



Economic impact of *Pectobacterium* and *Dickeya* species on potato crops in Switzerland

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Introduction

- Few studies of the economic impact of potato diseases are available.
- Few studies of the economic impact of *Dickeya* and *Pectobacterium* are available, due to a lack of data availability.
- In Switzerland, the data of the potato sector are public most of the time and with a relative easy access.
- *Objective: As a first step, study the impact of Pectobacterium and Dickeya in the Swiss context for the period 2004 to 2017, and as a second step, compare the results with similar studies performed with other diseases.*



First and foremost

The screenshot shows the XE Currency Converter website interface. The browser address bar displays the URL: <https://www.xe.com/currencyconverter/convert/?Amount=1&From=EUR&To=CHF>. The page header includes the XE logo, navigation links for 'SEND MONEY', 'BUSINESS', 'TOOLS', and 'RESOURCES', and a 'GET THE APP' button. The main content area is titled 'Francs' and features a conversion form with the following fields: 'Amount' (1), 'From' (EUR Euro), and 'To' (CHF Swiss Franc). The conversion result is displayed as 1 EUR = 1.08782 CHF. Below the result, the inverse conversion is shown: 1 CHF = 0.919271 EUR and 1 EUR = 1.08782 CHF. The page also includes a 'FEEDBACK' button and a disclaimer: 'All figures are live mid-market rates, which are not available to consumers and are for informational purposes only.' The last update time is noted as 2019-09-01 07:25 UTC. The Windows taskbar at the bottom shows the system tray with the date 01.09.2019 and time 09:26.

Decomposition of the economic impact of *Pectobacterium* and *Dickeya*

→ Total loss = $L_y + L_r + L_d + L_p$

- L_y = Loss due to yield reduction in ware and seed potato production.
- L_r = Loss due to the rejection of seed lots.
- L_d = Loss due to the downgrading of seed lots.
- L_p = loss due to post-harvest soft rot in seed and ware potato production.



Loss due to yield reduction (Ly)

Yield reduction can be decomposed as follow:

- Missing plants due to mother tuber soft rot.
- Yield reduction due to diseased stems.
- Soft rot of progeny tubers.

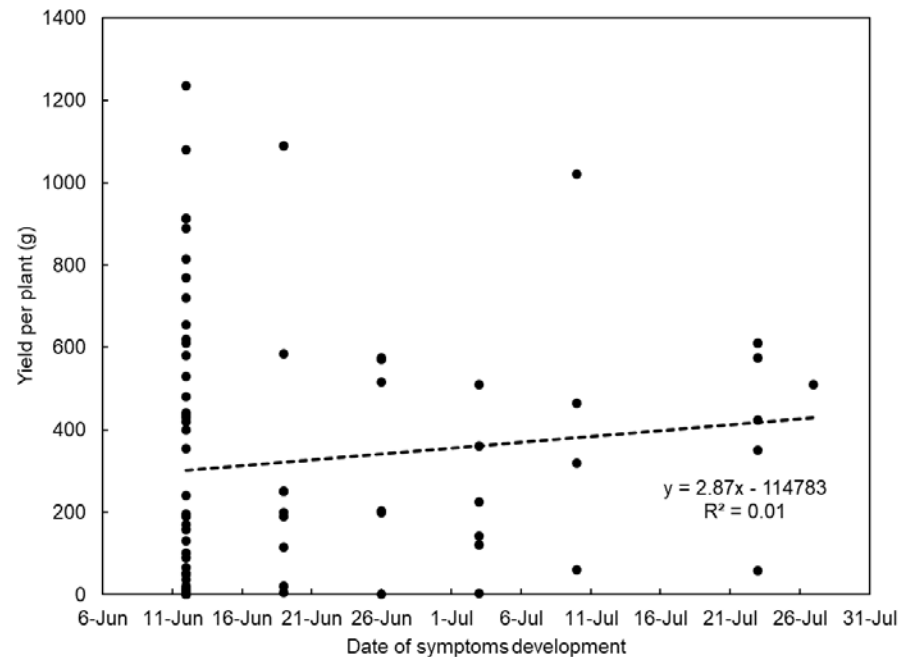


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Loss due to yield reduction (Ly)

