




# The design of testing plans for testing of adventitious presence of GM seeds in non GM seed lots

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# design of testing plans

- to change from a testing plan to a new one
  - to explore a number of possibilities and select the most appropriate
    - Technically
    - Economically
    - Socially
- Look for satisfaction on all aspects 

Example of a practical question  
and look for a plan

General strategy to obtain satisfactory testing plans



***My government does not want GM seeds to enter the country, we have used a protocol we found in europe (0/3000 seeds), it worked for some time but now we have problems with this.***

**What problem?**



***In past years we were able to let seed lots enter the country, now we refuse so many that we have a problem because we need to grow the crop but we do not find enough seed lots that we can accept***

**Do you have information about the level of AP in the lots you receive?**

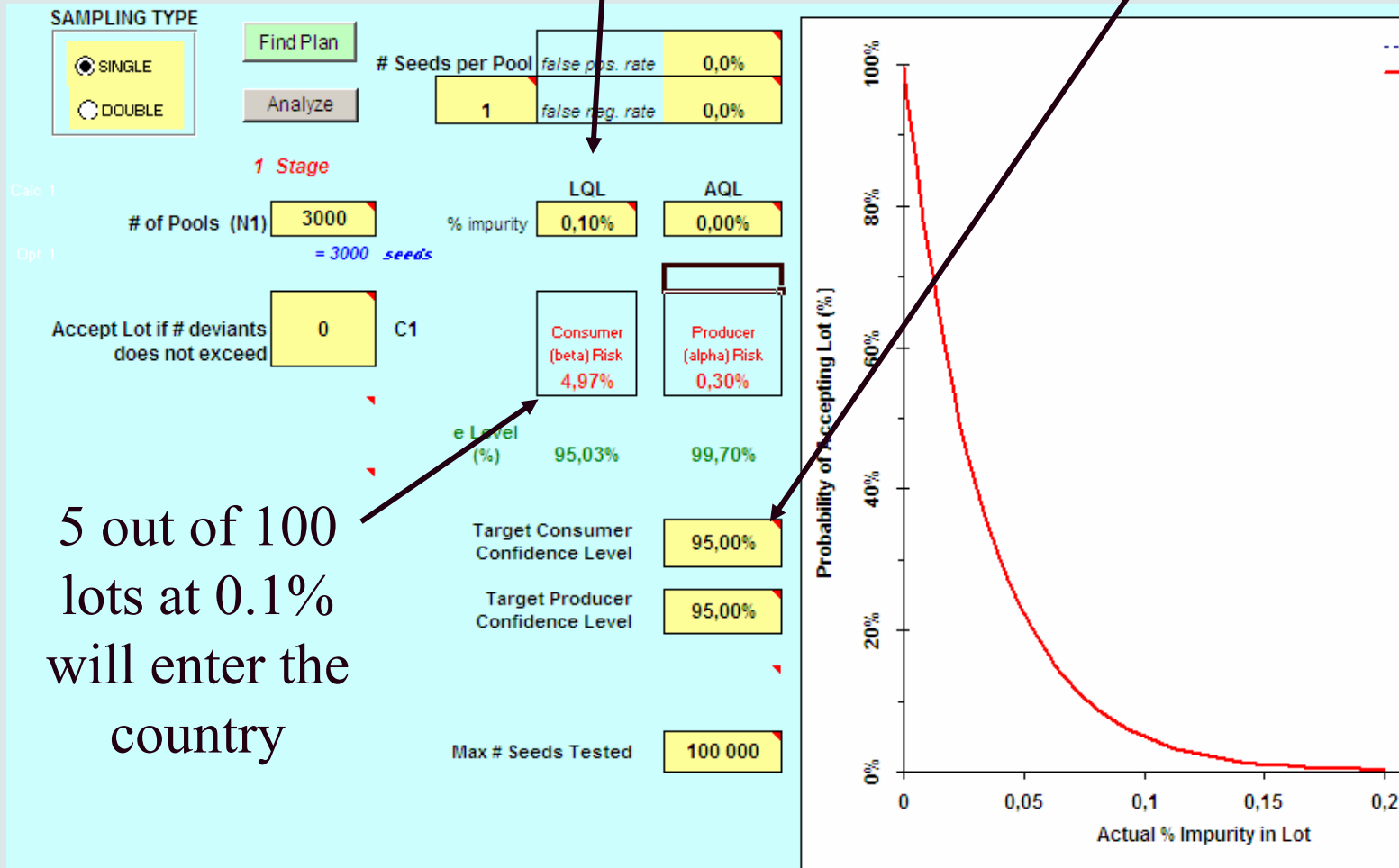


***Yes, we quantified presence in all rejected lots, in fact most of them (96% last year) are between 0.015% and 0.020%***



# The testing plan you use:

accept lot if you find 0 GM seed in 3000 seeds  
lots at 0.1% are rejected at a 95% rate



