

MONITORING OF MORTALITY IN BELGIAN HONEYBEE COLONIES 2020-2021

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FASFC GT Varroa, 22/12/2021

Object

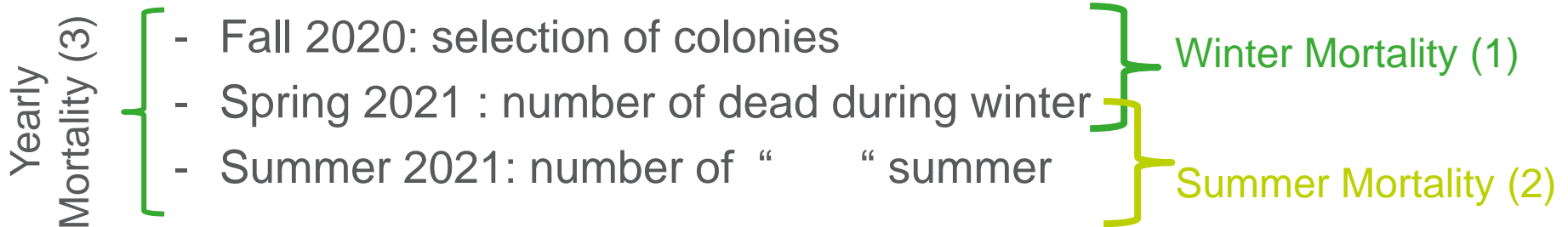
- Continuation of the program of surveillance of honeybee colonies health launched by FASFC in 2016.
- Monitoring of honeybee colonies mortality in Belgium 2020-2021

Sampling methodology

- Population frame:
 - 9056 registered beekeepers in Belgium:
 - ~5400 in Flanders
 - ~3500 in Wallonia
 - ~ 200 in Brussels
- Sampling :
 - 2 stage sampling :
 - ~ 25 apiaries per LCU
 - 1 to 6 colonies per apiary (only strong colonies)

Data collection

- 3 visits :



- Data collected:

- Number of colonies alive, dead, sold, potential reason of death, feeding strategy, treatment(s).
- Merged or weak colonies considered as dead.

Methodology : Statistical analysis

- Winter mortality

- Colony mortality (Pi_{v2}):

$$Pi_{v2} = \frac{dead_{v2}}{mi_{v1}}$$

- Weighed Colony Sample Mortality (WCSM) :

$$WCSM = \frac{\sum(Mi_{v1} * Pi_{v2})}{\sum Mi_{v1}}$$

- Seasonal mortality

- $Pi_{v3} = \frac{dead_{v3}}{mi_{v2}}$

- Year mortality

- $Pi_{vy} = \frac{dead_{v2} + dead_{v3}}{mi_{v1}}$

Data 'cleaning'

Raw sample : 846 colonies selected in 199 apiaries.

For winter :

- 7 suppression for lack of data
 - 5 in Liège
 - 1 in BNA
 - 1 in OVB
- 1 in OVB for non-valid data
 - > final dataset of 814 colonies in 191 apiaries.

For summer:

- 17 apiaries with 100% winter mortality
 - > dataset of 629 colonies in 174 apiaries

For year:

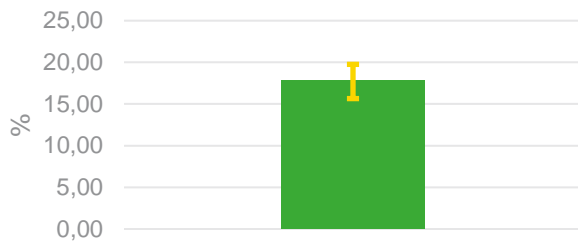
-> 174 apiaries and 764 colonies

Sample distribution, by geographical entity

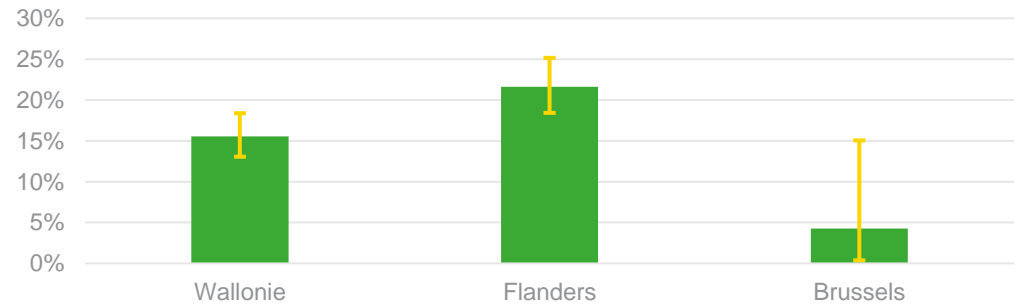
Geographical Entity	Beekeepers in population		Selected apiaries		Total colonies within selected apiaries	Selected colonies
	N	%	n	%	Mi	mi
Belgium	9.056	100%	191	100	1.328	814
Flanders	5.368	59%	93	49%	573	367
Wallonia	3.481	38%	90	47%	708	414
Brussels	207	2%	8	4%	47	33
Antwerp	1.460	16%	24	13%	136	95
East-Flanders	1.175	13%	22	12%	136	85
Limburg	984	11%	13	7%	199	63
FI Brabant	960	11%	10	5%	91	52
West Flanders	789	9%	24	13%	110	72
Hainaut	873	10%	24	13%	169	114
Liege	743	8%	19	10%	150	69
Luxembourg	627	7%	21	11%	159	100
Namur	796	9%	14	7%	135	74
Wal Brabant	442	5%	12	6%	95	57

