

Documentation of the used coefficients in Farm-N.

The expected net yields and N-demand of the crops are specified for each soil type and +/- irrigation. A table containing the Danish values can be found Anon (2002), see Table 1. The assumed fertilizer values of animal manures are taken from the latest Danish regulations (Anon (2005), page 33) and are used to calculate the additional mineral fertilizer that may be bought to satisfy the standard N-demand. The fertilizer value of cattle slurry is currently 70 %, pig slurry is 75 % and deep litter is 45 %. Animal housing that produces partially separated manures (solid manure and urine) is not currently included, as only 9 % of livestock are housed in this type.

The feed and N use of livestock is calculated using methods described in Poulsen og Kristensen (1998). The methods were updated in 2000 but a description is only available in Danish only: Poulsen et al (2001). A short Danish documentation of dairy herds and bulls can be seen at : http://130.226.173.223/FarmN/Beregning_foderbehov.doc. The initial N-efficiencies (output of N in animal products/feed N-uptake) of the animal groups are on annual basis: Dairy cows 26.3 %, Heifers 15.2 %, Bulls 23.1 %, Sows with piglets delivered at 7 kg/pig 17.2 %, Piglets 7-30 kg 49.1 % and slaughter pigs 30-102 kg 37.7 %.

In Poulsen og Kristensen (1998), the specific ammonia losses per animal housing system are described. The ammonia losses are updated with the values described in Hutchings et al (2001), found on link http://www.sciencedirect.com/science?_ob=MIimg&_imagekey=B6VH3-42HFNYH-6-5&_cdi=6055&_user=635791&_orig=browse&_coverDate=04%2F30%2F2001&_sk=999649988&view=c&wchp=dGLbVtb-zSkzS&md5=d2e35f1499357ba655bb7fa5d037055e&ie=/sdarticle.pdf

The user determines which crops can receive animal manure. The animal manure(s) is partitioned to those crops that have the highest utilization of animal manure-N, see Danish tables in Anon. (2005): http://www.lr.dk/planteavl/informationsserier/dyrkningsvejledninger/markeffekt_hus.htm. Ammonia losses after field application of manure are then calculated using the method described in Hutchings et al (2001).

The denitrification loss is calculated using the model SimDen (Vinther and Hansen (2004)) An Excel spreadsheet containing the model can be downloaded from http://www.agrsci.dk/media/webdav/filer/jpm/ostof/simden_ver_1_9.

Changes in soil-N are calculated on the basis of the C-inputs from manure and crop residues and the current soil C/N, using a dynamic model that is briefly described in Petersen og Berntsen (2003). The model is similar to that used in the FASSET model, see www.FASSET.dk. The change in soil-N used here is that which is predicted to occur after 10 years. The initial soil C/N values are dependent on the farm and soil types; dairy farms in general have 20 % more C and N than pig and arable farms. On sandy soils (clay <10 %) the soil C/N is typically 16, and on clay soil (clay>10) the C/N is 11-12. The values used are derived from 700 representative Danish soil samples (Heidmann et al (2001) and Heidmann et al (2002)(in Danish)).

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- Anon. 2005: Vejledning og skemaer 2005/06., 1-103. Ministeriet for Fødevarer, Landbrug og Fiskeri. Plantedirektoratet.
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- Vinther, F. P. and Hansen, S. Vinther, F. P. and Hansen, S. 2004: SimDen - en simpel model til kvantificering af N₂O-emission og denitrifikation. see www.agrsci.dk/simden .104, 1-47. DJF rapport Markbrug.

Table 1. Norm N quota and expected net yield per crop. DK rules 2002/03, Anon. 2002.

