

GMOs – Sampling

Andreas Heissenberger



- Sampling
 - Principles
 - Project results
 - Recommendation of the European Commission
- Conclusions

Why is sampling an issue?

- Sampling is mayor source of error
- Sampling for GMOs necessary to check threshold requirements (enforcement and industry)
- Usually no statistically evaluated sampling protocols for packed products used in food control
- Sampling for GMOs in kernel lots (trucks, ships, silos,...) has to be designed to detect one kernel in a certain amount of non GMO-kernels and not to measure an average value, like protein or water content

Steps in the Analytical Process



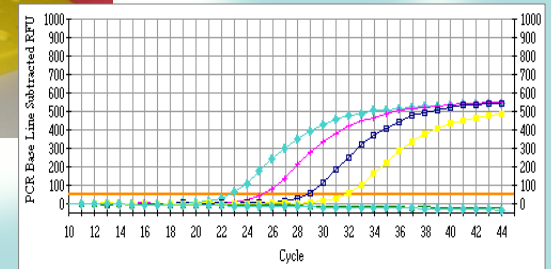
lot



sample



analysis



Sampling Error



Analytical Error

Distribution???

- What's the distribution of the GMO in the lot?
- Should we make assumptions?
- Is it homogeneous?
- Is there stratification?

**In reality we have
no idea!!!!**



Distribution in optimal situation

0,1%

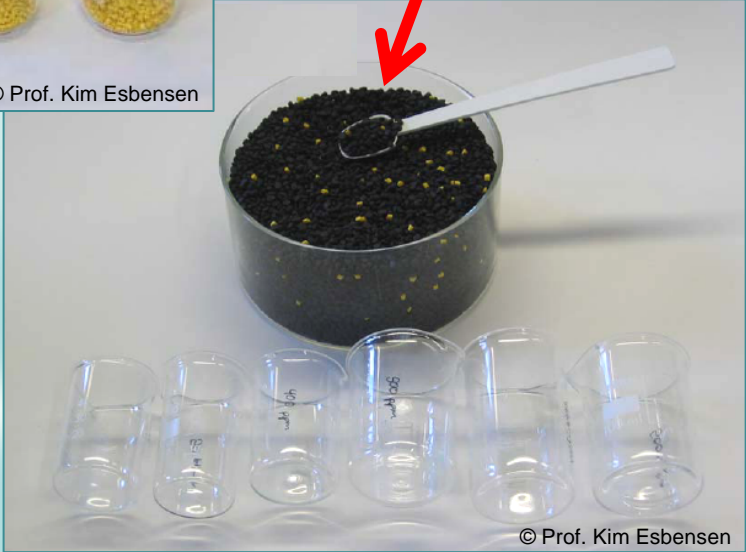
1%



© Prof. Kim Esbensen



© Prof. Kim Esbensen

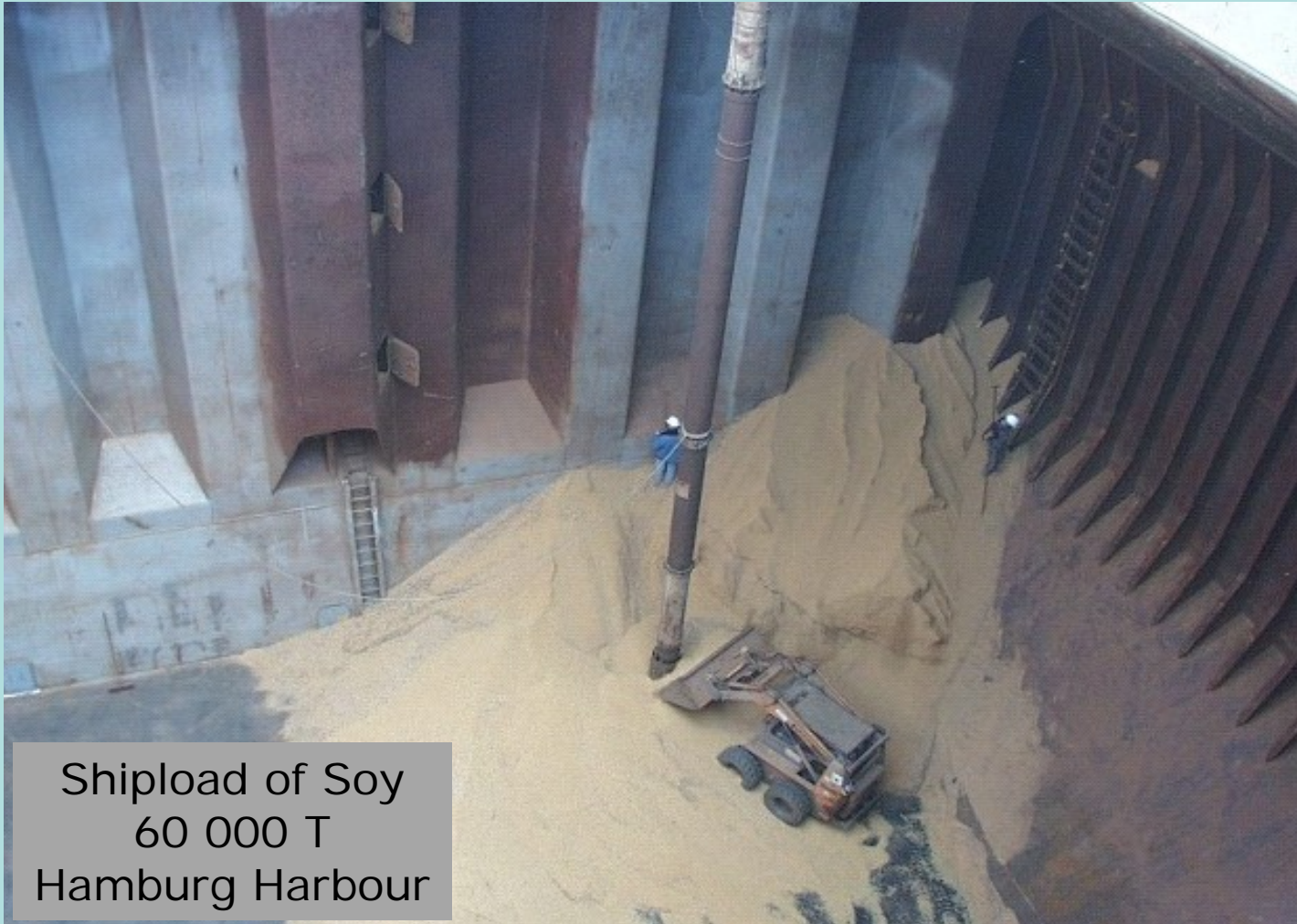


© Prof. Kim Esbensen

Sampling protocols

- Bulk Products
 - various protocols and ISO standards (no statistics given)
 - prEN TS specifically for GMOs: no assumptions made
- Packed products
 - Various standards, e.g. ISO 2859, usually not followed
 - National inspection guidelines
- **Are they fit for the purpose?**

Agricultural Commodities

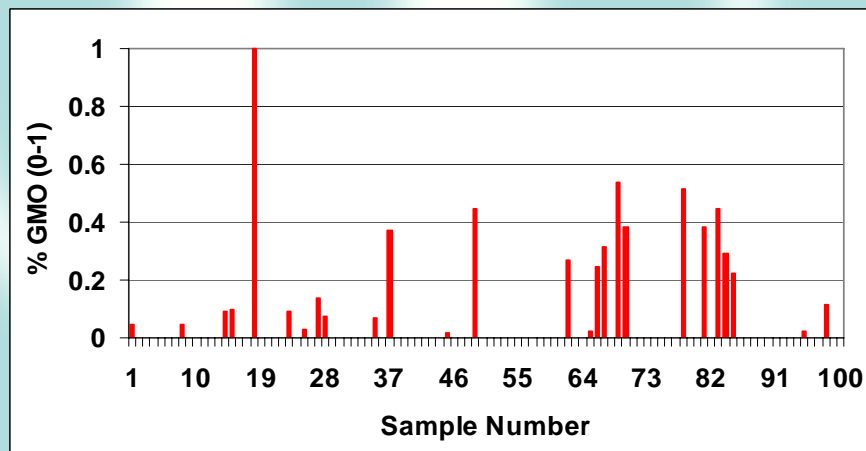
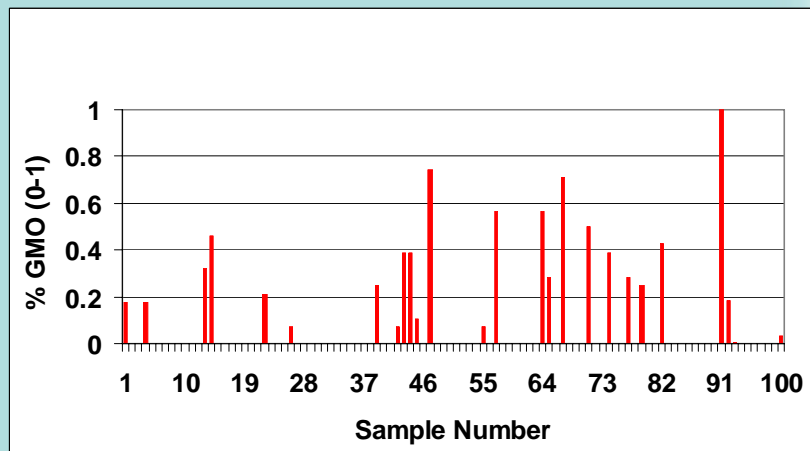
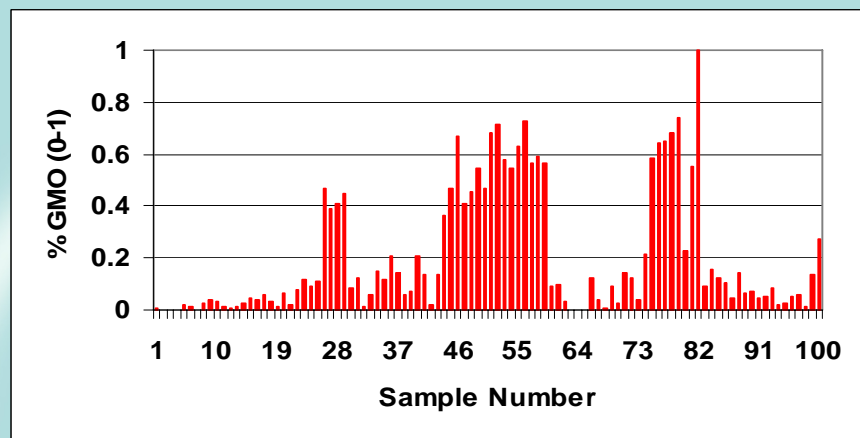
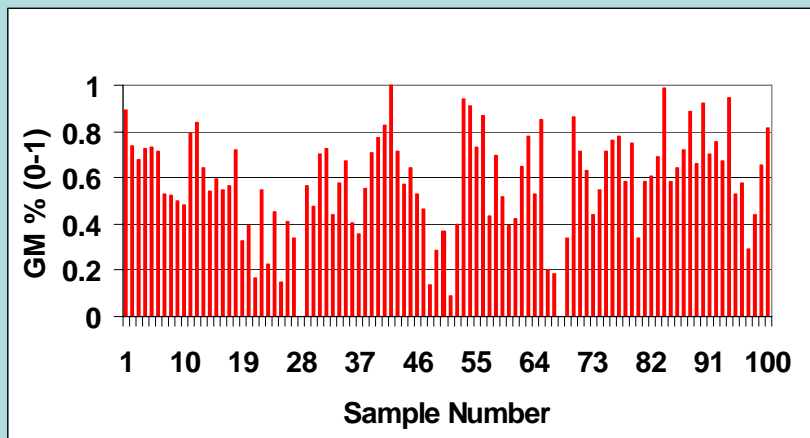