5 out of 100  
lots at 0.1%  
will enter the  
country



Here is a testing plan that will allow lots from 0 to 0.02% to enter the country and still reject lots with 0.1% or more, which is what your present testing plan does



**SAMPLING TYPE**

SINGLE  DOUBLE

Find Plan Analyze

# Seeds per Pool **1**

false pos. rate	0,0%
false neg. rate	0,0%

**1 Stage**

Calc 1 # of Pools (N1) **9150** = 8156 seeds

Opt 1 % impurity **0,10%** **0,02%**

Accept Lot if # deviants does not exceed **4** C1

Consumer (beta) Risk	5,00%	Producer (alpha) Risk	3,93%
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Confidence Level **95,00%** **96,07%**

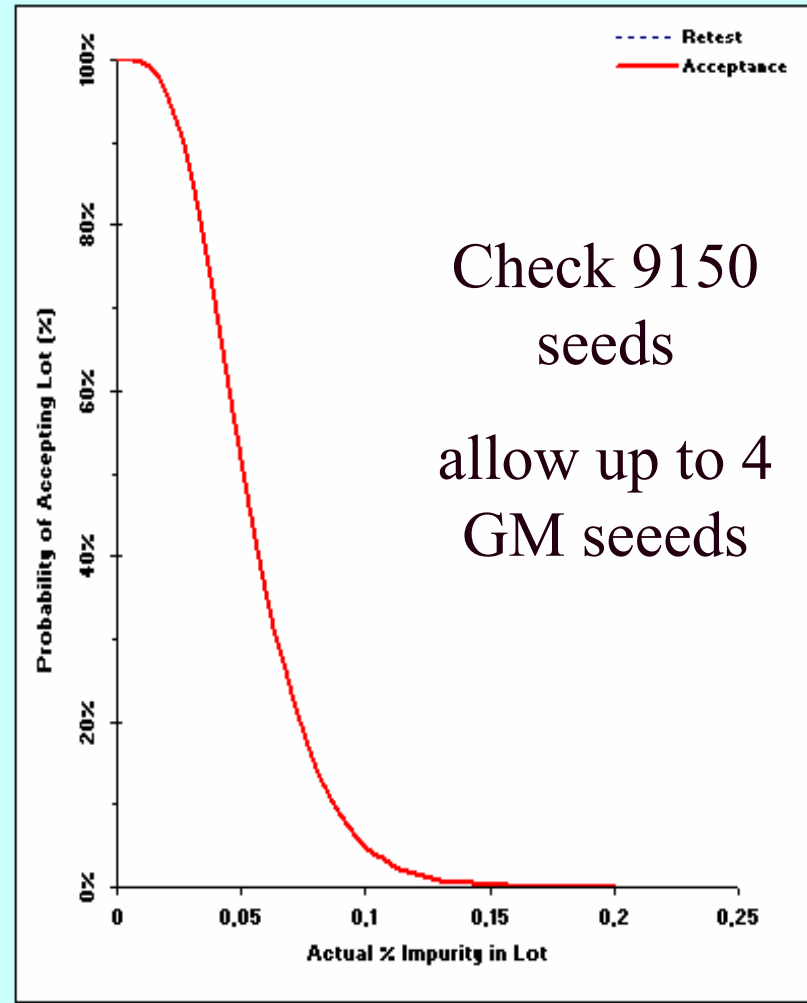
Target Consumer Confidence Level **95,00%**