Winter mortality 2020-2021

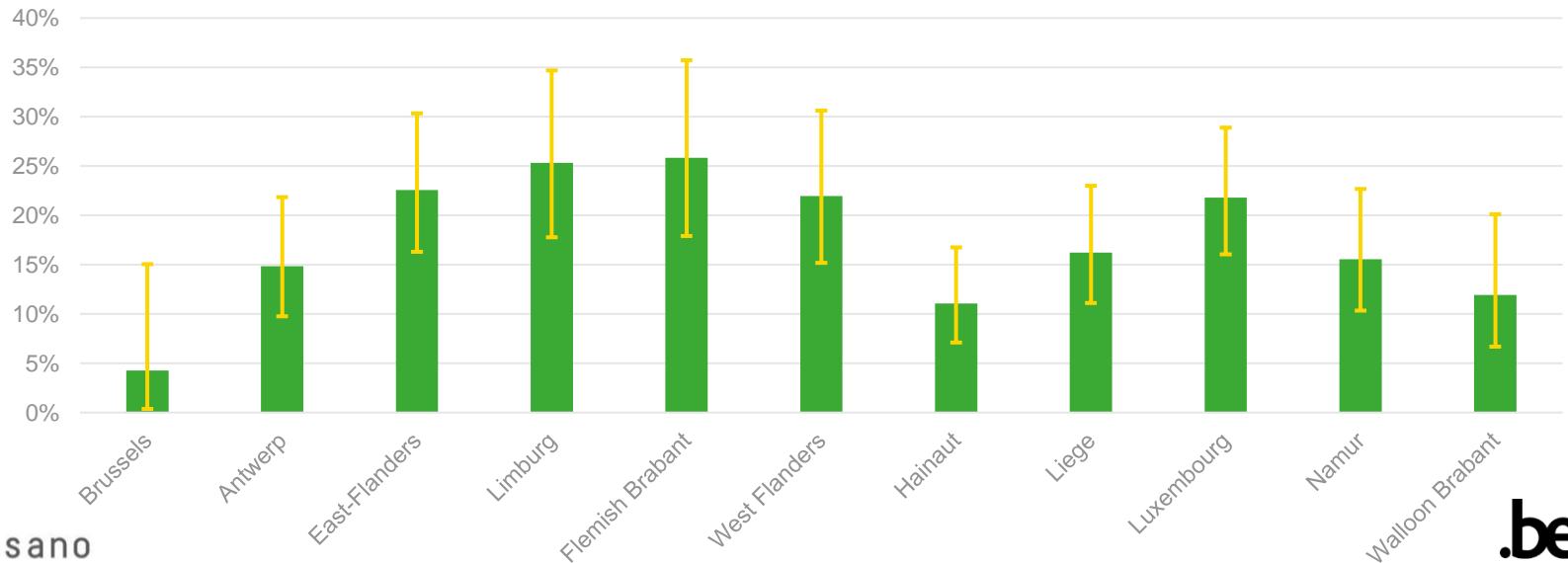
Belgium Winter mortality



Regions Winter mortality

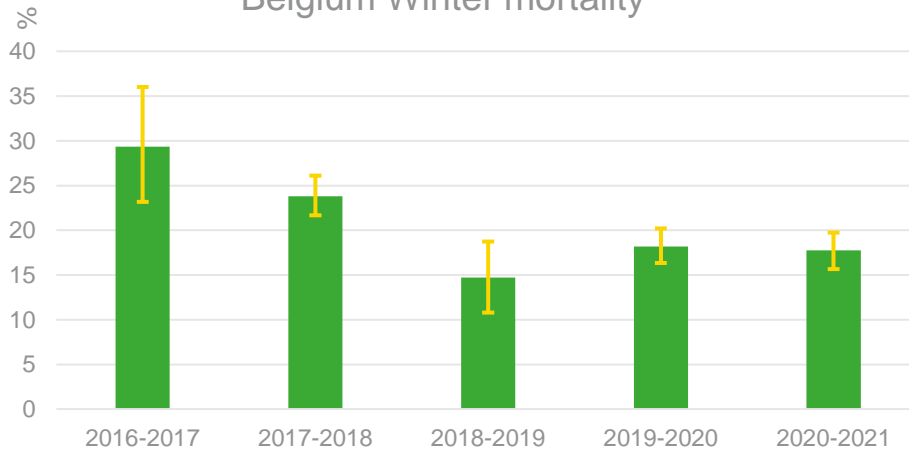


Provinces Winter Mortality

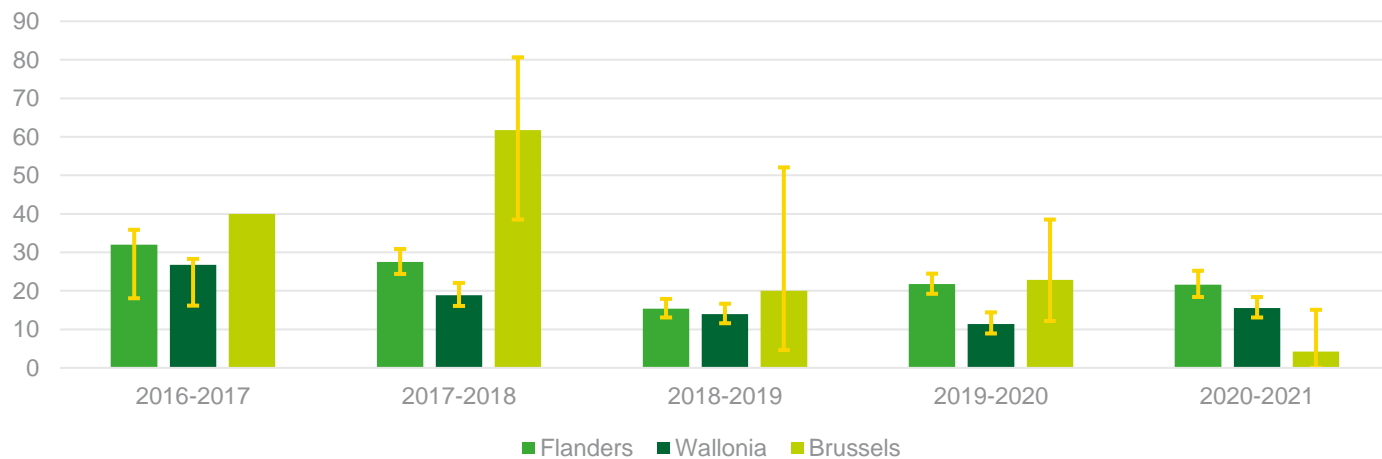


Winter mortality evolution

Belgium Winter mortality



Region winter mortality

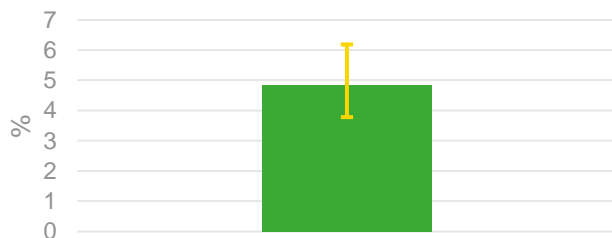


Winter mortality details

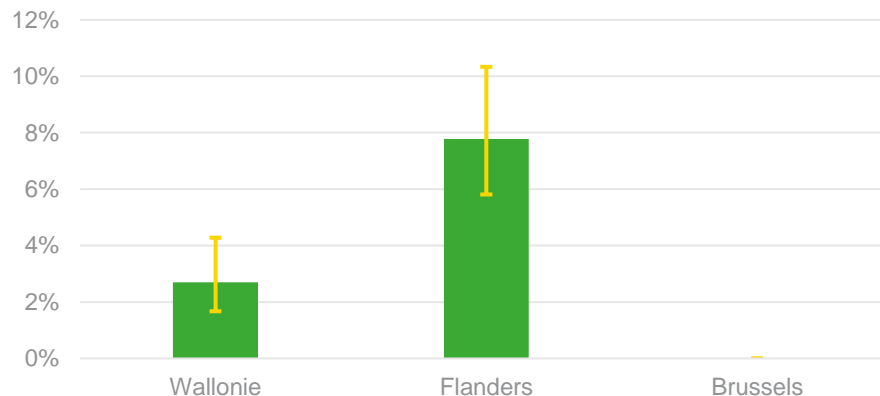
Geographical entity	Sampled apiaries 2021	Sampled colonies 2021	Overwintering weighted colony mortality from Fall to Spring											
			Estimated mortality										2020-2021	
			2016-2017		2017-2018		2018-2019		2019-2020		%	95% CI		
		%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI			
Belgium	191	814	29.34	23.19-36.03	23.81	21.66-26.10	14.73	10.81-18.74	18.2	16.34	20.2	17.76	15.66	19.76
Brussels	8	33	40	NA	61.76	38.53-80.66	20	4.59-52.06	22.81	12.13	38.5	4.26	0.00	15.04
Flanders	93	367	32.02	18.09-35.84	27.47	24.35-30.83	15.34	13.08-17.92	21.76	19.24	24.5	21.62	18.44	25.18
Antwerp	24	95	28.61	9.49-40.14	15.91	11.21-22.07	13.25	9.19-18.7	29.36#	24.79	34.4	14.83	9.75	21.84
