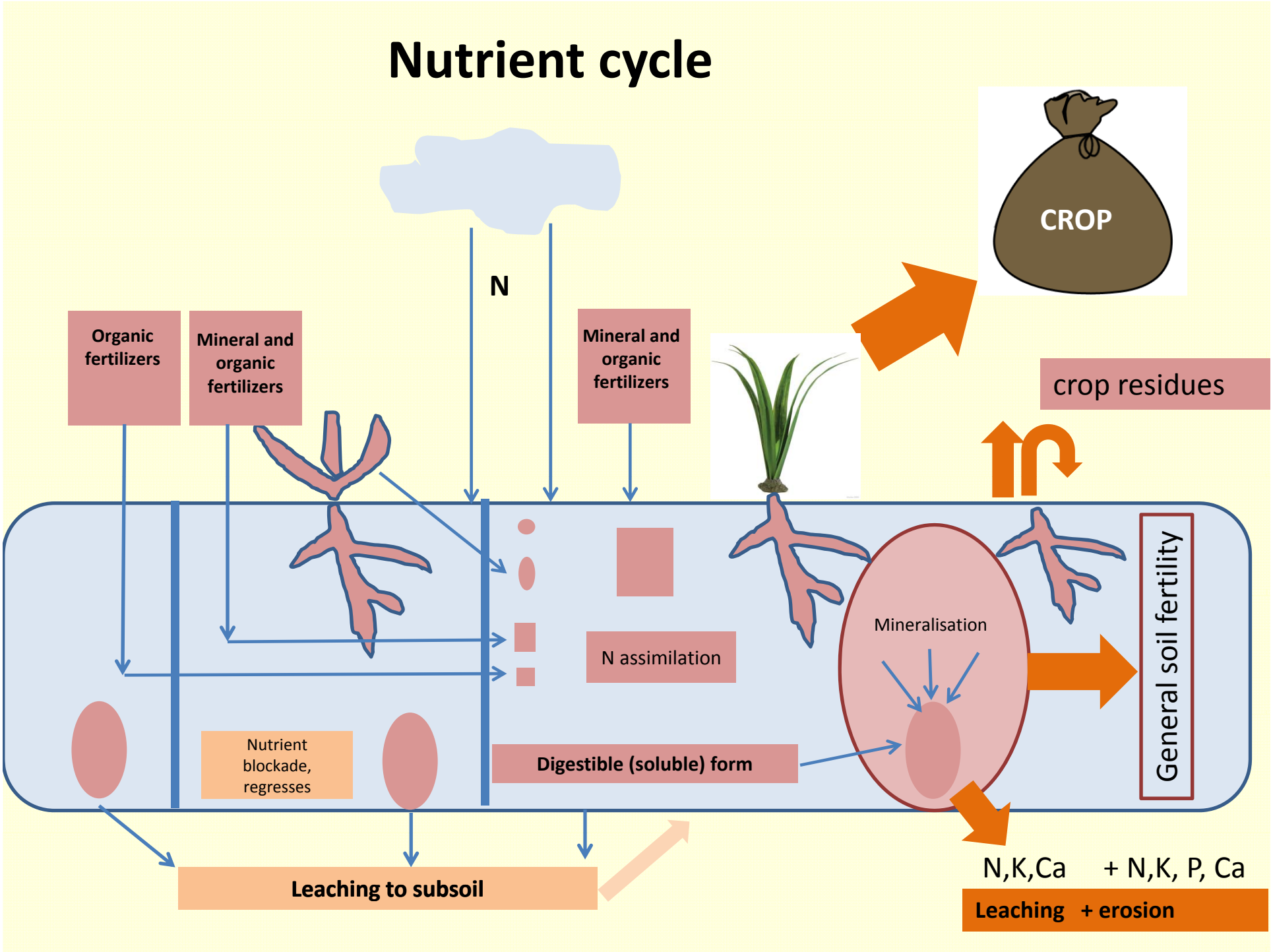
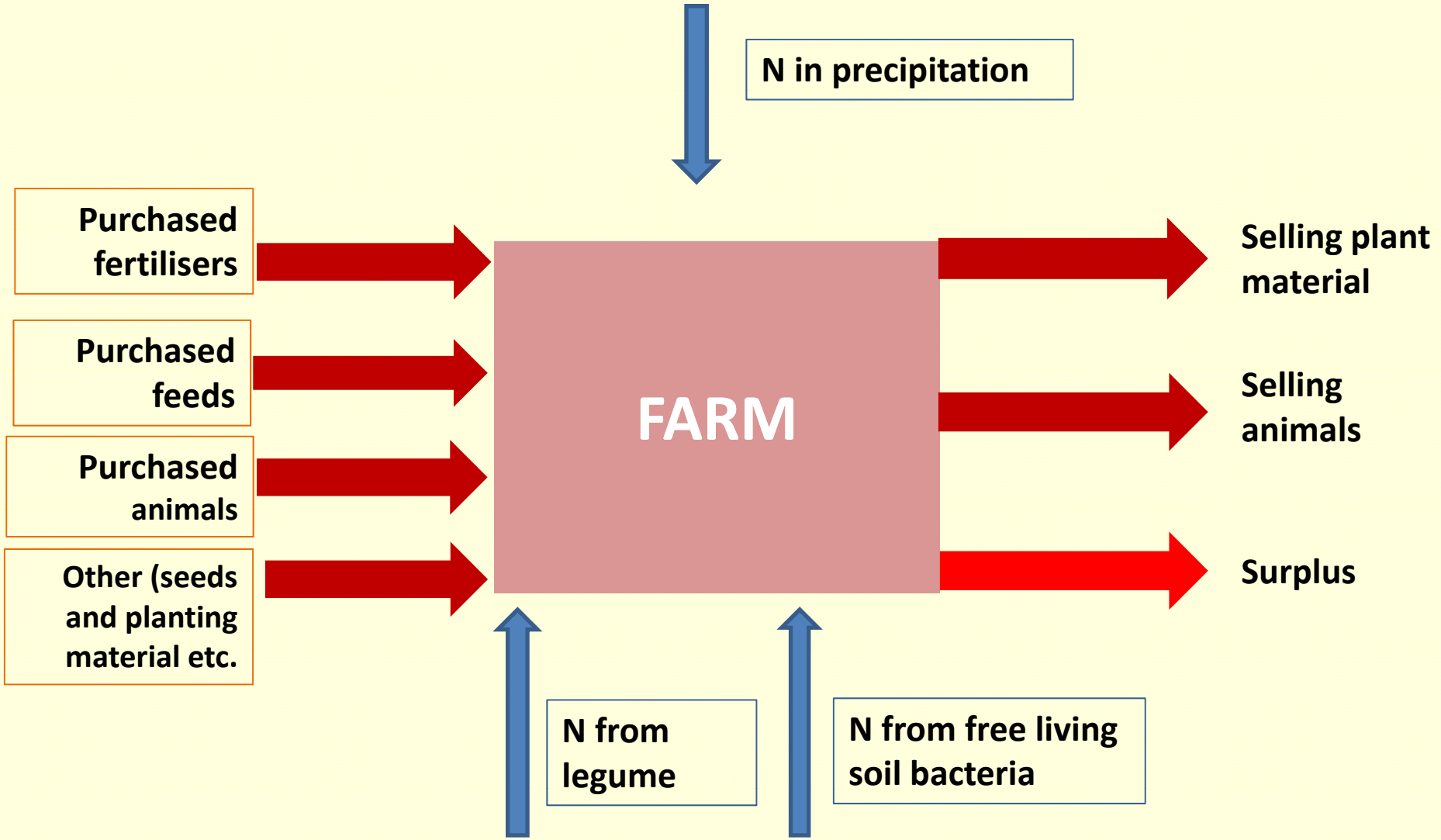
Nutrient balance „on the field”