Target Producer Confidence Level **95,00%**

Max # Seeds Tested **100 000**

Type  
0.02% in  
AQL

click on  
find plan





# Can you use seedcalc to show me why we have our problem? ( with 0/3000 seeds)



**SAMPLING TYPE**

SINGLE  DOUBLE

Find Plan **# Seeds per Pool**

false pos. rate	0,0%
false neg. rate	0,0%

Analyze **1**

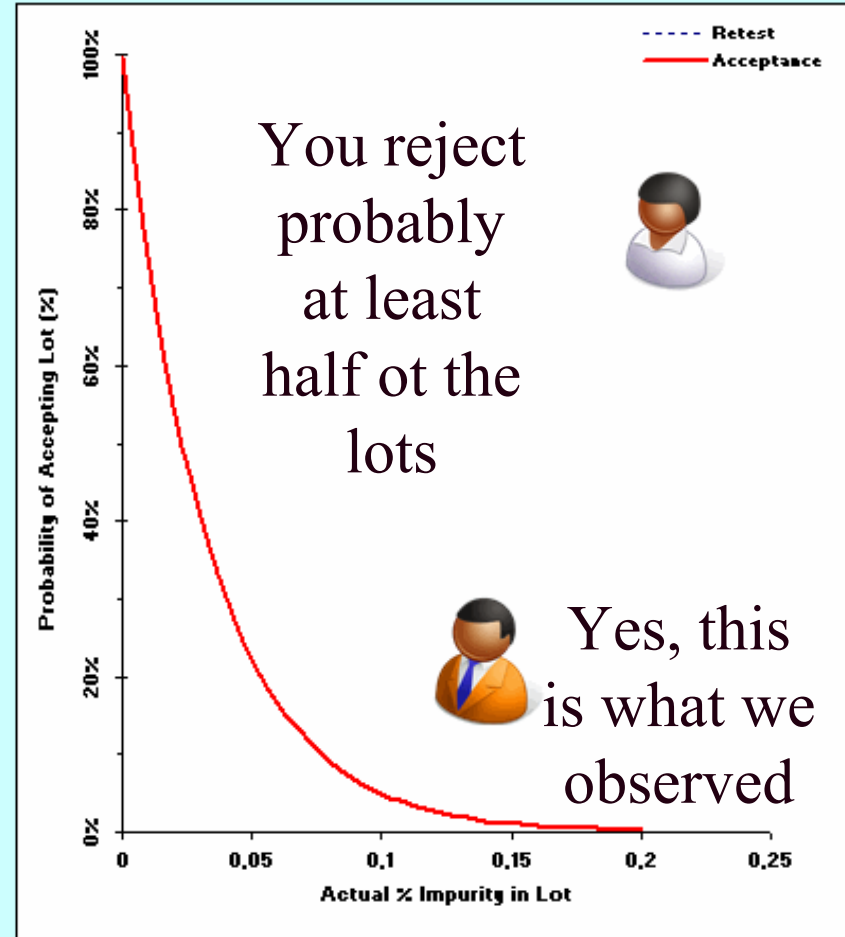
**1 Stage**

**# of Pools (N1)** **3000**  
*= 3000 seeds*

**Accept Lot if # deviants does not exceed** **0** **C1**

<b>LQL</b>	<b>0,10%</b>	<b>AQL</b>	<b>0,02%</b>
<b>Consumer (beta) Risk</b>	<b>4,97%</b>	<b>Producer (alpha) Risk</b>	<b>45,29%</b>
<b>Confidence Level</b>	<b>95,02%</b>	<b>Confidence Level</b>	<b>54,71%</b>
<b>Target Consumer Confidence Level</b>	<b>95,00%</b>	<b>Target Producer Confidence Level</b>	<b>95,00%</b>
<b># Seeds Tested</b>	<b>100 000</b>		

Lots at 0.02% have less than a fifty/fifty chance to be accepted





If we are OK to let 0 to 002% entrer and reject 0,1%, can you show me « what if » I use less seeds than the 9150 you indicate

*Focus on 0,1% level*



# of Pools (N1)	5320 <i>= 5320 seeds</i>	% impurity	LQL 0,10%	AQL 0,02%
Accept Lot if # deviants does not exceed	2	C1	Consumer (beta) Risk 10,00%	Producer (alpha) Risk 9,35%



*if you accept risks up to 10% you need about 5300 seeds*



# of Pools (N1)	3380 <i>= 3380 seeds</i>	% impurity	LQL 0,10%	AQL 0,02%
Accept Lot if # deviants does not exceed	1	C1	Consumer (beta) Risk 14,90%	Producer (alpha) Risk 14,87%



*if you accept risks up to 15% you need about 3400 seeds*



# of Pools (N1)	3000 <i>= 3000 seeds</i>	% impurity	LQL 0,10%	AQL 0,02%
Accept Lot if # deviants does not exceed	1	C1	Consumer (beta) Risk 19,90%	Producer (alpha) Risk 12,29%



*if you keep 3000 seeds and accept 1 seed instead of 0,*

*20% lots at 0.1% will be accepted*

*12% lots at 0.02% will be rejected*

Decrease seed number => increase both risks when AQL and LQL are fixed



# Can I continue to use a zero tolerance testing plan, on more seeds to solve my problem?



0/3000

45% of 0.02 lots will be rejected

# of Pools (N1)	3000 <i>= 3000 seeds</i>	% impurity	LQL 0,10%	AQL 0,02%
Accept Lot if # deviants does not exceed	0	C1	Consumer (beta) Risk 4,97%	Producer (alpha) Risk 45,29%



0/10 000

85% of 0.02 lots rejected

Check more seeds will amplify your problem

# of Pools (N1)	10000 <i>= 10000 seeds</i>	% impurity	LQL 0,10%	AQL 0,02%
Accept Lot if # deviants does not exceed	0	C1	Consumer (beta) Risk 0,00%	Producer (alpha) Risk 86,60%



## A testing plan with less seeds then?

0/1000 will reduce the problem, but you would let 37% of lots having 0.1% AP enter the country

<i>1 Stage</i>				
# of Pools (N1)	1000 <i>= 1000 seeds</i>	% impurity	LQL 0,10%	AQL 0,02%
Accept Lot if # deviants does not exceed	0	C1	Consumer (beta) Risk 36,77%	Producer (alpha) Risk 18,21%

