EquiSoil
Pasture for horses

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Example Report
Eurofins Agro

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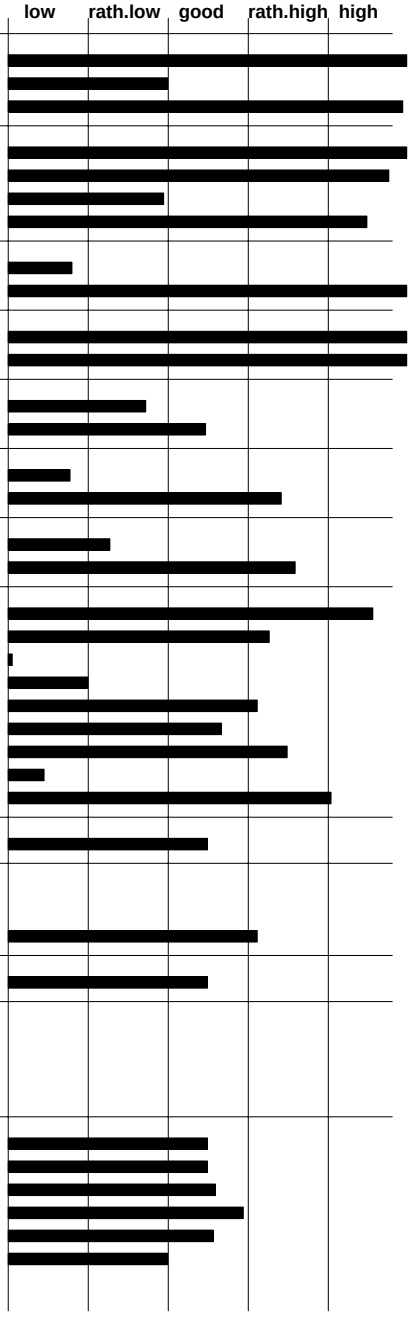
Analysis	Investigation/ordernr:	Date sampling:	Date report:
		29-04-2020	17-03-2021

Results		Unit	Result	Target value
Chemical	Total N stock	kg N/ha	15040	2400 - 3780
	C/N ratio		13	13 - 17
	N-supplying capacity	kg N/ha	250	95 - 145
	S-plant available	kg S/ha	81	20 - 30
	Total S stock	kg S/ha	3980	570 - 1340
	C/S ratio		49	50 - 75
	S-supplying capacity	kg S/ha	45	20 - 30
	P-plant available	kg P/ha	2,3	5,1 - 7,5
	P-soil stock	kg P/ha	685	255 - 365
	K-plant available	kg K/ha	1335	135 - 200
	K-soil stock	kg K/ha	1360	650 - 820
	Ca-plant available	kg Ca/ha	130	170 - 395
	Ca-soil stock	kg Ca/ha	16190	13070 - 19605
	Mg-plant available	kg Mg/ha	345	535 - 690
	Mg-soil stock	kg Mg/ha	1125	535 - 840
	Na-plant available	kg Na/ha	75	110 - 160
	Na-soil stock	kg Na/ha	160	55 - 80
	Si-plant available	g Si/ha	160020	14010 - 60700
	Fe-plant available	g Fe/ha	12120	5840 - 10510
	Zn-plant available	g Zn/ha	< 230	1170 - 1750
	Mn-plant available	g Mn/ha	1630	2330 - 3040
	Cu-plant available	g Cu/ha	160	95 - 150
	Co-plant available	g Co/ha	15	10 - 20
	B-plant available	g B/ha	1130	235 - 350
	Mo-plant available	g Mo/ha	50	230 - 11670
	Se-plant available	g Se/ha	15	8,2 - 11
Physical	Acidity (pH)		7,1	> 5,0
	C-organic	%	8,4	
	Organic matter	%	14,7	
	C/OS-ratio		0,57	0,45 - 0,55
	Carbonate lime	%	2,5	2,0 - 3,0
	Clay (<2 µm)	%	33	
	Silt (2-50 µm)	%	31	
	Sand (>50 µm)	%	19	
	<16 µm	%	42	
	Clay-humus (CEC)	mmol+/kg	404	> 279
	CEC-saturation	%	100	> 95
	Ca-saturation	%	86	80 - 90
	Mg-saturation	%	9,8	6,0 - 10
	K-saturation	%	3,7	2,0 - 5,0
	Na-saturation	%	0,7	1,0 - 1,5
	H-saturation	%	< 0,1	< 1,0
	Al-saturation	%	< 0,1	< 1,0