Nutrient cycle



Nitrogen balance „on the farm gate”



The differences between the balance sheets

"On the field" balance takes into account the specific fields and their sum.
On the "input„ side we have mineral and organic fertilizers + crop residues + nutrients from previous year .
On the "output„ side are only plant products.

Balance **"at the farm gate"** includes the supply components containing nutrients - to the farm from the outside.
Takes into account beside fertilizers, nutients contained in the seed, feed - especially concentrates, live animals as well as the absorption of nitrogen by legumes.
On the "output" side - plant products and animal products

„At the farm gate" balance equation

$$M_{surplus} = M_{input} - M_{output}$$

$M_{input} = m_{fert} + m_{feed} + m_{other} + m_{Nprecipit} + m_{Nlegum}$

m_{fert} - nutrient contents in fertilisers,kg
m_{feed} - nutrient contents in feeds,kg
m_{othe} - nutrient contents in other (*eg. seeds, animals*),kg
$m_{Nprecipi}$ - nitrogen with precipitation,kg
m_{Nlegum} - nitrogent assimilate with legume,kg

$m_{feed} = \sum m_{feedi} \cdot k_i$
eg.: farmer bought 1 tonne concentrate *T-Komplet Pregio* for pigs. N contents k_i = 2,08%. Input = 20.8 kg