Crop	Unirrigated course sand <50 % fine sand(20-200µ m)		Unirrigated finsand >50 % fine sand(20-200µ m) or > 5,87% C		Irrigated course sand < 10% clay(< 2µ m)		Unirrigated Loamy sand 10-15% clay		Unirrigated Loamy sand > 15% clay(< 2µ m)	
	Yield	N quota	Yield	N quota	Yield	N quota	Yield	N quota	Yield	N quota
	100 kg/ha	kg N/ha	100 kg/ha	kg N/ha	100 kg/ha	kg N/ha	100 kg/ha	kg N/ha	100 kg/ha	kg N/ha
Sprin grain										
Spring barley after cereals	40	118	47	114	52	134	57	119	61	128
Spring barley after beets	44	105	52	102	57	123	62	107	66	117
Spring barley after grass/clover	44	51	52	48	57	69	62	53	66	63
Spring barley after potatoes	44	114	52	112	57	132	62	116	66	126
Spring barley after other crops	44	101	52	98	57	119	62	102	66	112
Sprin oats	41	97	48	92	53	113	58	97	62	107
Spring wheat after min. 2 yr grain	41	127	48	124	53	145	58	131	62	141
Spring wheat after other crops	41	122	48	120	53	141	58	126	62	136
Spring grain other	41	97	48	92	53	113	58	97	62	107
Mixture of spring grain and legumes for ripe harwest (maks. 50 pct. legumes)	31	60	38	52	43	63	48	44	51	51
Winter grain										
Winterwheat after grain	50	154	64	157	68	175	80	167	85	177
Winterwheat after grain(yr=-1), grass/clover(yr=-2)	56	112	70	116	75	135	88	128	93	139
Winterwheat after rape, legumes	56	124	70	128	75	147	88	140	93	151
Winterwheat after grass for seed	56	138	70	141	75	161	88	153	93	164
Winterwheat after grass/clover	56	88	70	92	75	111	88	103	93	114
Winterwheat after other crops	56	138	70	141	75	161	88	153	93	164
Extra for bread winter grain	50	36	64	42	68	43	80	47	85	49
Winter rye after grain	41	115	53	115	53	129	62	116	66	124
Winter hybrid rye after grain	49	124	64	127	64	141	75	131	80	140
Winter rye after other crops	41	92	53	92	53	106	62	93	66	102
Winter hybrid rye after other crops	49	102	64	104	64	116	75	108	80	117
Winter barley after grain	50	151	54	142	58	161	66	146	70	155
Winter barley after grass/clover	50	79	54	70	58	88	66	73	70	83
Winter barley after other crops	50	129	54	120	58	138	66	123	70	132
Winter triticale	41	136	53	137	53	151	62	139	66	146
Wintergrain others	41	124	53	124	53	138	62	125	66	133
Industial crops										
Winter rape	19	157	27	168	27	168	32	174	34	177
Spring rape	19	123	21	112	23	129	23	105	24	112
Legumes										
Spring pea	45	0	45	0	45	0	45	0	45	0
Broad bean	45	0	45	0	45	0	45	0	45	0
Lucerne	120	0	120	0	120	0	120	0	120	0
Lucerne with minimum 25 pct. grass	120	68	120	68	120	68	120	68	120	68
Orther legumes	-	0	-	0	-	0	-	0	-	0

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Seed crops										
Ryegrass for seed	12	127	12	127	12	127	12	127	12	127
Clover for seed	4	0	4	0	4	0	4	0	4	0
Rodfrugter:										
Potatoes, industri	350	168	400	163	450	186	450	163	450	168
Potatoes, human consumption	300	146	300	132	400	164	400	141	400	146
Sucker beets	350	113	425	107	500	127	500	104	500	109
Grovfoder:	net DM/ha		net DM/ha		net DM/ha		net DM/ha		net DM/ha	
Fodersuckerbeets, roots + top	9052	177	12069	177	12069	190	13075	172	13075	177
Kålroer, rod + top	7040	166	8549	159	8549	172	8549	150	8549	154
Silage maize after grain	9114	157	9114	143	10253	170	10139	146	10709	158
Silage maize after grass/clover	10941	84	10941	71	12309	98	12172	74	12856	85
Whole crop spring barley after grass/clover	6291	51	7385	44	8206	63	9163	47	9163	52
Whole crop spring barley after other crops	6291	123	7385	117	8206	136	9163	120	9163	124
Whole crop spring barley and legumes	6291	60	7385	54	8206	73	9163	56	9163	61
Whole crop winter grain	7858	154	10478	159	10478	172	13097	168	13097	172
Green crop of spring grain, harwest before ear emergensy	2891	97	3771	96	3771	104	4211	93	4211	98
Green crop of spring grain and legumes, do	3016	60	3934	53	3934	63	4393	47	4393	52
Green crop of winter grain, harwest before ear emergensy	4072	116	5430	122	5430	136	6787	131	6787	136
Permanent grass, low production	3493	141	3493	141	3493	141	3493	141	3493	141
Grass/clover with < 50% clover of total DM	7096	227	7392	231	8871	254	7688	236	7688	236
Pure grass	7890	286	8497	295	10318	322	9104	304	9104	304
Pure grass for dry pillets, tons/ha	11	257	13	311	15	365	14	338	14	338