East-Flanders	22	85	53.09	23.96-66.27	13.66	8.91-20.29	25.09	17.26-34.94	14.04	9.49	20.2	22.57	16.32	30.34
Limburg	13	63	18.11	0.68-31.32	8.21	3.28-17.79	8.52	5.82-12.26	7.55	4.55	12.2	25.33	17.78	34.71
Flem Brabant	10	52	27.43	11.52-31.97	57.45	50.8-63.84	20.36	14.65-27.54	46.36*	33.85	59.4	25.82	17.89	35.72
West Flanders	24	72	28.77	12.62-35.35	17.57	11.79-25.32	22.61	15.87-31.12	22.44**	17.05	28.9	21.97	15.20	30.64
Wallonie	90	414	26.73	16.12-28.26	18.88	16.09-22.03	13.93	11.59-16.65	11.41	8.95	14.4	15.54	13.05	18.40
Hainaut	24	114	20.69	7.43-28.63	24.13	17.64-32.06	23.74	18.43-30	36.06***	21.88	53.1	11.07	7.10	16.76
Liege	19	69	18.88	3.04-25.56	7.05	4.05-11.84	10.74	7.34-15.41	6.94	4.19	11.2	16.22	11.12	23.01
Luxembourg	21	100	33.98	11.23-42.89	27.33	20.67-35.18	11.19	6.36-18.75	4.81	1.62	11.7	21.80	16.06	28.88
Namur	14	74	27.46	9.92-39.21	22.04	15.6-30.16	12.5	7.47-20.01	8.75	4.36	16.3	15.56	10.33	22.68
Wal Brabant	12	57	33.9	14.39-41.75	17.05	10.5-26.35	1.49	0-8.75	23.61	15.74	33.79	11.93	6.69	20.13