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$M_{input} = m_{sold} + m_v$

m_{sel} - nutrients contained in sold products,kg
m_v – nutrients output as a result random events,kg

$m_{sold} = \sum m_{soldi} \cdot n_i$
eg.: farmer sold 1 tonne live pigs. N contents n_i = 2,60%. Output = 26.0 kg

Nitrogen balance PGE Chwałowice 2011 year

M_{inp}	Input		kg N
$m_{fertili}$	0		**0**
m_{feed}	0		**0**
m_{other}	52,8		**52,80**
m_{preci}	37,82 x 15	=	**567,30**
m_{soil} =	37,82 x 15	=	**567,30**
m_{legume} =	G16+J40+J41	=	**652,15**
			1 839,55

M_{output}	Output	kg N
m_{s_plant}		**609,00**
m_{sv_animal}		**334,15**
		943,15

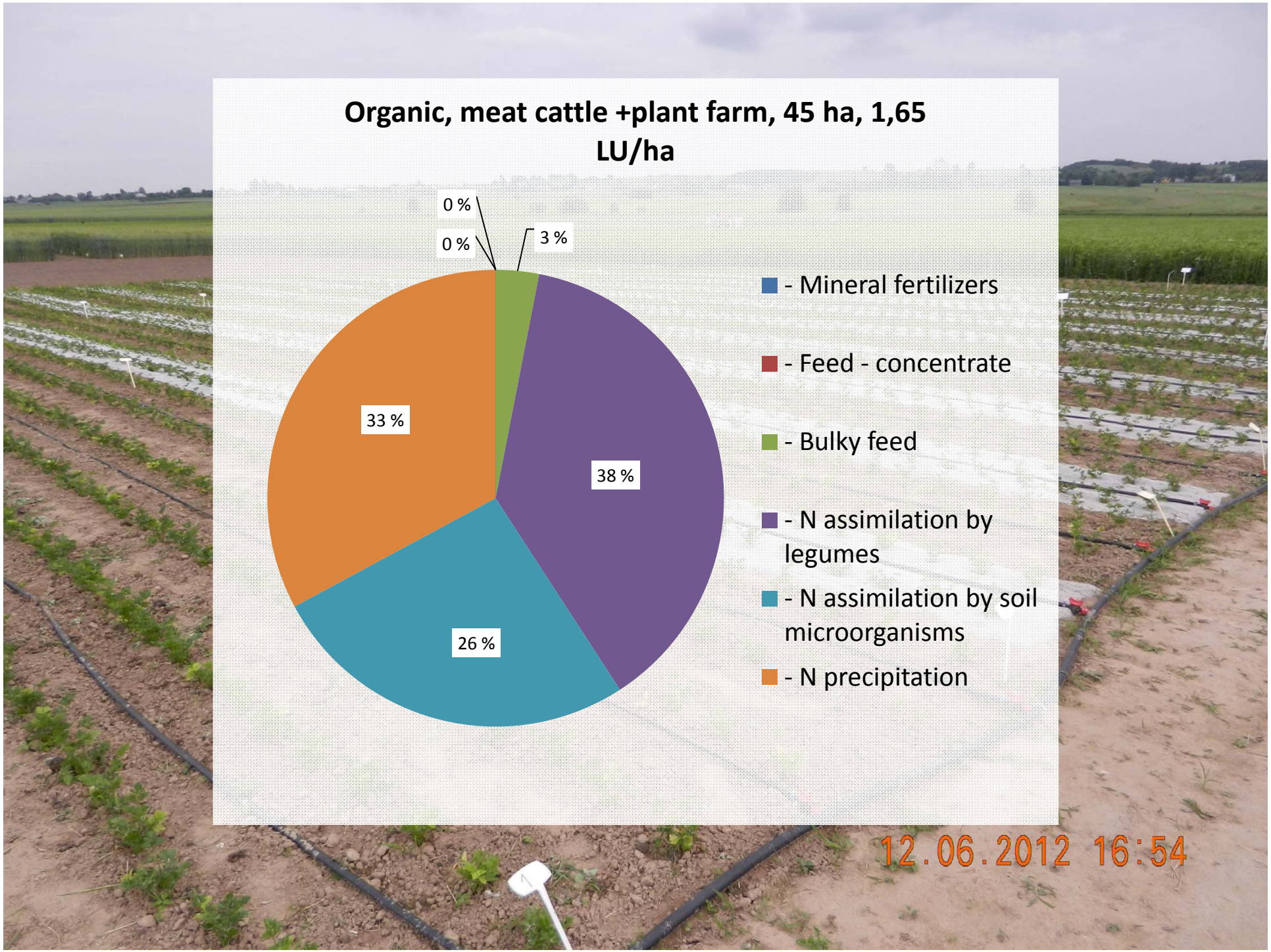
$$M_{surplus} = M_{input} - M_{output}$$