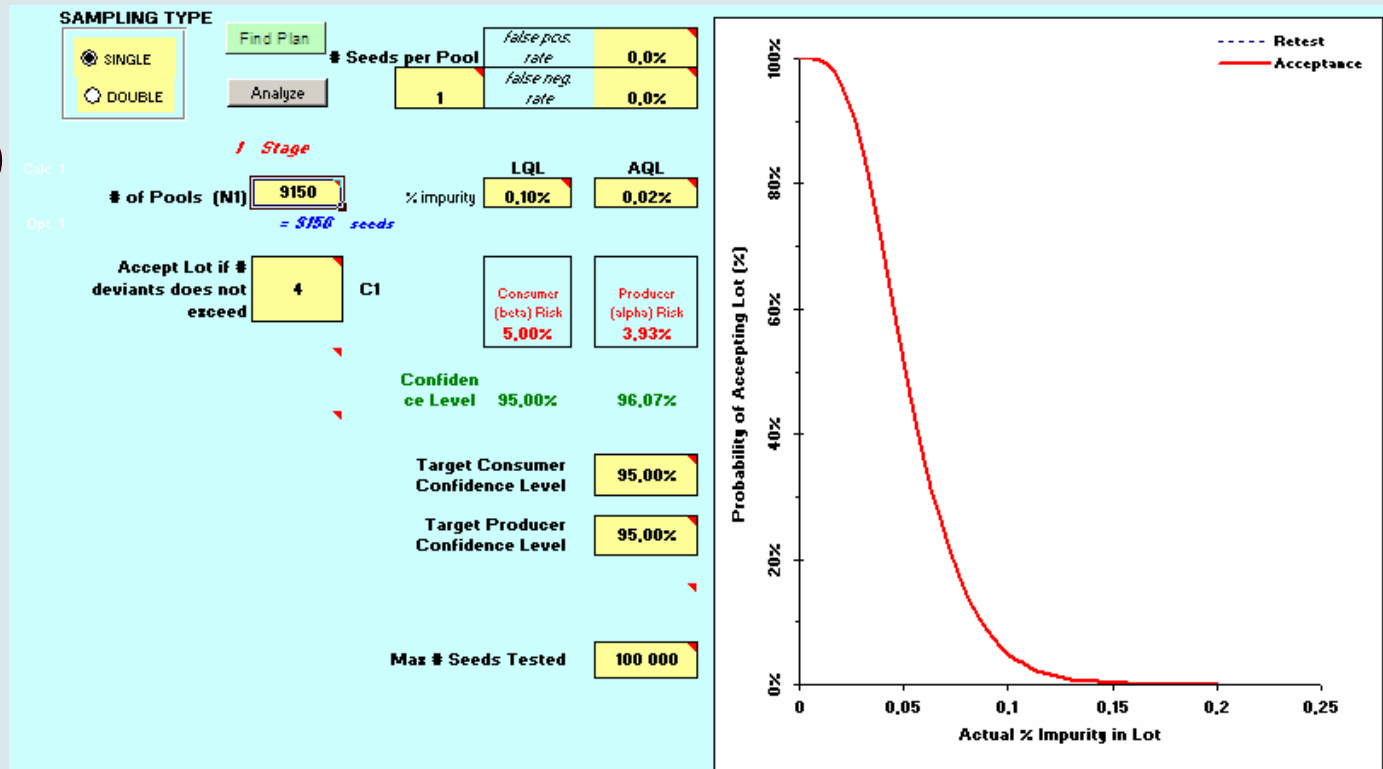




# Can you show me again the first answer?



Check 9150 seeds  
allow up to 4 GM seeds



The same original consumer risk is kept : less than 5% at 0.1% AP

If you agree 0.02% level is acceptable for the country, 95% of the lots at this level of AP will be accepted

*It needs 3 times more seeds which is neither a technical nor economical problem, but we need to change our law*





***Is it smarter to speak of level rather than a number of seeds to check in our law?***



I guess the level in your law was clear even if was not written, as you said « we did not want any GM seeds to enter the country ».

The level was zero,  
using 3000 seeds from a european protocol, in fact you used a consumer risk at 5% for an AP level of 0.1%



***What do you suggest as a smart design?***

1 The use of two levels of quality, one you are ready to accept often, the other you want to reject often

2 To take into account sampling variability, because you are not interested to accept or reject the small sample you destroyed by testing it,

you want to accept/reject the lot from which the sample was taken





# How to use seedcalc for the design of testing plans

## Using seedcalc

- to change from a testing plan to a new one
- To explore a number of possibilities and select the most appropriate
  - Technically
  - Economically
  - Socially
  - Compromising all issues

Strategy to obtain ad hoc testing plans



# How to define a testing plan adapted to levels of quality and controlled risks

- AQL: the level of quality you are ready to accept often for instance 95%, but you can use another %
- LQL: the level of quality you want to reject often for instance 95%, but you can use another %