- Yield reduction due to lack of emergence is mitigated by the compensation of neighboring plants (8% of yield loss for 25% of missing plants*).
- Yield reduction due to blackleg is mitigated by the healthy stems of the plant





Loss due to yield reduction (Ly)

Year	Location	Bacteria specie	Reference of isolate	Cultivar	Inoculation method	Blackleg (%)	Yield loss (t/ha)	Yield loss (%)	Yield loss for 1% blackleg (t/ha)	Reference
2006	Lammi (Finland)	<i>Dickeya dianthicola</i>	Ech w04K	Nicola	Vacuum infiltration	97.5	35.58	45	0.36	Laurila et al. 2010
2006	Lammi (Finland)	<i>Dickeya dianthicola</i>	Ech w04M	Nicola	Vacuum infiltration	82	38.71	49	0.47	Laurila et al. 2010
2014	Changins (Switzerland)	<i>Dickeya dianthicola</i>	8823	Agria	Soaking	25.5	8.54	22	0.35	De Vries et al., 2014
2015	Changins (Switzerland)	<i>Dickeya dianthicola</i>	8823	Agria	Soaking	18.9	9.03	56	0.51	Unpublished data
2006	Lammi (Finland)	<i>Dickeya solani</i>	Ech w0443	Nicola	Vacuum infiltration	45.5	6.88	9	0.15	Laurila et al. 2010
2006	Lammi (Finland)	<i>Dickeya solani</i>	Ech t042	Nicola	Vacuum infiltration	25.5	-3.81	-5	-0.15	Laurila et al. 2010
2006	Lammi (Finland)	<i>Dickeya solani</i>	Ech t0433	Nicola	Vacuum infiltration	63.5	35.53	45	0.56	Laurila et al. 2010
2006	Lammi (Finland)	<i>Dickeya solani</i>	Ech s0432-1	Nicola	Vacuum infiltration	59.5	24.48	31	0.41	Laurila et al. 2010
2006	Lammi (Finland)	<i>Dickeya solani</i>	Ech s0413	Nicola	Vacuum infiltration	56	30.01	38	0.54	Laurila et al. 2010
2006	Lammi (Finland)	<i>Dickeya sp.*</i>	Ech w0440	Nicola	Vacuum infiltration	34	15.25	19	0.45	Laurila et al. 2010
2006	Lammi (Finland)	<i>Dickeya sp.*</i>	Ech w0431	Nicola	Vacuum infiltration	27.5	-4.11	-5	-0.15	Laurila et al. 2010
2006	Lammi (Finland)	<i>Pectobacterium atrosepticum</i>	K Eca s035b	Nicola	Vacuum infiltration	42	12.61	16	0.30	Laurila et al. 2010

➔ Average yield loss for 1% of blackleg: 0.32 t/ha

➔ Need to connect this average value with blackleg prevalence in seed and ware potato production



Loss due to yield reduction (Ly)