$M_{surplus}$ = 1839,55 - 943,15

$M_{surplus}$ = 896,4

$M_{sur./ha}$ = 896,04 kg N : 37,82ha = 23,7 kgN/ha

Organic farm, 45 ha, 0,8 LUV/ha	Quantity	
	kg N	kg N·ha^{-1}
Input	0	
- Mineral fertilizers	0	
- Feed - concentrate	0	
- Bulky feed	52,80	1,40
- N assimilation by legumes	652,15	17,24
- N assimilation by soil microorganisms	453,84	12,00
- N precipitation	567,30	15,00
Total input:	**1726,09**	**45,64**
Output		
- Plant products	609,00	16,1
- Animal products	334,15	8,80
- Other products		
Total output:	**943,15**	**23,7**
Surplus:	**782,94**	**21,94**
Effective use of N:		**54,64%**


Organic, meat cattle +plant farm, 45 ha, 1,65 LU/ha
0 %
0 %
3 %
33 %
38 %
26 %
- Mineral fertilizers
- Feed - concentrate
- Bulky feed
- N assimilation by legumes
- N assimilation by soil microorganisms
- N precipitation
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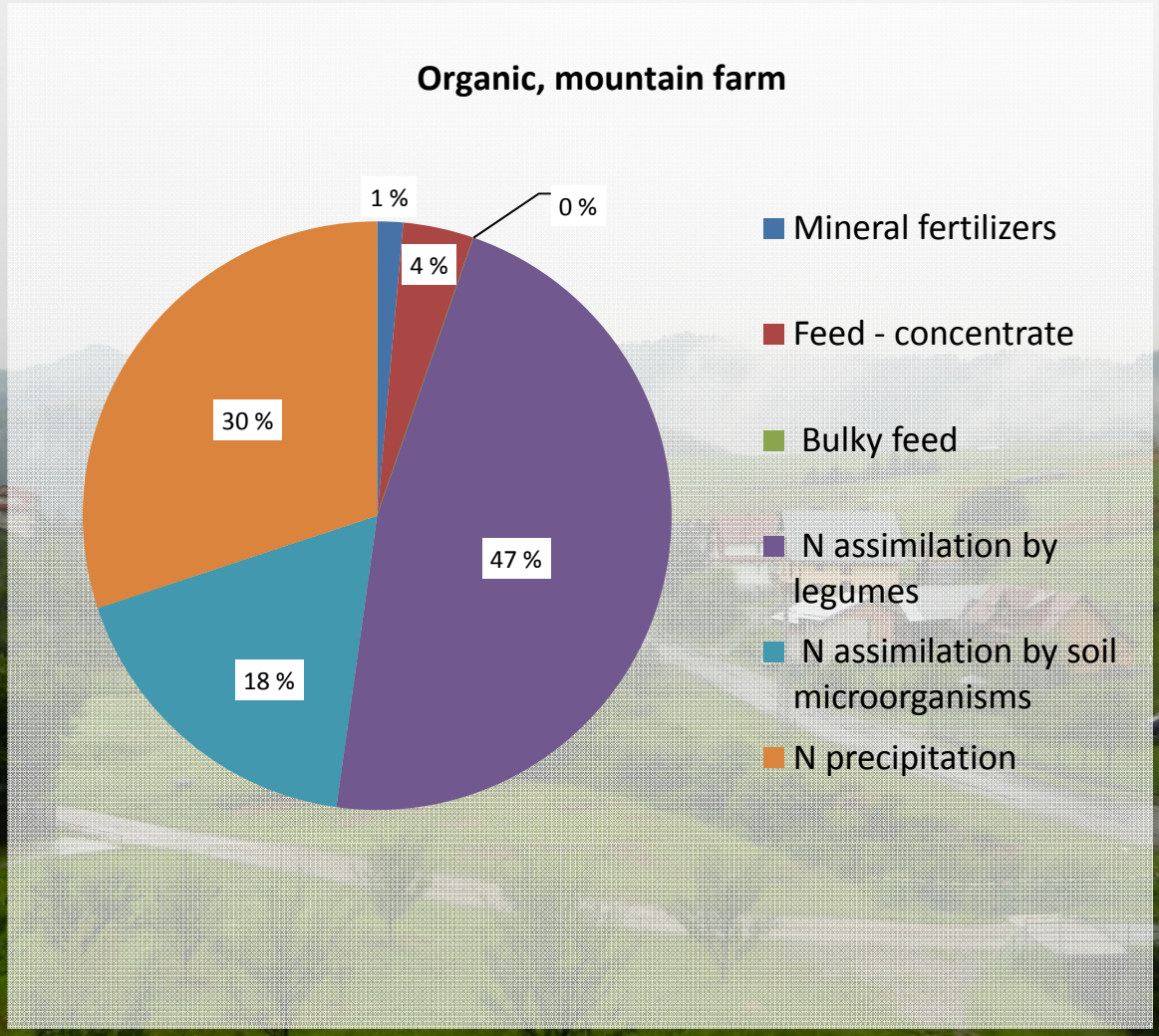
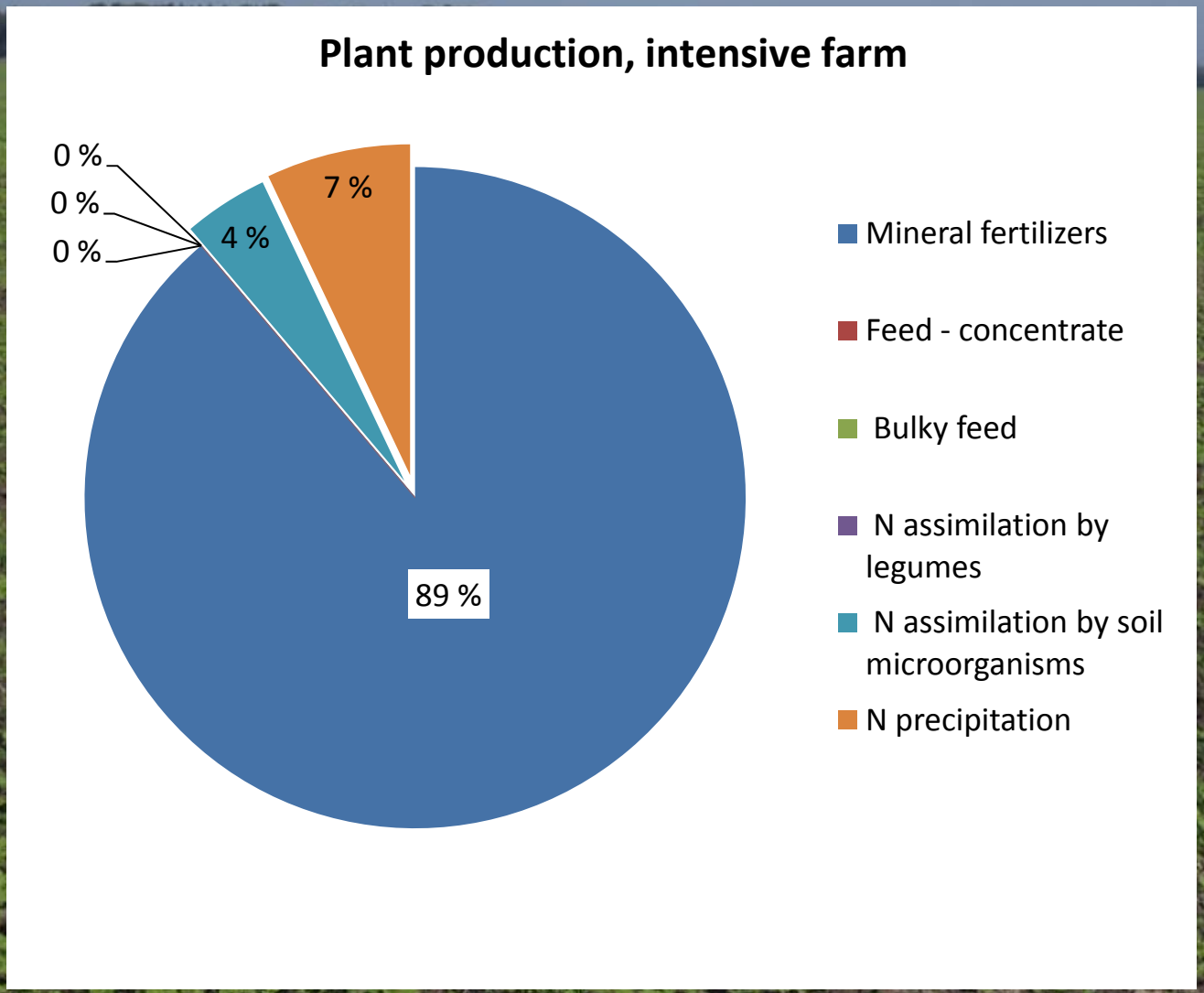
Mountain farm, sheep and cattle, 65 ha	Quantity	
	kg N	kg N·ha^{-1}
Input		
- Mineral fertilizers	42,5	0,8
- Feed - concentrate	117,2	2,2
- Bulky feed	0,0	0,0
- N assimilation by legumes	1398,2	26,5
- N assimilation by soil microorganisms	528,5	10,0
- N precipitation	898,5	17,0
Total input:	**2984,9**	**56,5**
Output		
- Plant products	0,0	0,0
- Animal products	1707,8	32,3
- Other products		0,0
Total output:	**1707,8**	**32,3**
Surplus:	**1277,1**	**24,2**
Effective use of N:	**57,2%**	**57,2%**