Results		Unit	Result	Target value	low	rath.low	good	very good
	Soil crumbling	score	8,7	6,0 - 8,0				
	Soil slaking	score	8,2	6,0 - 8,0				
	Risk on wind erosion	score	8,9	6,0 - 8,0				

		Unit	Result	Target value	low	rath.low	good	rath.high	high
	Moisture retention cap.	mm	39						
Biological	Microbial biomass	mg C/kg	1179	735 - 2205					
	Microbial activity	mg N/kg	190	125 - 175					
	Fungal/bacterial ratio		0,9	0,7 - 1,0					

Essential nutrients
Each crop requires nutrients. The essential nutrients that a crop needs most are nitrogen (N), sulphur (S), phosphate (P), potassium (K), calcium (Ca) and magnesium (Mg). The other essential nutrients are the micro nutrients iron (Fe), zinc (Zn), manganese (Mn), copper (Cu), boron (B), molybdenum (Mo) and chloride (Cl). A crop require relatively low concentrations of these micro nutrients, however a deficit can cause loss of yield and/or quality in every crop.

A number of other nutrients (sodium, silicon, cobalt, selenium) can also be important to - amongst other factors - the yield, quality, resilience, sturdiness, fertility, palatability and (animal) health.

Elements can also compete with each other. For example, if the Mg status is "good" but the K status is "high", then an Mg deficiency can still occur. Therefore, the recommended dosages take these interactions into consideration.

Fertilisation recommendations and legislation
The fertilisation recommendations aim to achieve an agronomical optimum yield and crop quality. The recommendations do not take any legal restrictions into consideration.

Recommend.

		Situation	2020 t/m 2023 spring	summer	autumn
in kg per ha per year	Stikstof (N)	grazing	81	27	13
		haying	107	53	28

		Situation	2020 spring	summer	2021 t/m 2023 spring	summer
in kg pure fertiliser per ha each cut	Sulphate (SO_3)	grazing/haying	0	0 (2th cut)	0	0 (2th cut)
	Phosphate (P_2O_5)	grazing	15	0	25	20 (once)
		haying	15	0	25	20
	Potassium (K_2O)	grazing	0	0	0	85 (once)
		haying	0	0	30	30

		2020	2021	2022	2023
in kg per ha per year	Calcium (CaO)	100	100	100	100

		Situation	2020 spring	summer	2021 t/m 2023 spring	summer
in kg pure fertiliser per ha each cut	Magnesium (MgO)	grazing/haying	75	75 (once)	0	0
	Sodium (Na_2O)	grazing/haying	45	45 (once)	45	45 (once)

			2020	2021	2022	2023
in kg per ha per year	Copper (Cu)	grazing/haying	0	0	0	0
	Cobalt (Co)	grazing/haying	0	0	0	0
in g per ha per year	Selenium (Se)	grazing/haying	0	0	0	0
in kg per ha per year	Lime (nw)	grazing/haying	0	-	-	-
			For every one-tenth pH increase, a lime gift (NV) of 285 is required.			
Soil structure	Effective org. matter	per year	5580			
	Calcium (CaO)	once	0			
	Magnesium (MgO)	once	0			

Explanation

In the formulation of the recommendations it has been assumed that the sampled layer matches the sod (to be created) or tillage depth.
Horses will neglect spots with a lot of manure. Here, the sod quickly runs wild. Drag the parcel to evenly distribute the manure. Regular mowing of the wild spots ensures a smooth parcel and even growth of the grass. If horses share pasture with sheep or cattle, the grass will be grazed bare more evenly.
Animal manure contains many useful nutrients. However, part is not (directly) available to the grass. The active part is expressed as a coefficient (WC). In the figures below, the coefficients of the two types of fertilizer have already been taken into account:

	Cattle slurry	Pig slurry
N	1,8	2,5
P_2O_5	1,2	2,7
K_2O	6,5	6,9
MgO	1,3	1,8
Na_2O	0,7	1,1

The fertilization advice you can fill with fertilizer, but also by a combination of manure and fertilizer. A sample calculation for nitrogen:
- Advice for hay in the spring is 90 kg N per ha
- Application of 20 m^3 cattle slurry per hectare

With the 20 m^3 cattle slurry 20 x 1.8 (wc) = 36 kg N is applied. The remaining 54 kg (90 - 36) is filled with fertilizer, in this cas calcium ammonium nitrate (CAN). CAN contains 27% N. So for 54 kg N, 200 kg CAN (100/27 x 54) is needed.
The 20 m^3 cattle slurry also supplies 24 kg P_2O_5 (WC 1.2) and 130 kg K_2O (WC 6.5).