With this goals defined you can

look to ad hoc testing plans

Subsampling strategy,

Nb of pools

Nb of seeds per pool

Maximum positive pools

=decision rule

**SAMPLING TYPE**

SINGLE  DOUBLE

Find Plan Analyze

# Seeds per Pool	1	false pos. rate	0,0%
		false neg. rate	0,0%

1 Stage

# of Pools (N1)	200	% impurity	LQL 1,00%	AQL 0,50%
	= 200 seeds			

Accept Lot if # deviants does not exceed

0	C1	Consumer (beta) Risk 13,40%	Producer (alpha) Risk 63,31%
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# How to define a testing plan adapted to levels of quality and controlled risks

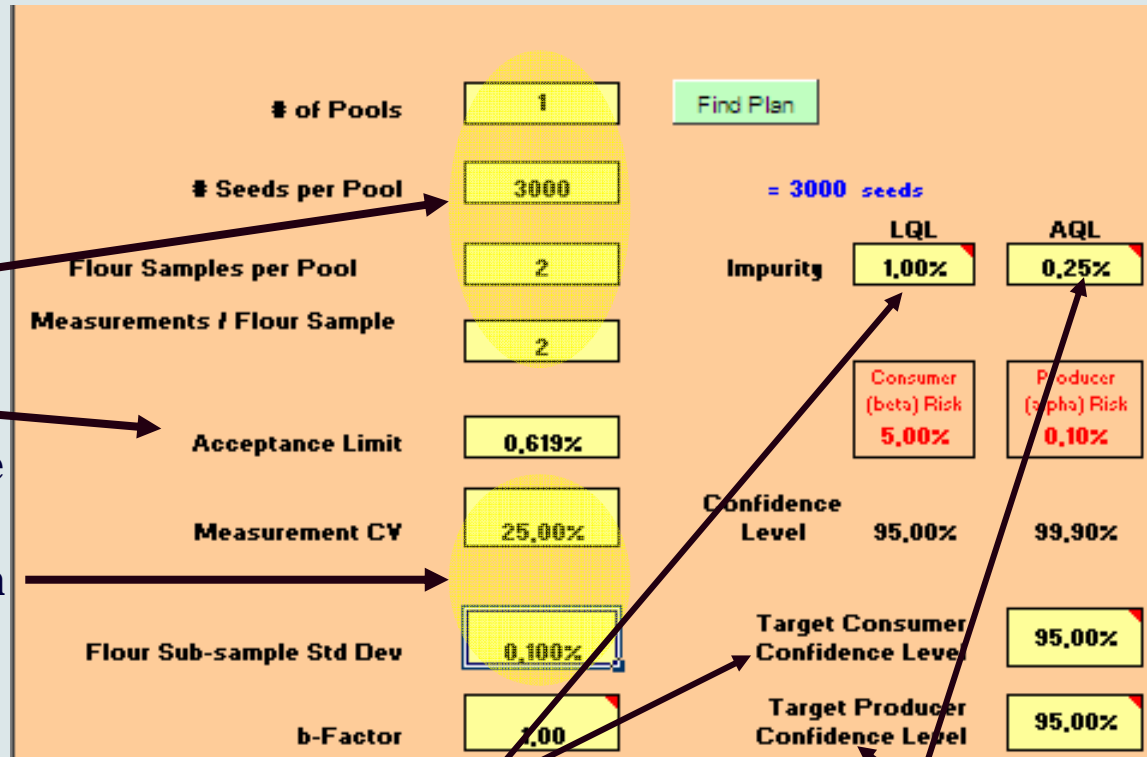


With this goals defined  
you can look to ad hoc  
testing plans

Real time PCR  
Test design

Acceptance limit  
= your decision rule

Analytical precision



LQL: the level of quality you want to reject often

AQL: the level of quality you are ready to accept often

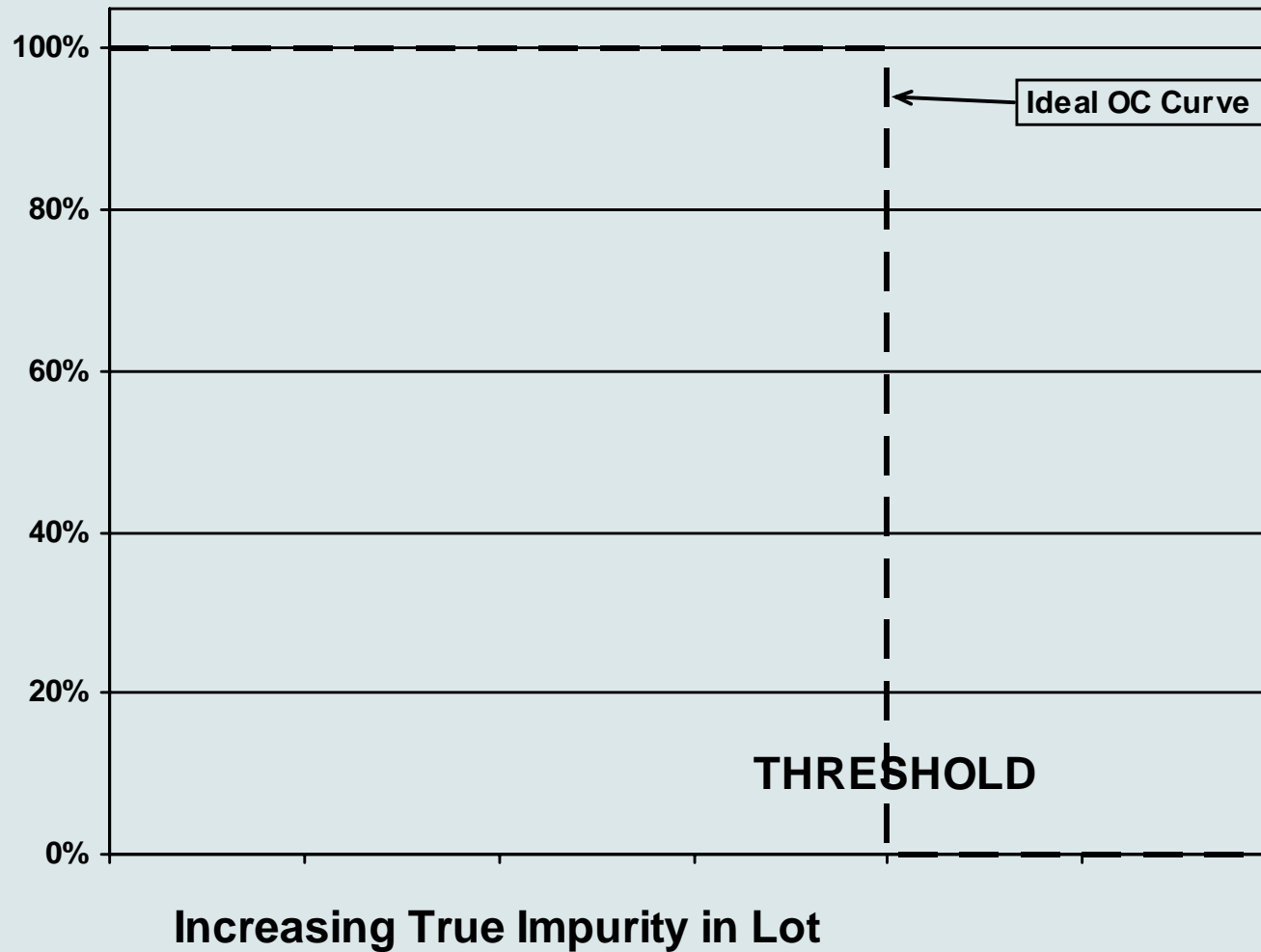