Mountain farm, sheep and cattle, 65 ha



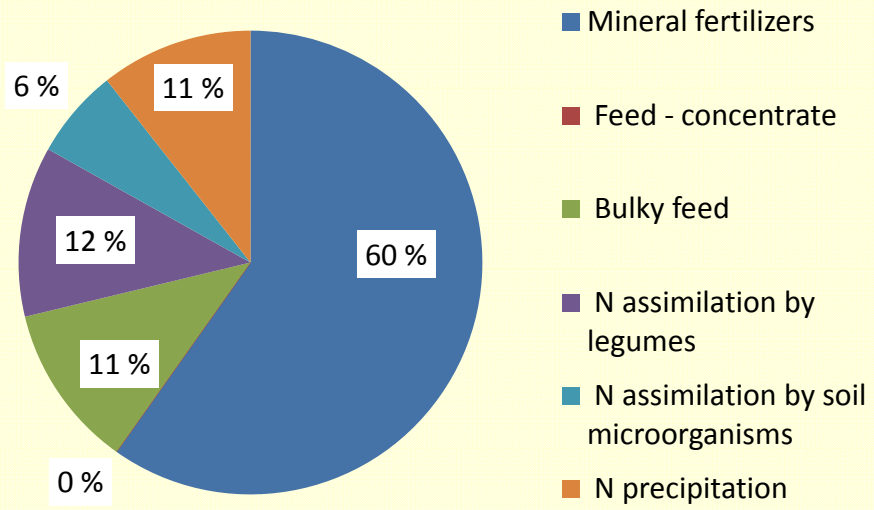
Crop production 176 ha wheat and winter rape	Quantity	
	kg N	kg N·ha^{-1}
Input		
- Mineral fertilizers	37 757,0	214,0
- Feed - concentrate	0,0	0,0
- Bulky feed	0,0	0,0
- N assimilation by legumes	0,0	0,0
- N assimilation by soil microorganisms	1 764,0	10,0
- N precipitation	2 998,8	17,0
Total input:	**42 519,8**	**241,0**
Output		
- Plant products	18 050,2	102,3
- Animal products	0,0	0,0
- Other products		0,0
Total output:	**18 050,2**	**102,3**
Surplus:	**24 469,6**	**138,7**
Effective use of N:	**42,5%**	**42,5%**

Crop production 176 ha wheat and winter rape



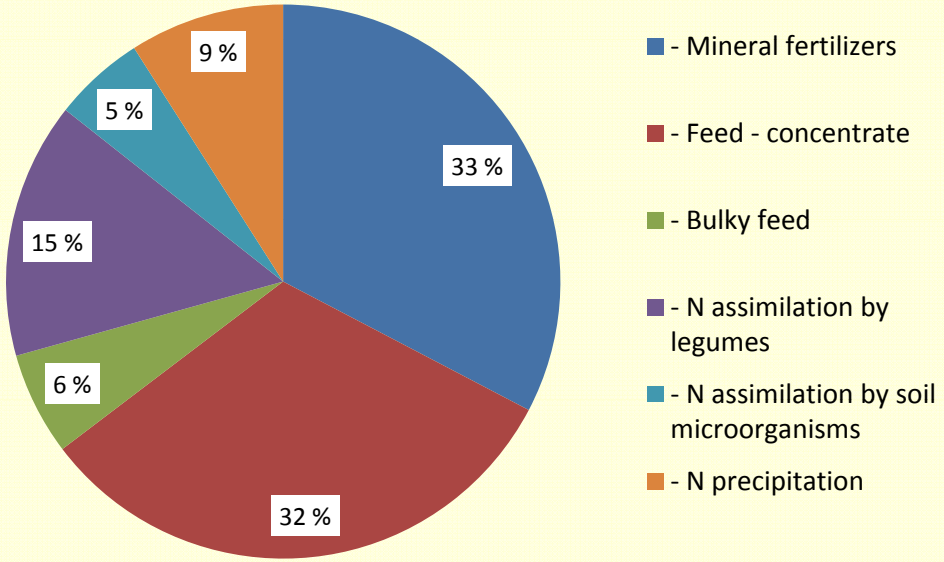
Milk farm, 48 ha, 1 LU/ha	Quantity	
	kg N	kg N·ha^{-1}
Input		
- Mineral fertilizers	4570,0	95,7
- Feed - concentrate	0,0	0,0
- Bulky feed	875,0	18,3
- N assimilation by legumes	908,2	19,0
- N assimilation by soil microorganisms	477,7	10,0
- N precipitation	812,1	17,0
Total input:	**7643,0**	**160,0**
Output		
- Plant products	910,0	19,0
- Animal products	2712,0	56,8
- Other products		0,0
Total output:	**3622,0**	**75,8**
Surplus:	**4021,0**	**84,2**
Effective use of N:	**47,4%**	**47,4%**