Nitrogen:
When nitrogen is in excess, the energy and protein concentrations of the grass tend to increase readily and can easily become too high. Than, horses get too much energy. Laminitis could be one of the consequences, but obesity is also undesirable for breeding mares. Depending on the soil type, it is therefore recommendable to apply no more than 200kg of pure nitrogen annually, distributed over five gifts.
Do not forget to take animal manure into account.

Sulphur:
Sulphur (S) is released by the degradation (mineralisation) of organic matter or manure. This mineralisation is performed by soil organisms. Soil organisms are not very active under colder conditions, which means not much S is released from the soil early in the spring. Therefore, it is sensible to fertilise with S for many early crops, even if the soil content is good or high (consult with your adviser).
Sulfur is essential for the formation of proteins and it is also important for sufficient grass growth.
An excess of sulphur can cause problems. Too much S in grass can result in poor utilisation of trace elements (including copper) by cattle.

Phosphate:
P-supplying capacity is 67 . The target in the range is 17 - 27
The P-buffering capacity indicates whether the P-soil stock is high enough to maintain the level of plant available P. When the buffering capacity (buffering power) is low, the plant available P will not remain on level during the growing season: it will decrease.
Phosphate is important for the root development, particularly in young plants. The advice is based on both the readily available phosphate (P-PAE) as well as on the phosphate stock (P-AL).

Potassium:
Potassium is important for the firmness of the plant.

Calcium:
Depending on the state of the soil, the calcium recommendation is partly crop-based and partly soil-based.
The crop-based CaO fertilisation recommendation (directly below the potassium advice) is primarily intended to improve the quality of the crops.
The soil-based recommendation is intended to supplement the soil supply of calcium and will also have a positive effect on the soil structure (see CEC triangle). Please note: you may also be advised to give a dose of lime. You do not have to give several doses of calcium; you should subtract calcium from nitrogen, phosphate and lime fertilisers from the total.

Magnesium:
Magnesium (Mg) is important for the yield of grass, but the Mg supply must also be correct in order to avoid the risk of grass tetany.
The magnesium concentration of grass is less important for horses than for cattle. However, too low soil magnesium concentrations should be prevented. Therefore, the recommended magnesium gift is equal for horse pastures.

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Sodium:
Carrying and lactating mares and young horses which provide only light work can meet their sodium demands with the indicated fertilization and normal grass provision. Horses that provide heavy labour and sweat regularly cannot meet their sodium demands through only grass. These horses require supplementation of sodium through concentrates or a mineral lick.

Copper:
Copper is not of importance for the growth of grass. It is important for a proper bone development, the formation of blood and the metabolism process. Despite a good copper condition deficiencies may still arise. This is then due to poor utilization o f the copper in the feed. Lowering the crude protein content in the feed will improve the copper utilization. By splitting the copper gift over the years the chance of leaching will decrease and ensures a uniform supply to the grass.

Cobalt:
Cobalt is not of importance for the growth of grass. It is an important component of vitamin B12. The availability of cobalt decreases at high pH and can leach. Splitting the cobalt gift over the years decreases the chance of leaching and ensures a uniform supply to the grass.

Selenium:
Selenium is important for horses. It plays a role in fertility and muscle metabolism amongst others. Too high selenium content can be toxic to horses.

Acidity:
The acidity (pH) of the soil affects the availability of nutrients, the soil structure and also the soil life. Note the target range: a too low pH can be adjusted by liming.

Soil life:
The biological soil fertility is measured by 3 characteristics, the microbial biomass, the microbial activity, and the fungal/bacterial ratio.
The acknowledgement of the measured results is based upon the amount of organic matter. There is not a recommendation given for the measured characteristics. On the basis of research projects there will be more information available.

Organic matter

Figure: Organic matter balance

13,5 % 14,7% Organic matter

Yearly breakdown rate (percentage) of the total organic matter content (%): 2,3

- Stock of organic matter which will remain after 1 year in the sampled layer if no (effective) organic matter is supplied.
- Total required supply of effective organic matter as a result of the degradation of the organic matter.
- Supply of organic matter through grass
- Amount needed to replenish, e.g. through animal manure

Organic matter is of great importance for the pasture. It plays a role in the structure and moisture retention capacity of the soil. The organic matter can also release nutrients through mineralization. Often reseeding is detrimental to the development of the organic matter. Note that the percentage of organic matter remains approximatter the same.