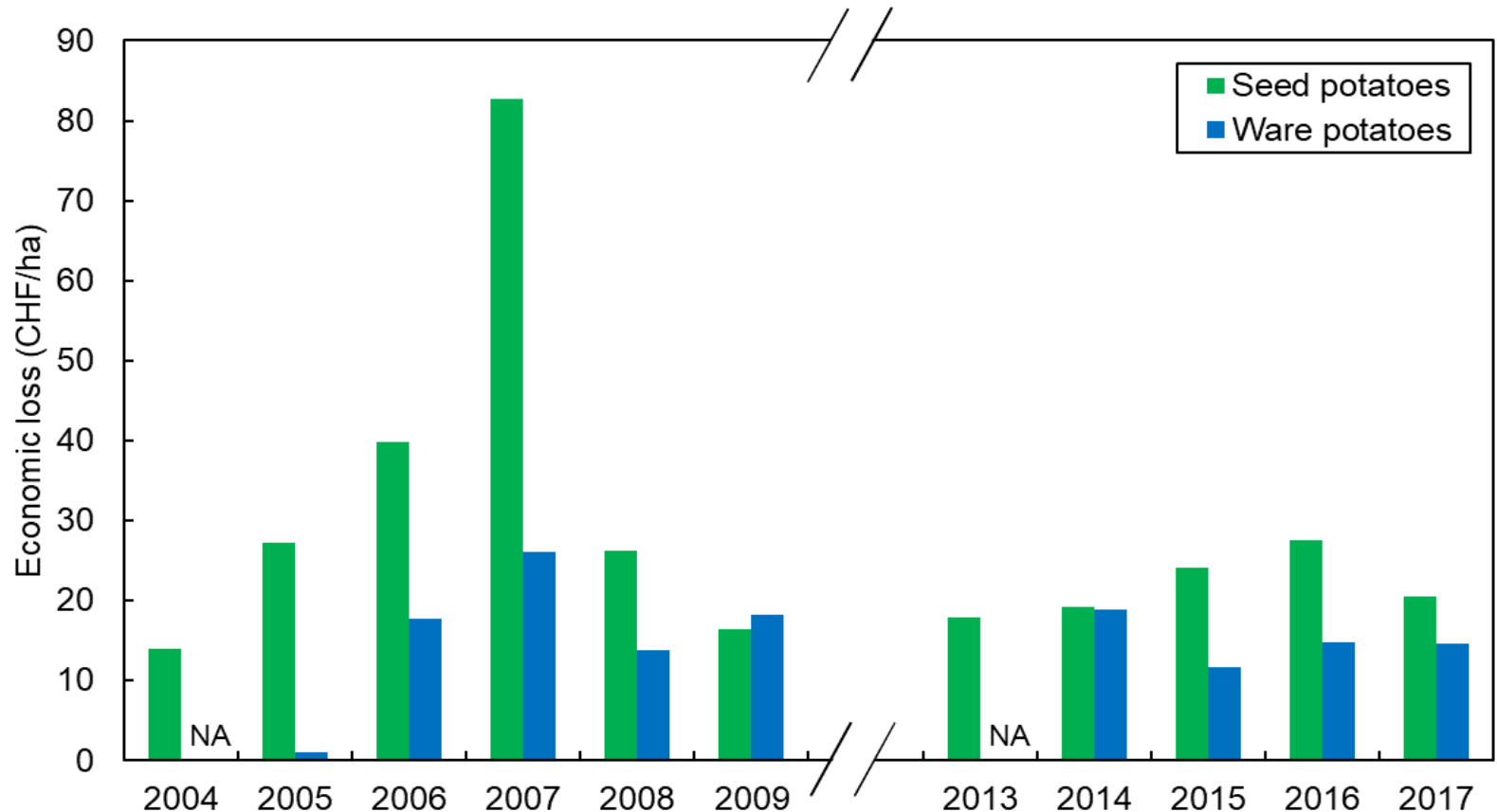
Certification class	2004	2005	2006	2007	2008	2009	2013	2014	2015	2016	2017	Average
F1	0.000	NA	NA	NA	NA	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F2	0.000	NA	NA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F4	NA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S	0.020	0.000	0.000	0.011	0.027	0.000	0.020	0.020	0.265	0.020	0.000	0.035
SE1	0.024	0.060	0.600	0.039	0.040	0.000	0.037	0.020	0.061	0.024	0.020	0.084
SE2	0.109	0.056	0.133	0.429	0.116	0.048	0.042	0.055	0.062	0.085	0.066	0.109
SE3	0.060	0.108	0.248	0.298	0.056	0.065	0.067	0.072	0.056	0.061	0.066	0.105
E	0.034	0.117	0.133	0.287	0.103	0.058	0.062	0.072	0.056	0.167	0.073	0.106
A	0.008	0.116	0.183	0.097	0.123	0.062	0.137	0.084	0.107	0.110	0.079	0.100