Summer mortality 2021

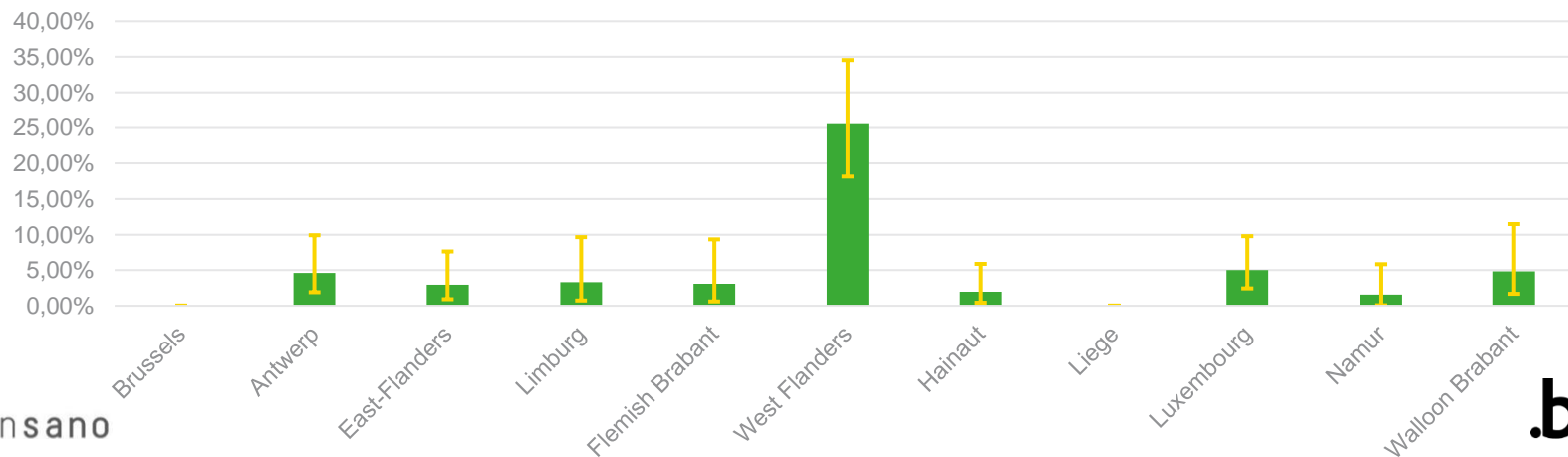
Belgium summer mortality



Regions summer mortality

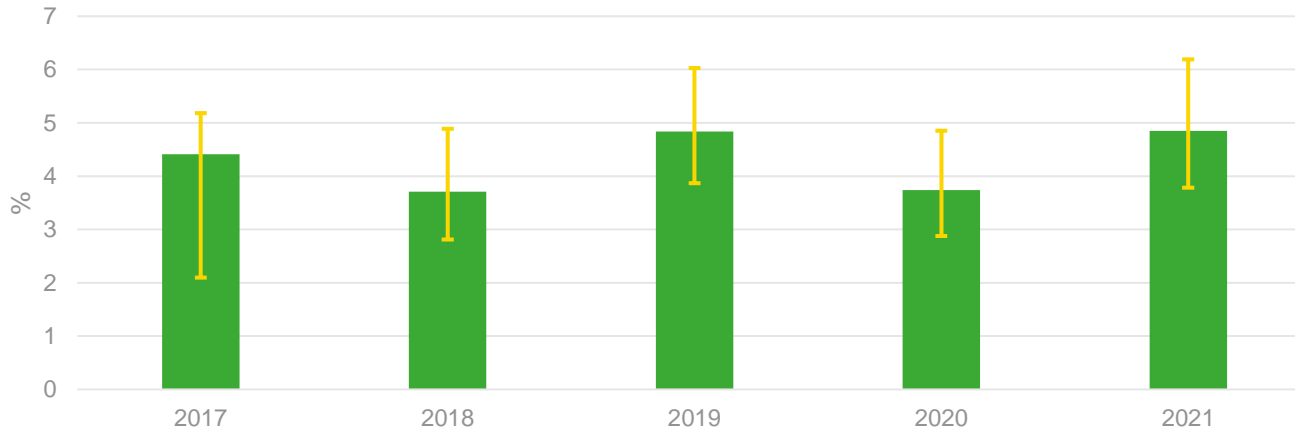


Provinces summer mortality

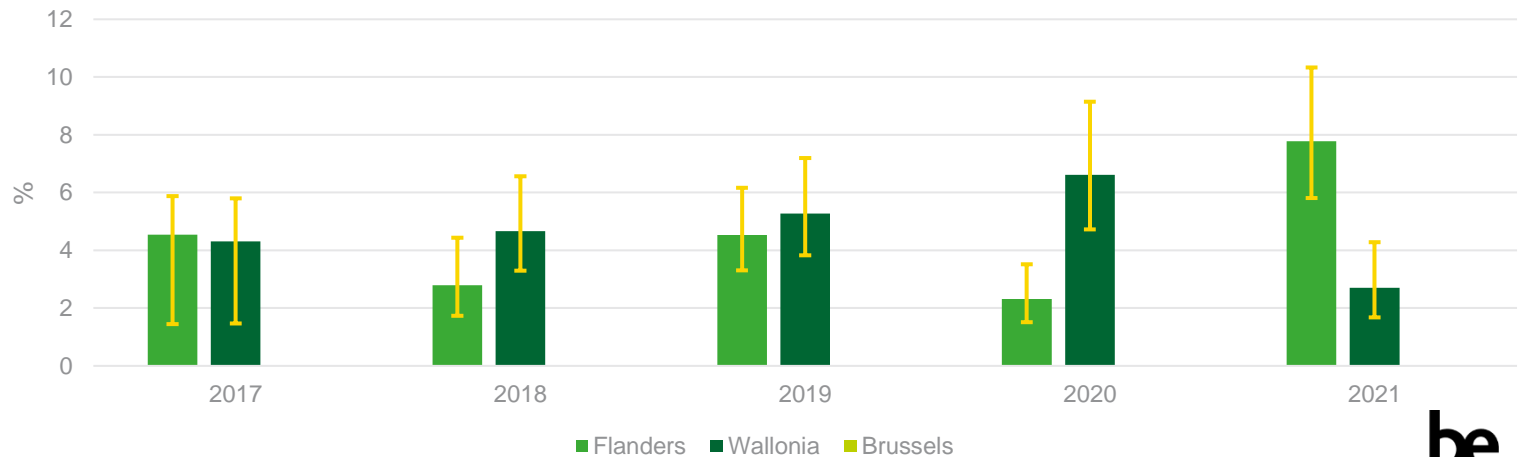


Summer mortality evolution

Belgium summer mortality



Region summer mortality

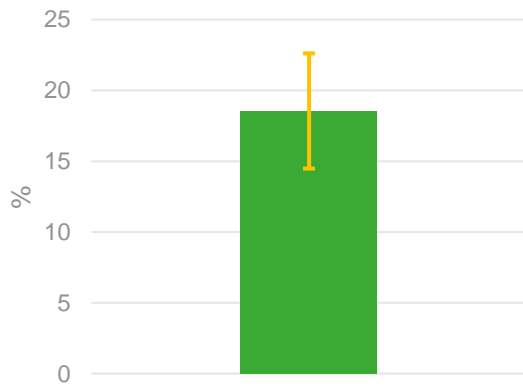


Summer mortality details

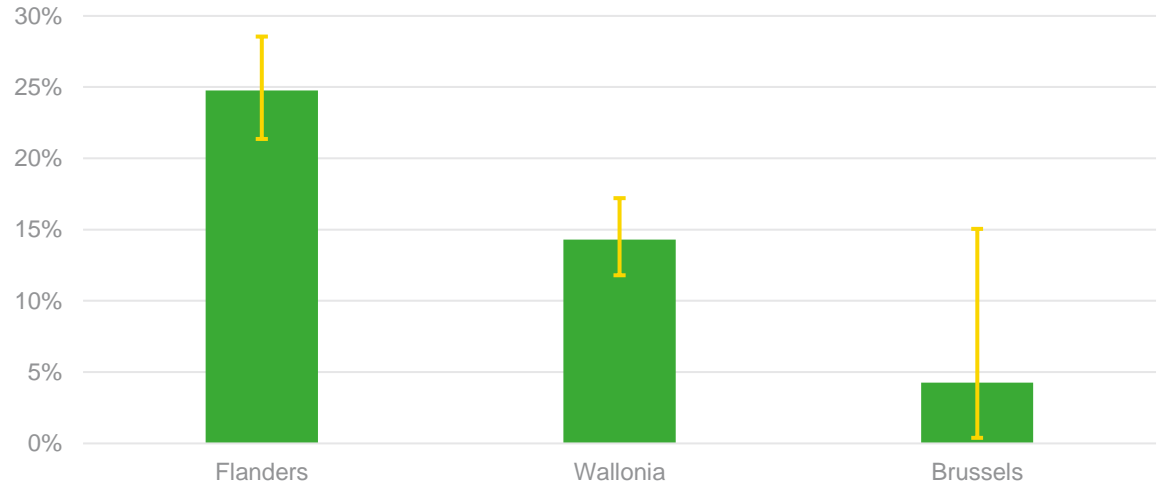
Seasonal weighted colony mortality from Spring to Summer														
Geographical entity	Sampled apiaries 2021	Sampled colonies 2021	Estimated mortality											
			2017		2018		2019		2020			2021		
