



Soil fertility in domestic and public gardens: state of the art

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1. Introduction

Over the past 60 years the Soil Service of Belgium (SSB) developed a unique expertise in soil analysis and soil fertility advice. Every year, tens of thousands soil analyses are carried out, mainly upon request of professional agriculturists. The soil analysis, which is crucial for an optimal soil fertility, screens the soil condition, taking different parameters (like pH, %C and macro-elements) into account. Based on the soil analysis a fertilisation advice is given.

In Flanders, SSB has also been analysing soils of both domestic and public gardens. In these gardens, soil analysis is requested either when new gardens are being established or when poor plant growth is observed. The information gathered by SSB over the past years offers a unique insight in the soil fertility status of the Flemish garden complex, as well as its evolution.



3. Soil fertility – current status (2007-2009)

Soil fertility classes (here presented for private gardens with sandy soils, except lawns)

	pH-KCl	% C	P	K	Mg	Ca	Na
(in mg/100 g dried soil (AL-extract))							
Very low	<4.0	<1.2	<5	<5	<3	<20	<1.0
Low	4.0-4.5	1.2-1.4	5-8	5-8	3-4	20-39	1.0-2.0
Rather low	4.6-5.1	1.5-1.7	9-11	9-11	5-6	40-69	2.1-3.0
Optimal	5.2-5.6	1.8-2.8	12-18	12-18	7-10	70-140	3.1-6.0
Rather high	5.7-6.2	2.9-4.5	19-30	19-30	11-15	141-180	6.1-10.0
High	6.3-6.8	4.6-10.0	31-50	31-50	16-25	181-260	10.1-20.0
Very high	>6.8	>10.0	>50	>50	>25	>260	>20.0

- based on field trials
- based on agric. expertise
- soil type dependent
- OM dependent
- land use dependent

= BASIS of soil fertility advice at SSB

New gardens

	pH	% C	P	K	Mg	Ca	Na
Very low	2.5	7.9	4.8	5.2	2.9	2.5	4.6
Low	9.5	7.7	6.2	19.9	8.1	6.6	38.7
Rather low	11.4	12.0	5.6	14.5	11.8	11.8	23.0
Optimal	17.0	40.0	21.3	30.4	22.4	32.9	22.6
Rather high	17.6	27.1	34.4	20.9	17.6	15.1	6.2
High	20.7	5.0	19.7	5.0	19.0	9.3	4.3
Very high	21.3	0.3	8.0	4.1	18.2	21.8	0.6

- pH: too low (24%) – too high (60%)
- large variation in %C
- P: rather high, but quite some variation (only 17% lower than optimal)
- Mg: rather high – very high

Vegetable gardens

	pH	% C	P	K	Mg	Ca	Na
Very low	1.3	2.3	1.3	0.3	1.8	1.3	4.6
Low	7.4	2.5	1.3	7.4	3.1	4.8	39.4
Rather low	6.4	5.9	2.3	5.3	5.6	5.9	26.5
Optimal	18.1	30.3	5.9	13.0	13.2	30.5	23.2
Rather high	19.1	46.1	15.5	33.1	15.8	20.1	4.8
High	27.5	12.9	27.2	29.5	31.3	13.5	1.0
Very high	20.2	0.0	46.5	11.4	29.2	23.9	0.5

- pH: too high (67%)
- %C: optimal – rather high (59%)
- P: too high (89%)
- K: rather high – high (74%)
- Mg: high – very high (76%)

Ornamental gardens

	pH	% C	P	K	Mg	Ca	Na
Very low	1.2	4.5	1.7	3.6	1.7	1.0	2.9
Low	4.8	6.4	4.0	12.6	3.8	3.1	34.8
Rather low	7.4	11.0	5.5	12.6	6.0	8.1	19.0
Optimal	4.5	35.7	19.0	28.8	23.1	29.8	29.8
Rather high	18.3	31.9	31.4	28.3	17.6	16.2	6.7
High	24.8	10.0	27.1	11.0	24.3	13.6	5.5
Very high	29.0	0.5	11.3	3.1	23.5	28.2	1.3

- pH: too high (>50%)
- %C: optimal – rather high (42%)
- P: rather high, but quite some variation
- Mg: rather high – very high

Lawns

	pH	% C	P	K	Mg	Ca	Na
Very low	2.3	26.9	4.3	1.0	4.8	1.0	2.9
Low	2.9	37.1	8.9	7.2	10.8	3.7	51.1
Rather low	8.5	14.7	14.1	22.2	20.7	8.9	28.2
Optimal	13.5	18.2	21.3	33.3	23.6	33.7	11.0
Rather high	14.9	2.1	30.8	17.2	11.0	14.9	3.3
High	23.6	0.8	16.8	13.5	14.1	14.3	2.9
Very high	34.3	0.2	3.8	5.6	15.0	23.5	0.6

- pH: too high (73%)
- %C: too low (79%)
- P: rather high, but quite some variation
- Mg: large variation (37% lower than optimum)

2. Materials & Methods

- soil sample → standard soil analysis (texture, pH-KCl, %C, P, K, Mg, Ca, Na (in AL-extract))

↓ BEMEX (decision support system developed by SSB)

soil fertility advice

- 2007 – July 2009:

Destination	Number of soil samples	Number of analysed parameters
Vegetable garden	393	3,144
Ornamental garden	420	3,360
Lawn	483	3,864
New gardens	483	3,864
Greenhouse	38	342
TOTAL	1,817	14,536

- 1989 – July 2009: 31,722 soil samples & 254,410 analysed parameters

4. Evolution of the soil fertility in new gardens (1989-2009)

pH

Soil fertility class	1989-1992	2000-2003	2004-2007	2007-2009
Very low	7.0	2.5	3.3	2.5
Low	18.2	10.6	9.9	9.5
Rather low	22.9	16.0	13.6	1.4
Optimal	14.2	18.1	18.7	17.0
Rather high	13.7	17.6	16.5	17.6
High	12.8	17.4	19.1	20.7
Very high	11.2	17.8	18.9	21.3

- ↘ gardens with low pH
- ↗ gardens with high pH
- !! It is very difficult to decrease pH in soils with high pH!!

Phosphorus

Soil fertility class	1989-1992	2000-2003	2004-2007	2007-2009
Very low	4.1	2.0	1.4	4.8
Low	5.8	6.3	5.2	6.2
Rather low	5.4	5.2	4.4	5.6
Optimal	23.0	18.0	18.3	21.3
Rather high	31.3	33.0	35.1	34.4
High	21.1	25.8	26.6	19.7
Very high	9.3	9.7	9.0	8.0

- ↗ P-content until 2007
- 2007-2009: ↘ P-content

Magnesium

Soil fertility class	1989-1992	2000-2003	2004-2007	2007-2009
Very low	8.3	2.7	4.5	2.9
Low	16.9	10.1	8.1	8.1
Rather low	19.3	14.9	12.0	11.8
Optimal	26.8	26.1	26.4	22.4
Rather high	11.9	17.6	18.2	17.6
High	10.1	15.3	18.8	19.0
Very high	6.7	13.3	12.0	18.2

- ↗ gardens with high Mg

5. Conclusions

- Rich soil fertility in Flemish gardens
- Lime dressing: acid → excessive lime dressing
- Large variation in organic matter and macro-elements
- Unbalanced proportion of nutritive elements
- Tendency to lime dress to excess and overfertilise
Moreover, it is more difficult to repair soils with high pH and it is easier to lime dress when pH is too low

- Need for soil analysis
- Balanced soil fertilisation will result in optimal yield and minimal environmental impact