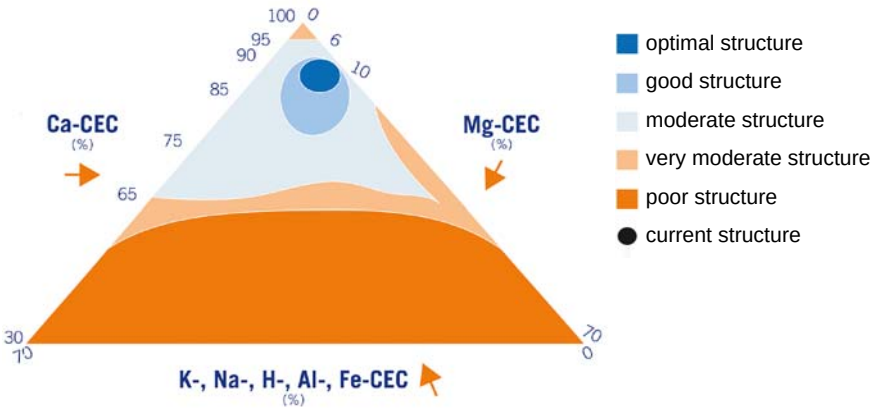
Figure: Quality of the organic matter

Organic matter consists primarily of C, N, P, S. If the organic matter contains relatively high amounts of N and/or S, this makes it attractive to soil organisms. Soil organisms happily eat this organic matter. N and S are released in the process and the amount of organic matter decreases slightly (dynamic organic matter). Organic matter can also contain a lot of C. This is generally less attractive to soil organisms (bacteria). As a result, the organic matter is not consumed as quickly by the soil organisms; making the organic matter more stable. Stable organic matter contributes - among other factors - to the workability of the soil and the looseness. Dynamic organic matter contributes primarily to the release of N and S and is therefore a source of these nutrients for the crop. The quality of the organic matter can be changed (gradually) by paying attention to the properties of soil improvers such as animal manure, compost and crop residues.

Physical

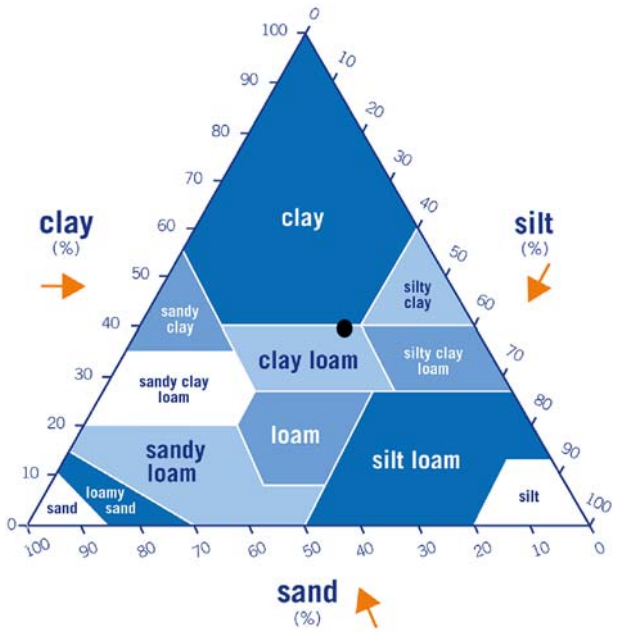
The assessment of soil structure is based on the Ca-CEC, K-CEC, and Mg-CEC ratio. Actual soil structure is - of course - not merely depending on ratio, but also on weather conditions, moisture condition of the soil, and the weight of the machinery.

Figure: Structure triangle



Physical

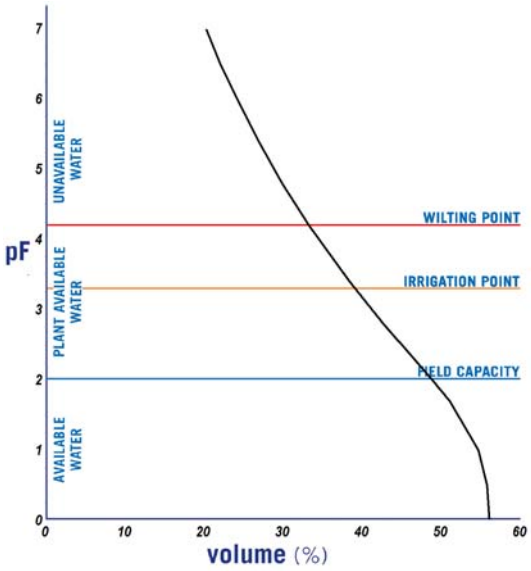
Figure: Texture triangle



Besides clay, the silt and sand fractions are presented as well. Clay is smaller than 2 micrometer (µm), silt particles are 2-50 µm and sand particles are larger than 50 µm. The relative distribution of soil particles is used to estimate the risk of slaking. Slaking causes the soil pores to be clogged with smaller particles and degrades soil structure. The risk of slaking is greatest at 10-20% clay.