Milk farm, 48 ha, 1 LU/ha

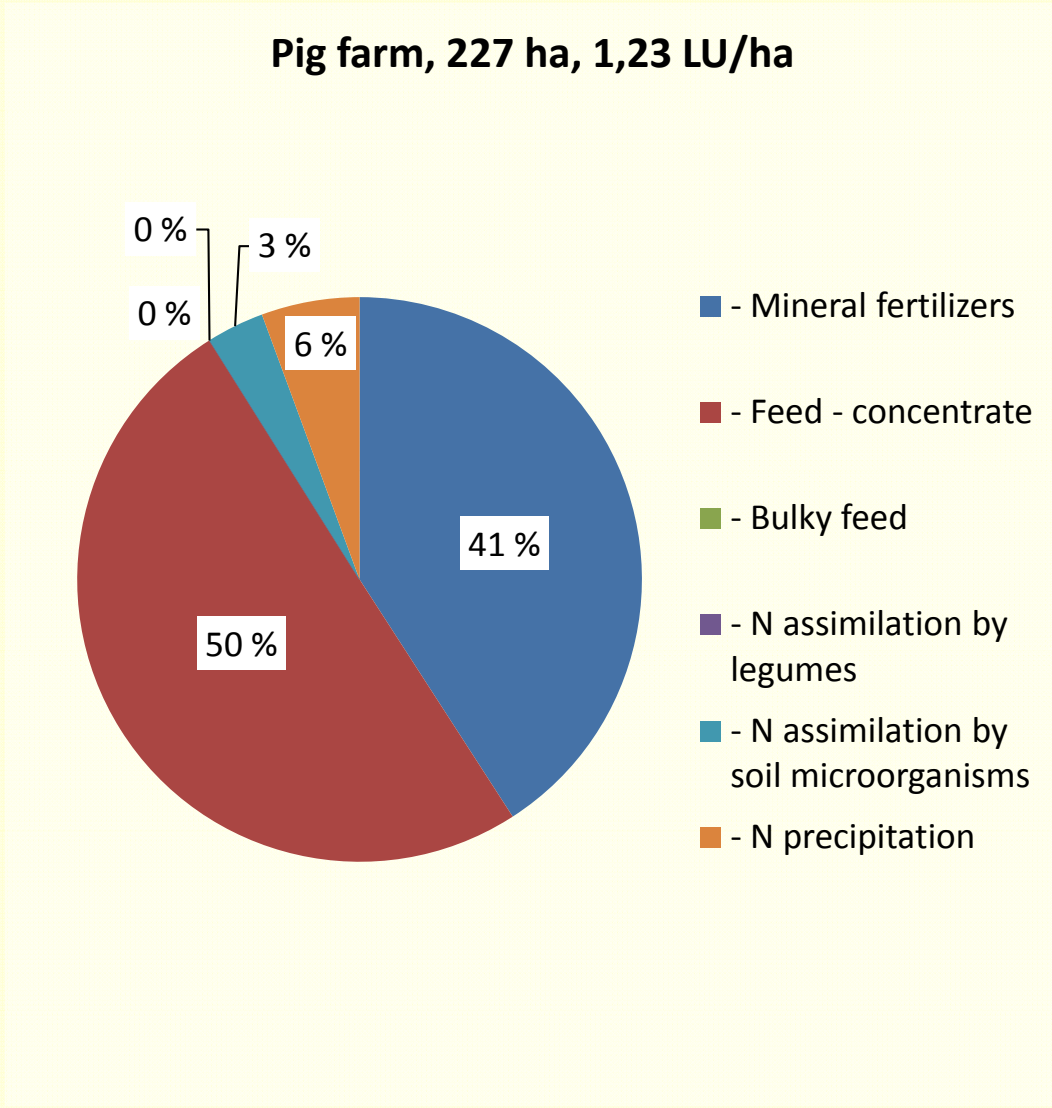


Mixed(milk+pig)farm,	Quantity	
	kg N	kg N·ha^{-1}
Input		
- Mineral fertilizers	2010,0	61,4
- Feed - concentrate	1968,4	60,1
- Bulky feed	370,0	11,3
- N assimilation by legumes	919,6	28,1
- N assimilation by soil microorganisms	327,4	10,0
- N precipitation	556,6	17,0
Total input:	**6152,0**	**187,9**
Output		
- Plant products	0,0	0,0
- Animal products	1925,6	58,8
- Other products		0,0
Total output:	**1925,6**	**58,8**
Surplus:	**4226,4**	**129,1**
Effective use of N:	**31,3%**	**31,3%**

Mixed pig&milk farm, 33 ha, 1,65 LU/ha



Pig farm, 230 ha , 1,25 LU/ha	Quantity	
	kg N	kg N·ha^{-1}
Input		
- Mineral fertilizers	28080,0	123,6
- Feed - concentrate	34493,5	151,9
- Bulky feed	0,0	0,0
- N assimilation by legumes	0,0	0,0
- N assimilation by soil microorganisms	2271,2	10,0
- N precipitation	3861,0	17,0
Total input:	**68705,7**	**302,5**
Output		
- Plant products	328,3	1,4
- Animal products	15460,8	68,1
- Other products		0,0
Total output:	**15789,1**	**69,5**
Surplus:	**52916,6**	**233,0**