## Operating characteristic curve

What we would like is impossible without a check of each individual seed

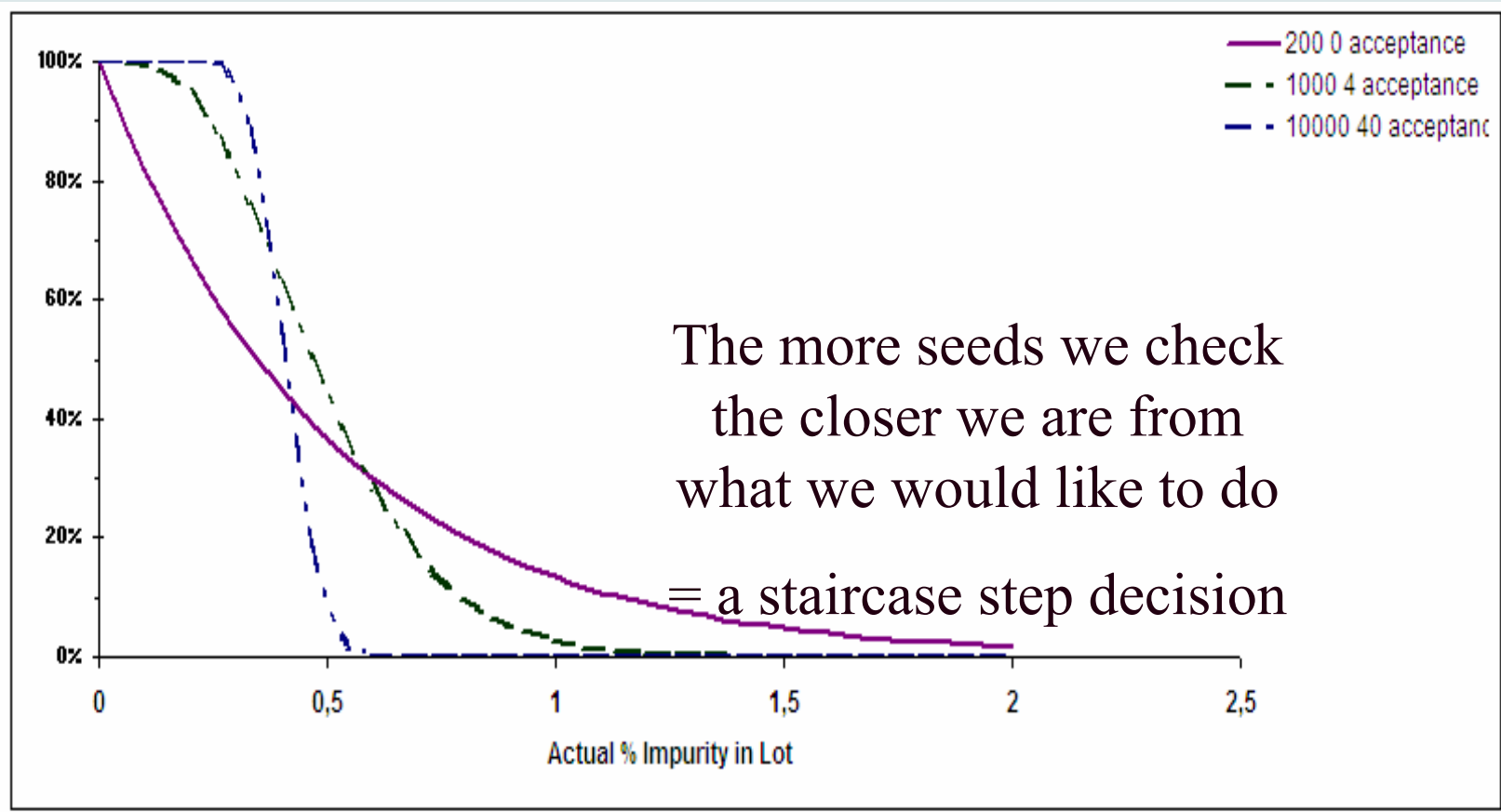


Chance of Accepting Lot



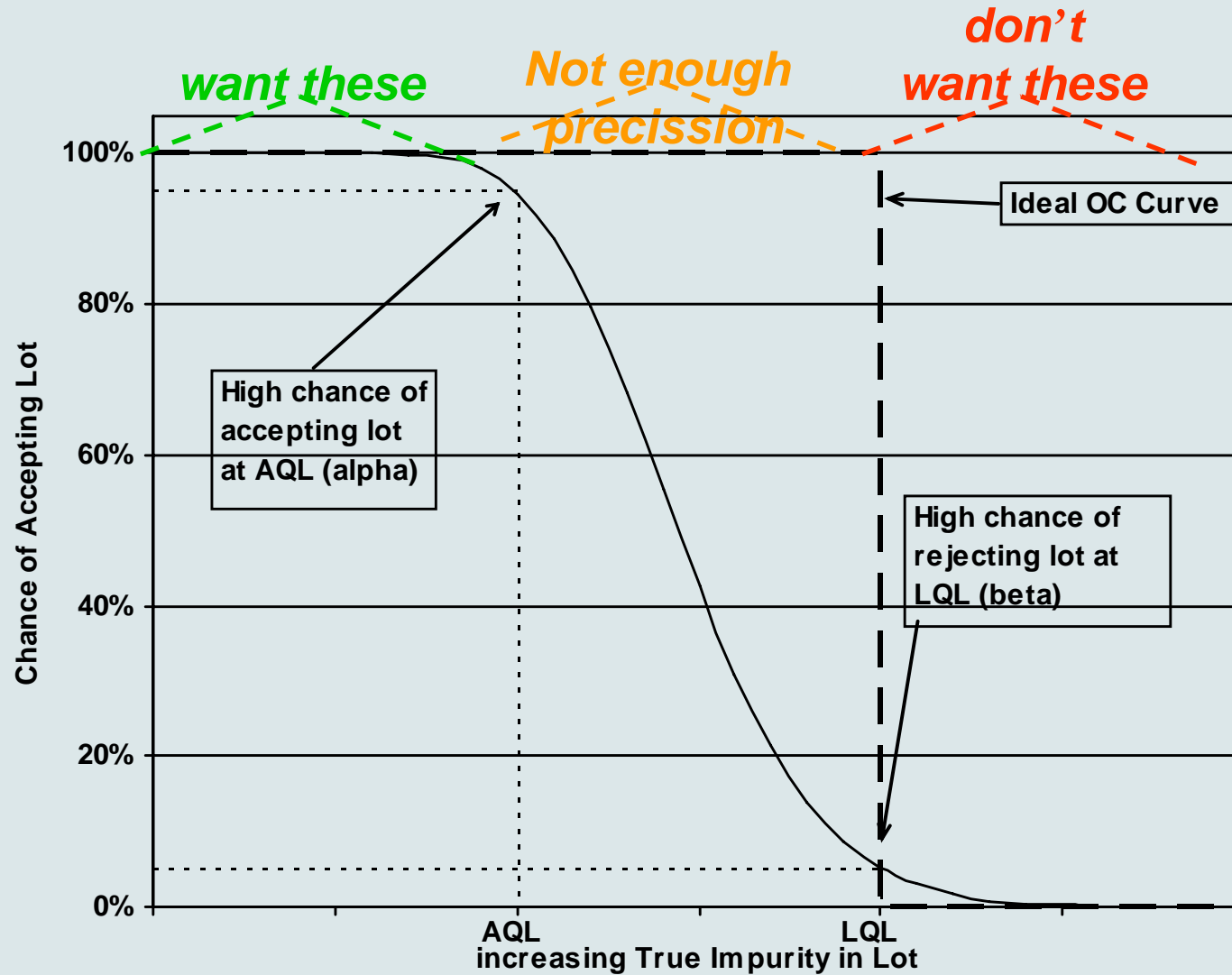


**Increasing precision = reduced uncertainty  
can be achieved by increasing the number of seeds  
to take (representatively) from the seed lot**





# Operating characteristic curve show the effect of your given testing plan in relation to your aim

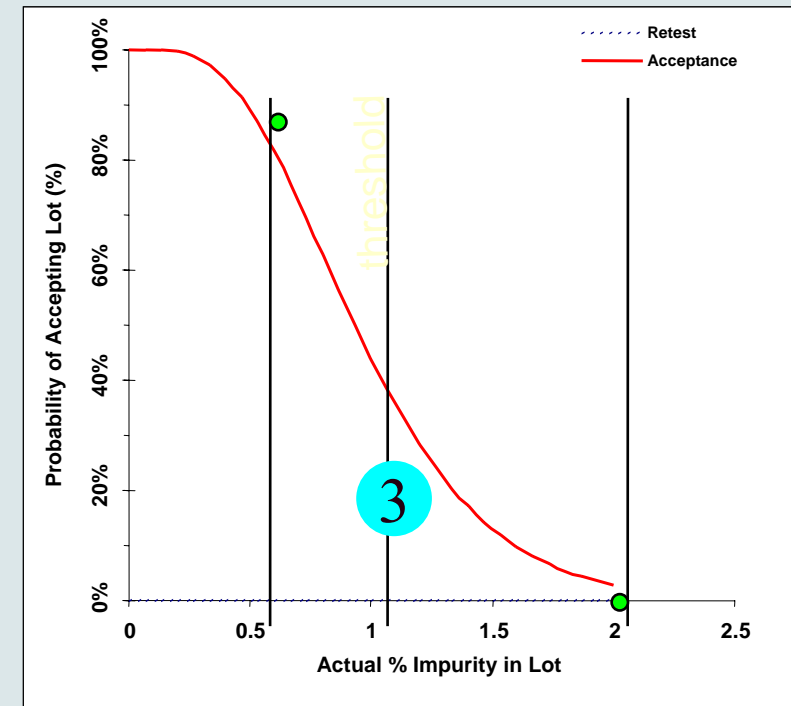