Soil crumbling score is: good, however the evaluation of soil crumbling status is also depending on crop type. Considering the results, the chance of soil slaking is small.

Figure: Water retention curve



The amount of plant available water in the sampled layer is 39 mm. This is the maximum amount you should irrigate. All excess irrigation will drain off the parcel or will sink to deeper layers.

Crops have difficulties to obtain water when the actual moisture level is below pF 3,3. When you are able to measure the moisture level, start with irrigation if the moisture content of the parcel is at 39,2 % and irrigate 25 mm.

The actual moisture level can be measured by using a soil moisture sensor, or collect soil from ten spots in the parcel. Measure the weight of the moist soil and the weight after 24 h drying. The difference between moist and dry soil is an indication of the moisture level of the parcel.

Contact & info

Soil layer:	0 - 25 cm
Sample was taken by:	Third party
Contact sample taking:	Klantenservice: 0888761010

Method		Result	Unit	Method	RvA
Results analyses	Total nitrogen stock	6440	mg N/kg	Em: NIRS (TSC®)	Q
	S-plant available	34,7	mg S/kg	Em: CCL3(PAE®)	
	Total sulphur stock	1705	mg S/kg	Em: NIRS (TSC®)	Q
	P-plant available	1,0	mg P/kg	Em: CCL3(PAE®)	Q
	P-soil stock	67	mg P_2O_5/100 g	PAL1: Gw NEN 5793	Q
	K-plant available	572	mg K/kg	Em: CCL3(PAE®)	Q
	K-soil stock	14,9	mmol+/kg	Em: NIRS (TSC®)	
	Ca-plant available	0,7	mmol Ca/l	Em: NIRS (TSC®)	
	Ca-soil stock	366	mmol+/kg	Em: NIRS (TSC®)	
	Mg-plant available	147	mg Mg/kg	Em: CCL3(PAE®)	Q
	Mg-soil stock	39,7	mmol+/kg	Em: NIRS (TSC®)	
	Na-plant available	32	mg Na/kg	Em: CCL3(PAE®)	Q
	Na-soil stock	3,0	mmol+/kg	Em: NIRS (TSC®)	
	Si-plant available	68540	µg Si/kg	Em: CCL3(PAE®)	
	Fe-plant available	5190	µg Fe/kg	Em: CCL3(PAE®)	
	Zn-plant available	< 100	µg Zn/kg	Em: CCL3(PAE®)	
	Mn-plant available	700	µg Mn/kg	Em: CCL3(PAE®)	Q
	Cu-plant available	68	µg Cu/kg	Em: CCL3(PAE®)	Q
	Co-plant available	6,9	µg Co/kg	Em: CCL3(PAE®)	Q
	B-plant available	484	µg B/kg	Em: CCL3(PAE®)	Q
	Mo-plant available	23	µg Mo/kg	Em: CCL3(PAE®)	
	Se-plant available	6,6	µg Se/kg	Em: CCL3(PAE®)	
	Acidity (pH)	7,1		Em: NIRS (TSC®)	
	C-organic	8,4	%	Em: NIRS (TSC®)	Q
	Organic matter	14,7	%	Em: NIRS (TSC®)	Q
	C-inorganic	0,37	%	Em: NIRS (TSC®)	
	Carbonate lime	2,5	%	Em: NIRS (TSC®)	
	Clay (<2 µm)	33	%	Em: NIRS (TSC®)	
	Silt (2-50 µm)	31	%	Em: NIRS (TSC®)	
	Sand (>50 µm)	19	%	Em: NIRS (TSC®)	
	Clay-humus (CEC)	404	mmol+/kg	Em: NIRS (TSC®)	
	Microbial biomass	1179	mg C/kg	Em: NIRS (TSC®)	
	Microbial activity	190	mg N/kg	Em: NIRS (TSC®)	
	Fungal biomass	442	mg C/kg	Em: NIRS (TSC®)	
	Bacterial biomass	509	mg C/kg	Em: NIRS (TSC®)	

The values stated on page 1 and 2 under 'Result' are calculated from the above mentioned analysis results.

Q Method accredited by RvA
Em: Method Eurofins Agro, Gw: Equivalent of, Cf: In conformity with
P-soil stock This analysis was performed in duplicate.

Results are reported in dry soil.
All procedures have been completed within the maximum shelf life between sampling and analysis.
The analyses were done at Eurofins Agro, Wageningen (NL).
The reported results only refer to the processed material on 01-05-2020