Shipload of Soy
60 000 T
Hamburg Harbour

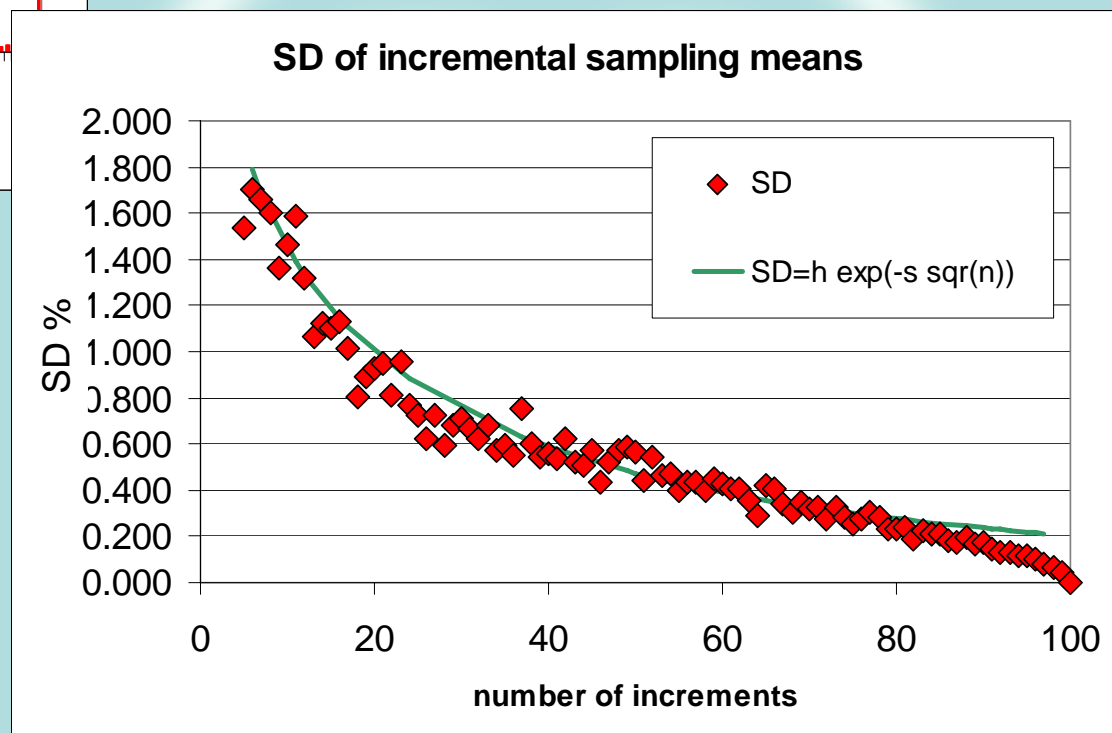
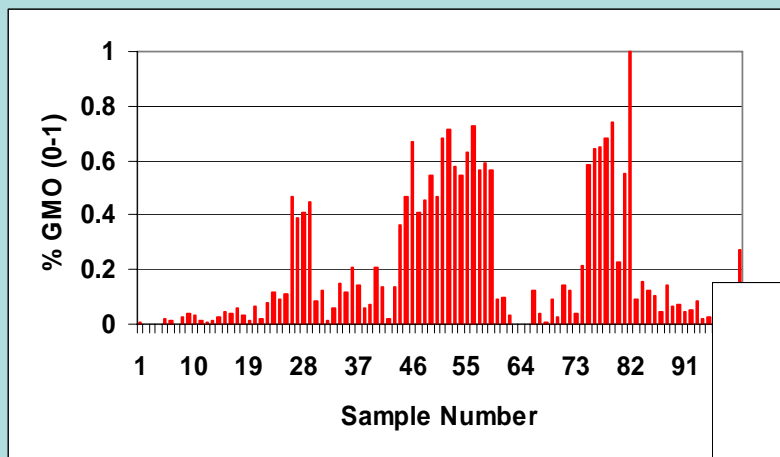
European Project - KeLDA