Effective use of N:	**23,0%**	**23,0%**


Pig farm, 227 ha, 1,23 LU/ha
0 %
3 %
0 %
6 %
41 %
50 %
- Mineral fertilizers
- Feed - concentrate
- Bulky feed
- N assimilation by legumes
- N assimilation by soil microorganisms
- N precipitation

Balances in advisory

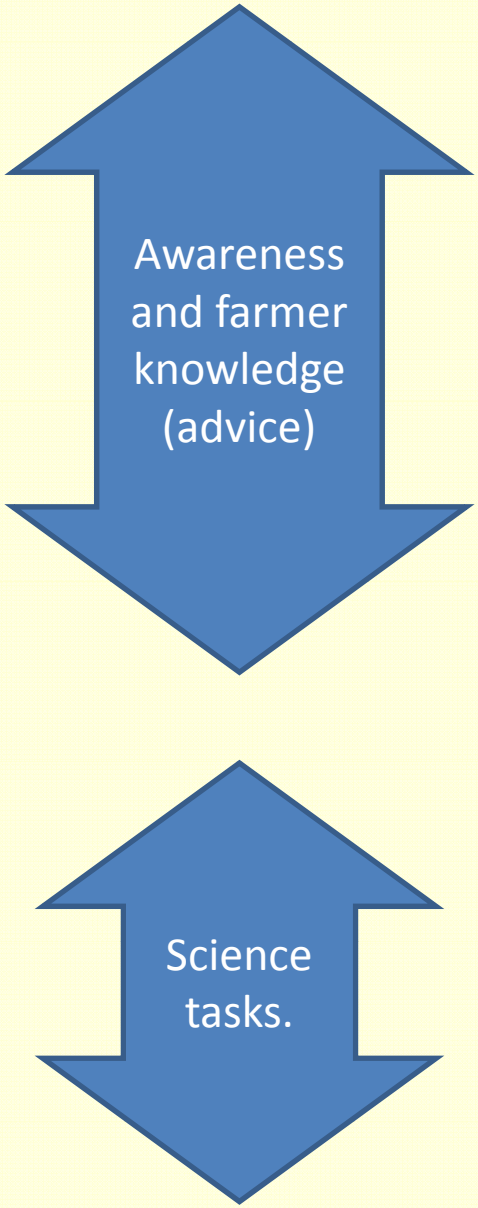
- allow for comprehensive look for farming
- farmers are motivated to improve the use of nutrients
- farmers perceive amount of components dispersed to the environment

- needs a quite work and time
- still require further work and unifying methodology

The main problems in a rational fertilization in Poland. :

- Uncommon of soil analysis.
- Routine fertilising: the regular use of the same doses of fertiliser for years, wrong nutrient proportions.
- Insufficient fertilisation advisory.
- Improper management of manure: too high doses, lack of special equipment.

- Determine the actual fertilising value of manure and slurry from different farming systems.
- Propose a more accurate methods of calculating fertilisation and use soil reserves.




Thank you