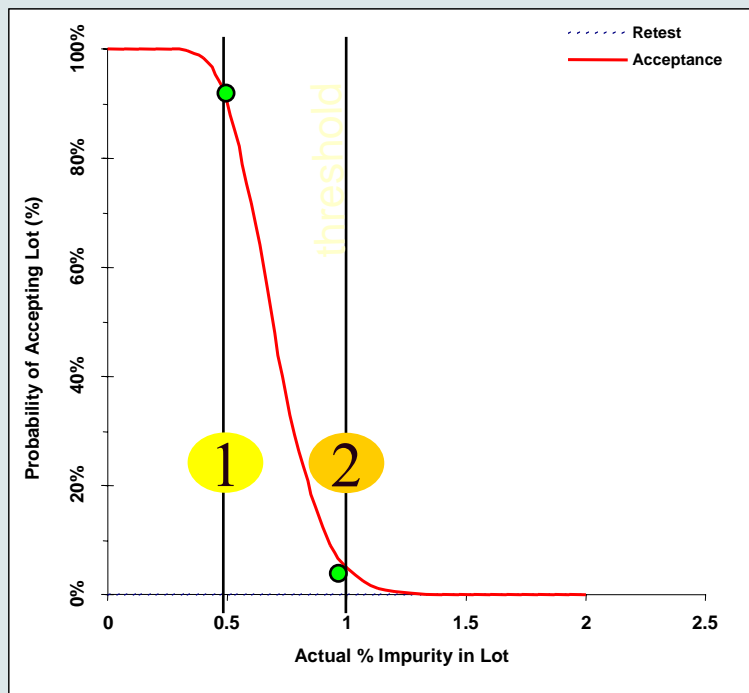




# One can find a relation between AQL and/or LQL and “The” threshold

- 1 AQL only = accept the level of quality producer usually deliver = avoid mistakes
- 2 LQL only = avoid what is above a threshold

- 3 LQL = 2 x threshold  
AQL =  $\frac{1}{2}$  x threshold  
(similar to tolerance approach)



But, it is always better to define both AQL and LQL