- Is the GM-distribution random?
- 17 soybean lots
 - soybean lots likely to contain GM material were sampled at the point of entrance in each MS
- Systematic sampling (ISO 6644)
- 100 samples/lot
- 3000 grains / sample (~ 0.5Kg)

The Observed Distributions



What do we learn?



EC Recommendations 2004/787/EC

- "...on technical guidance for sampling and detection of genetically modified organisms and material produced from genetically modified organisms as or in products in the context of Regulation (EC) No 1830/2003"
- Based on the general model that allows estimating lot GMO content, without imposing any distribution
- A sampling protocol is recommended that estimates GMO content and its associated sampling error as function of individual lot properties
- Based on statistical model and real data

Sampling grains and non-packed foodstuffs

3-step procedure:

- 1) Creation of a bulk sample mixing all the increments collected from a given lot.
- 2) Evaluation of bulk contamination level with respect to legal thresholds.
- 3) Analysis of individual increments to estimate confidence interval around the estimate, if necessary.

Sampling increments

Systematic sampling

Increments + File increments (0.5Kg)

Lot size in tons	Size of the bulk sample in kg	Number of increments
≤ 50	5	10
100	10	20
250	25	50
≥ 500	50	100

Sampling packed products

- Several ISO Standards in place, e.g. ISO 2859
 - Require usually a very high number of samples
 - Not meant for chemical analysis (each sample has to be analysed)
 - Not practical
 - Others which are not based on statistics are available
- Inspection bodies usually perform “grab sampling”
- Most likely no solution in the near future

Lot size (units)	AQL=1 %		AQL=2,5 %		AQL=4%		AQL=10 %	
	Sample size (units)	Max. N. non conforming units	Sample size (units)	Max. N. non conforming units	Sample size (units)	Max. N. non conforming units	Sample size (units)	Max. N. non conforming units
2 to 8	all	0	all or 5*	0	all or 3**	0	all or 5*	1
9 to 15	all or 13***	0	5	0	3	0	5	1
16 to 25	13	0	5	0	8	0	5	1
26 to 50	13	0	8	0	8	1	8	2
51 to 90	13	0	13	1	13	1	13	3
91 to 150	20	0	20	1	20	2	20	5
151 to 280	32	1	32	2	32	3	32	7
280 to 501	50	1	50	3	50	5	50	10
501 to 1 200	80	2	80	5	80	7	80	14
1 201 to 3 200	125	3	125	7	125	19	125	21
3 201 to 10 000	200	5	200	10	200	14	125	21
10 000 to 35 000	315	7	315	14	315	21	125	21
35 001 to 150 000	500	10	500	21	315	21	125	21
150 001 to 500 000	800	14	500	21	315	21	125	21
Above 500 000	1 250	21	500	21	315	21	125	21

* all items if less than 5, or a minimum of 5

** all items if less than 3, or a minimum of 3

*** all items if less than 13, or a minimum of 13

Sampling - Conclusions

- Correct sampling is NOT common practice
- Correct sampling is expensive and time consuming

BUT

If sample is taken in a incorrect way
(not representative)

→

analytical result can NOT be extrapolated to the
whole lot



Thanks for your attention!