Incidence in ware potato production the following year



Loss due to yield reduction (Ly)

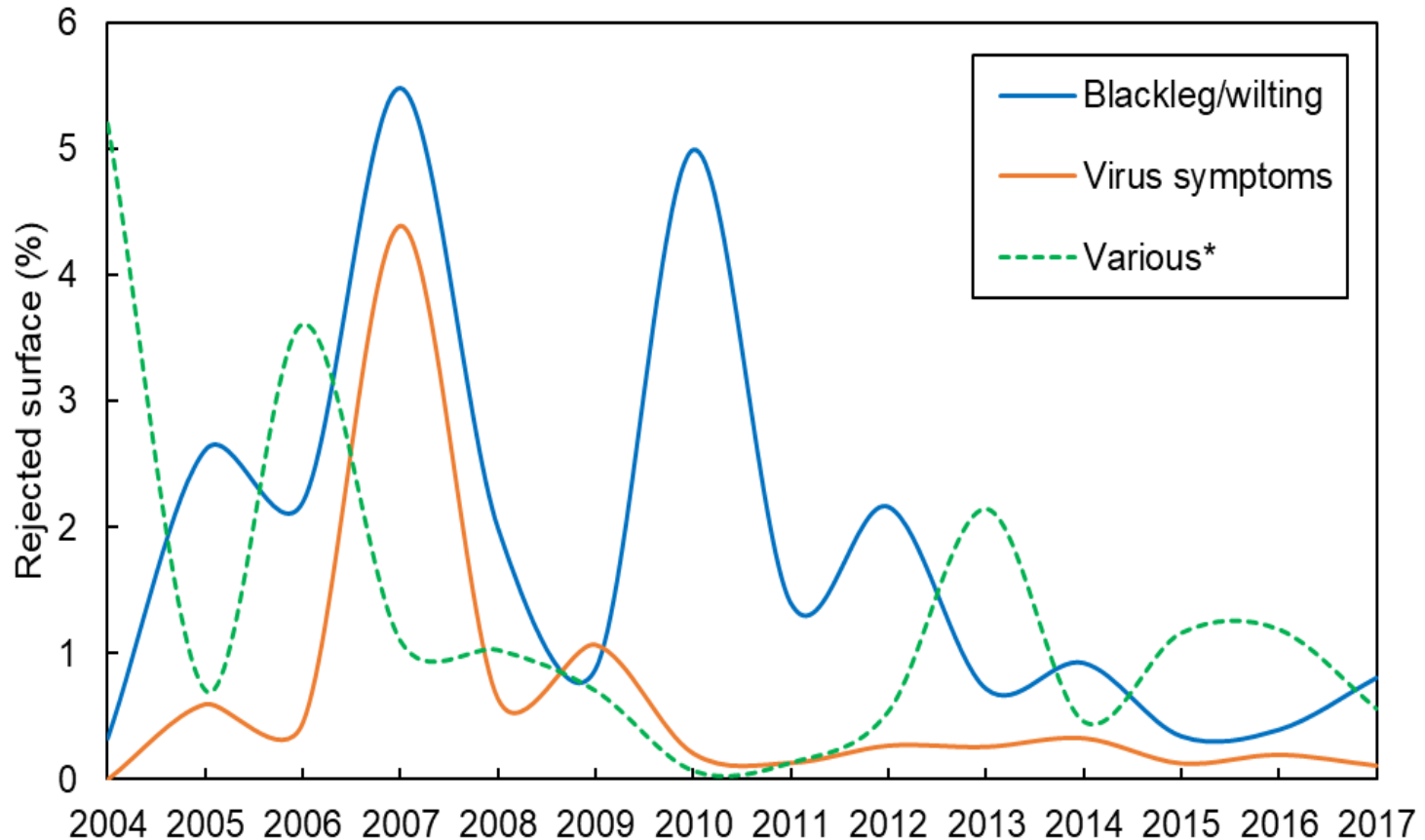


This financial loss is about 31.5 CHF/ha for seed potatoes and 15.2 CHF/ha for ware potato production