			%	95% CI	%	95% CI	%	95% CI	%	95% CI		%	95% CI	
Belgium	174	629	4.41	2.10 - 5.18	3.71	2.81 - 4.89	4.84	3.87 - 6.03	3.74	2.88	4.85	4.85	3.78	6.19
Brussels	8	31	0	NA	0	NA	0	NA	0	NA	NA	0.00	NA	NA
Flanders	85	278	4.54	1.45 - 5.88	2.79	1.73 - 4.44	4.53	3.31 - 6.16	2.32	1.51	3.52	7.78	5.81	10.33
Antwerp	21	76	2.71	0 - 5.95	0	NA	0	NA	2.93	1.53	5.38	4.62	1.92	9.92
East-Flanders	21	64	2.59	0 - 6.43	3.47	1.28 - 8.09	18.92	11.91 - 28.62	3.48	1.39	7.71	2.96	0.00	7.63
Limburg	11	45	7.03	0 - 12.60	1.54	0 - 9.00	2.5	1.16 - 5.05	1	0.04	3.83	3.30	0.00	9.65
Fl Brabant	10	39	7.24	0.53-12.05	0.85	0 - 5.16	5.91	2.98 - 11.05	0	NA	NA	3.08	0.60	9.35
West Flanders	22	54	3.88	0 - 5.44	8.4	4.52 - 14.80	5.31	2.22 - 11.34	2.09	0.57	5.67	25.51	18.16	34.57
Wallonie	81	320	4.31	1.47 - 5.80	4.66	3.29 - 6.56	5.27	3.83 - 7.20	6.61	4.73	9.15	2.70	1.68	4.28
Hainaut	21	91	9.69	1.97 - 15.06	4.73	2.03 - 9.95	6.1	3.33 - 10.69	3.57	0	19.2	1.96	0.00	5.87
Liege	14	47	1.49	0 - 2.99	6.12	3.35 - 10.72	6.13	3.63 - 10.04	3.57	1.69	7.04	0.00	NA	NA
Luxembourg	21	78	6.54	0.38-10.39	0.7	0 - 4.25	6.51	2.95 - 13.11	11.43	6.11	20.1	5.03	2.42	9.77
Namur	13	57	0.83	0 - 2.20	4.65	1.89 - 10.13	2.5	0.47 - 7.68	6.25	2.63	13.2	1.55	0.00	5.83
Wal Brabant	12	47	3.05	0 - 7.17	8.14	3.72 - 16.17	2.74	0.08 - 10.52	11.6	5.94	21	4.82	1.69	11.47