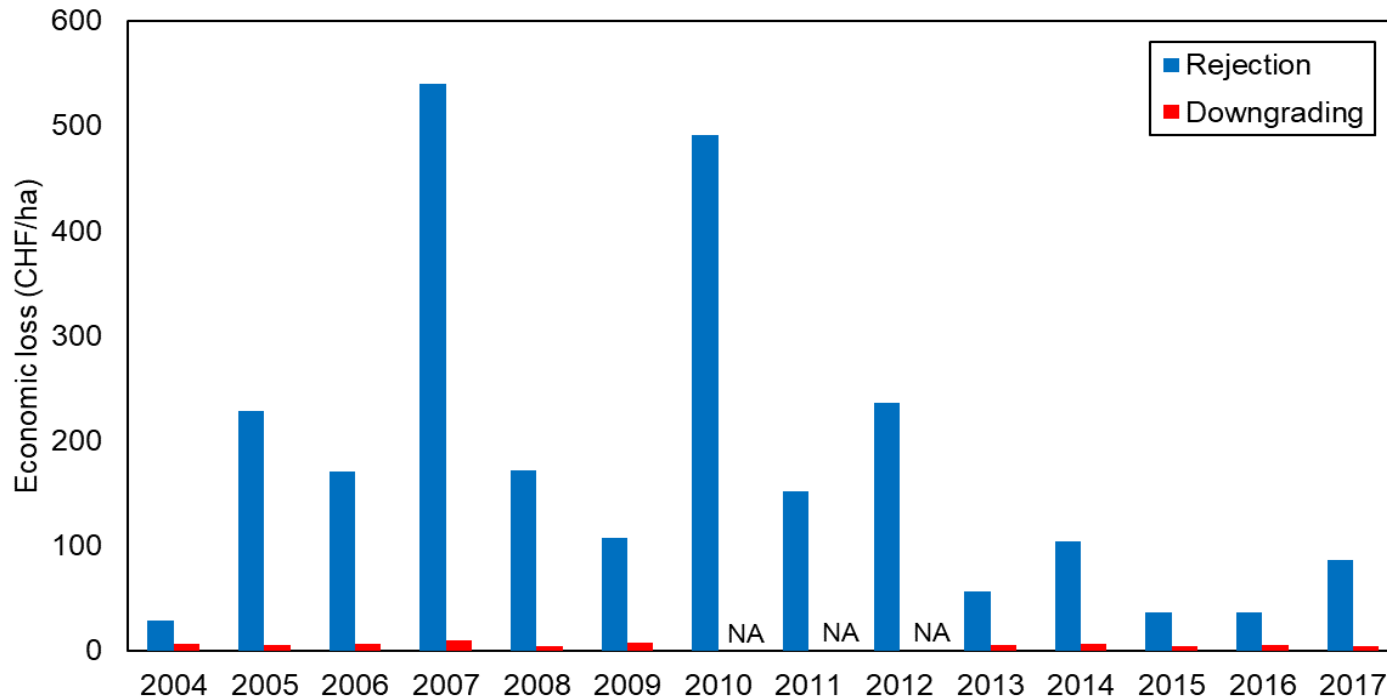
Loss due to downgrading or rejection of seed lots (Ld and Lr)



Loss due to downgrading or rejection of seed lots (Ld and Lr)



Loss due to downgrading or rejection of seed lots (Ld and Lr)



The financial loss due to downgrading, on average 5.8 CHF/ha, is low compared to the financial loss due to rejection, on average 174.6 CHF/ha.