Year mortality 2020-2021

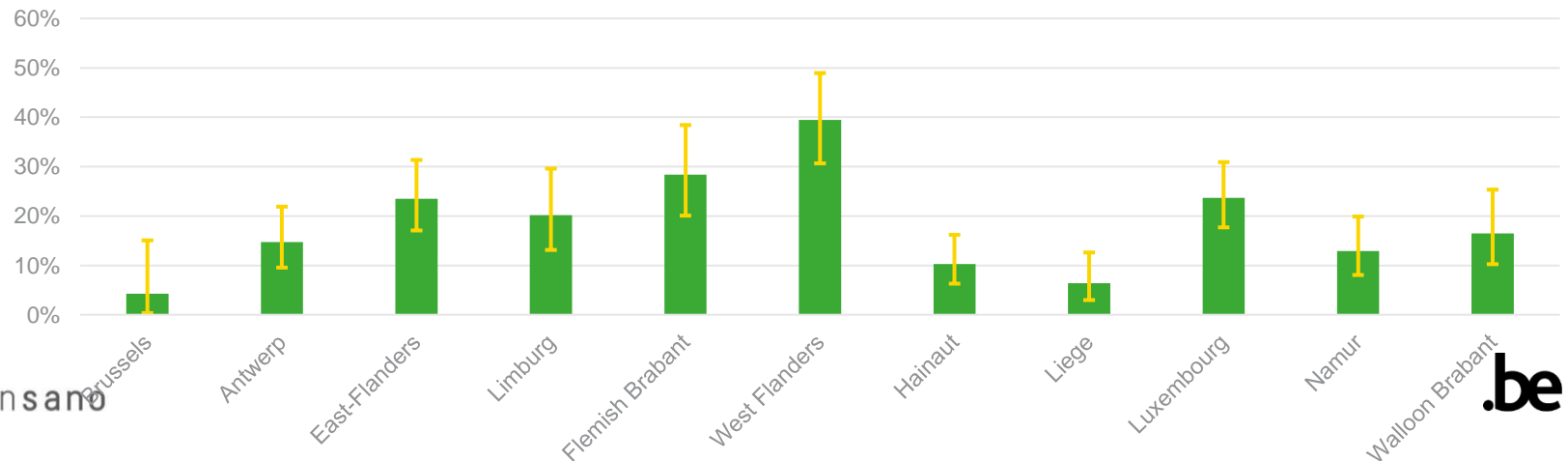
Belgium



Region year mortality

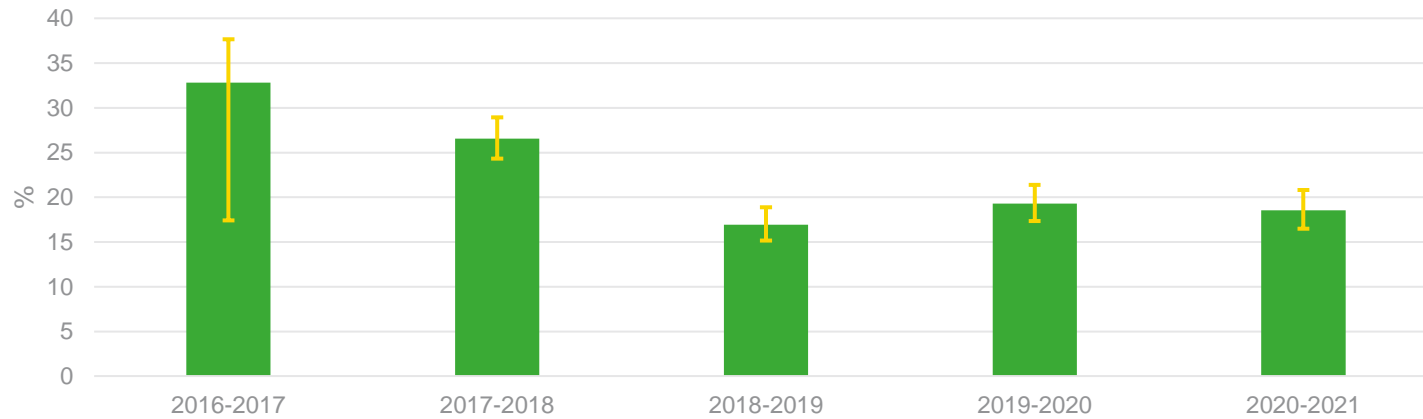


Provinces year mortality

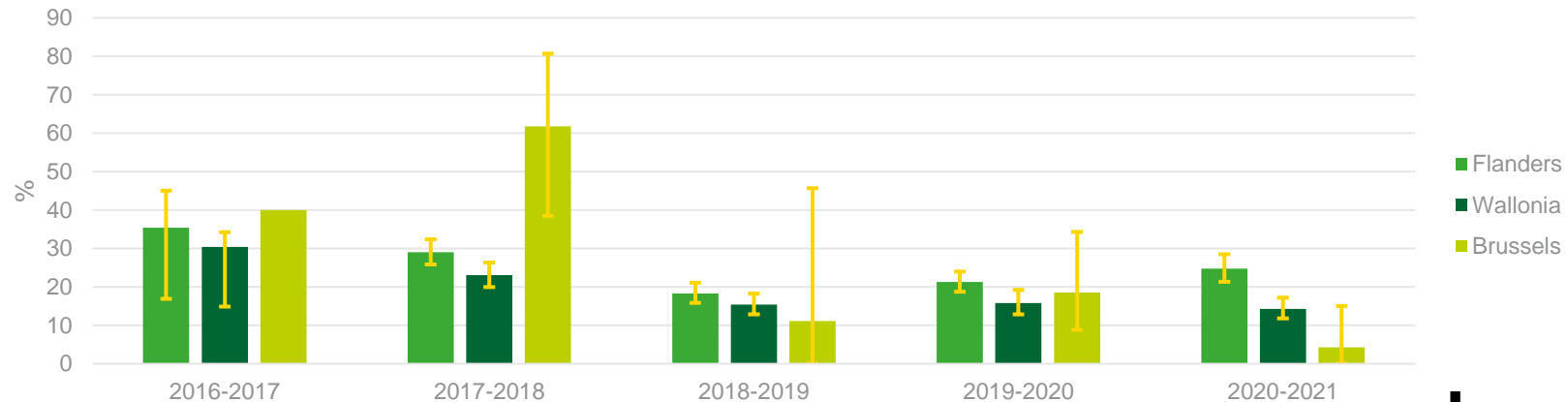


Year mortality evolution

Belgium year mortality



Region year mortality



Year mortality details

Yearly weighted colony mortality from Fall to Summer

Geographical entity	Sampled apiaries 2021	Sampled colonies 2021	Estimated mortality											
			2016-2017		2017-2018		2018-2019		2019-2020			2020-2021		
			%	95% CI	%	95% CI	%	95% CI	%	95% CI		%	95% IC	
Belgium	174	764	32.82	17.40 - 27.68	26.56	24.32-28.92	16.94	15.15-18.9	19.29	17.35	21.4	18.55	16.49	20.80
Brussels	8	33	40	NA	61.76	38.53-80.66	11.11	0 - 45.67	18.52	8.79	34.32	4.26	0.38	15.04
Flanders	85	351	35.36	16.87 - 35.04	29	25.81-32.40	18.31	15.83 - 21.07	21.25	18.72	24.01	24.77	21.35	28.54
Antwerp	21	89	30.72	9.31 - 38.75	15.91	11.21-22.07	13.25	9.19 - 18.7	31.96	27.21	37.1	14.74	9.58	21.93
East-Flanders	21	84	54.82	19.77 - 67.66	16.67	11.40-23.66	29.71	21.29 - 40.16	15.64	10.81	22.05	23.48	17.09	31.34