Loss due to post-harvest soft rot (Lp)



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Loss due to post-harvest soft rot (Lp)

- Survey in Switzerland:

Questions	Seed (SEMAG et SGD)	Ware (FENACO)	Processing (FENACO)
Percentage of the production rejected	0.75	1.00	0.20
Percentage of the production sorted to remove rotting tubers	1.88	0.20	0.50
Price of sorting (CHF/dt)	6.00	7.50	4.00

Loss due to post-harvest soft rot (Lp)

- Average loss in seed potato production: 95 CHF/ha
- Average loss in ware potato production: 129 CHF/ha
- Average loss in potato production for processing: 33 CHF/ha

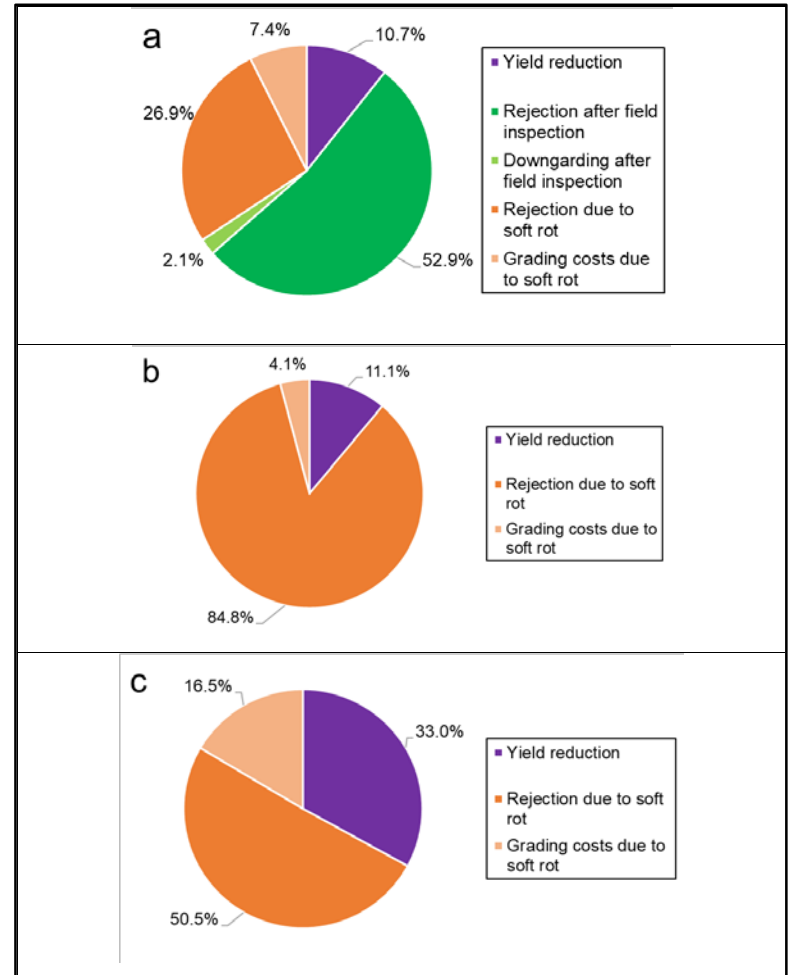
Total loss due to *Pectobacterium* and *Dickeya* in Switzerland

	Loss (CHF/ha)		
	Seed potatoes	Ware potatoes	Processing potatoes
Yield reduction (Ly)	32	15	15
Downgrading of seed lots (Ld)	6	0	0
Rejection of seed lots (Lr)	175	0	0
Post-harvest soft rot (Lp)	95	129	33
Total	308	144	48
(% of gross profit)	(3.8%)	(2.3%)	(0.7%)



Distribution of loss due to *Pectobacterium* and *Dickeya* in Switzerland

- Seed potatoes
- Ware potatoes (fresh market)
- Processing potatoes





Conclusions

- *Pectobacterium* and *Dickeya* are mainly impacting seed potato production compared to ware potato production.
- The impact on seed potato production varies a lot from one year to the other.
- The impact on ware potato production is relatively stable through years.
- For seed potato production, rejection due to blackleg and post-harvest soft rot are the main impacting losses.
- For ware potato production (fresh market), tuber soft rot is the most impacting loss (>80%)
- For processing potatoes, post harvest soft rot represent 50% of the losses, followed by yield reduction (33%).



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Thank you for your attention

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