Limburg	11	56	22.78	6.97 - 23.97	9.74	4.32 - 19.66	11.51	8.26 - 15.8	8.06	4.94	12.76	20.15	13.11	29.60
Fl Brabant	10	52	32.38	11.34 - 40.75	57.91	51.26-64.29	27.58	20.37 - 36.16	32.95	20.87	47.77	28.39	20.11	38.42
West Flanders	22	70	32.51	13.91 - 41.88	21.42	15.05-29.53	25.62	18.64 - 34.1	17.76	12.77	24.14	39.44	30.69	48.92
Wallonie	81	380	30.38	14.85 - 24.21	23.02	19.99-26.36	15.36	12.86 - 18.25	15.8	12.87	19.25	14.29	11.80	17.20
Hainaut	21	101	29.34	15.36 - 37.59	28.11	21.17-36.27	17.22	12.37 - 23.43	46.07	29.22	63.87	10.26	6.29	16.18
Liege	14	54	20.24	3.78 - 27.50	13.06	8.87 -18.83	10.74	7.34 - 15.41	10.08	6.7	14.82	6.38	2.97	12.60
Luxembourg	21	100	38.96	10.34 - 47.20	28.03	21.30-35.91	17.17	11.08 - 25.55	15.5	9.22	24.74	23.69	17.72	30.90
Namur	13	68	28.25	8.39 - 39.19	25.94	19.00-34.33	14.58	9.12 - 22.39	13.75	8.11	22.17	12.92	8.09	19.89
Wal Brabant	12	57	36.23	12.05 - 45.22	23.48	15.79-33.40	4.23	0.88 - 12.54	24.22	15.86	35.1	16.49	10.25	25.33

**Thank you for your
attention.**