

# Using the Taguchi method to test IPM strategies



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# Taguchi method – improving precision in engineering

Improve the quality of manufactured goods and processes

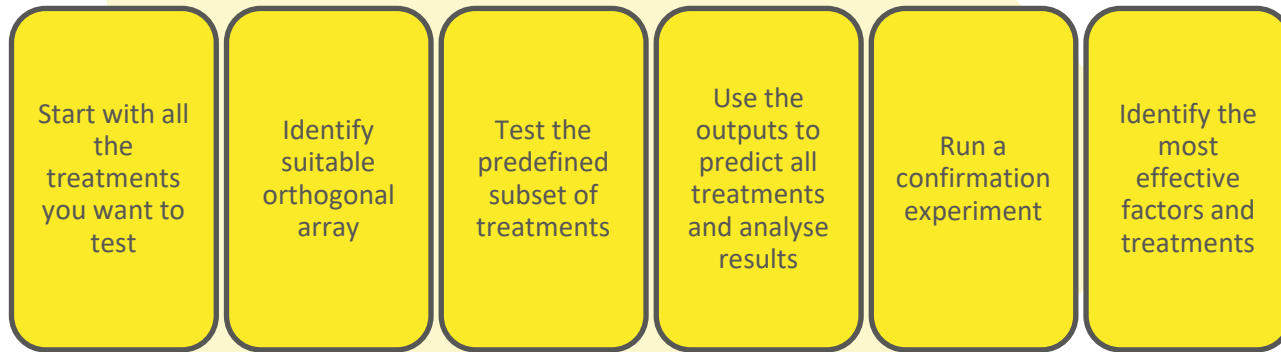
Ronald A. Fisher motivated to understand effect of factors to improve harvested yield.

Genichi Taguchi wanted to reduce variability, cost and minimise the number of experiments.

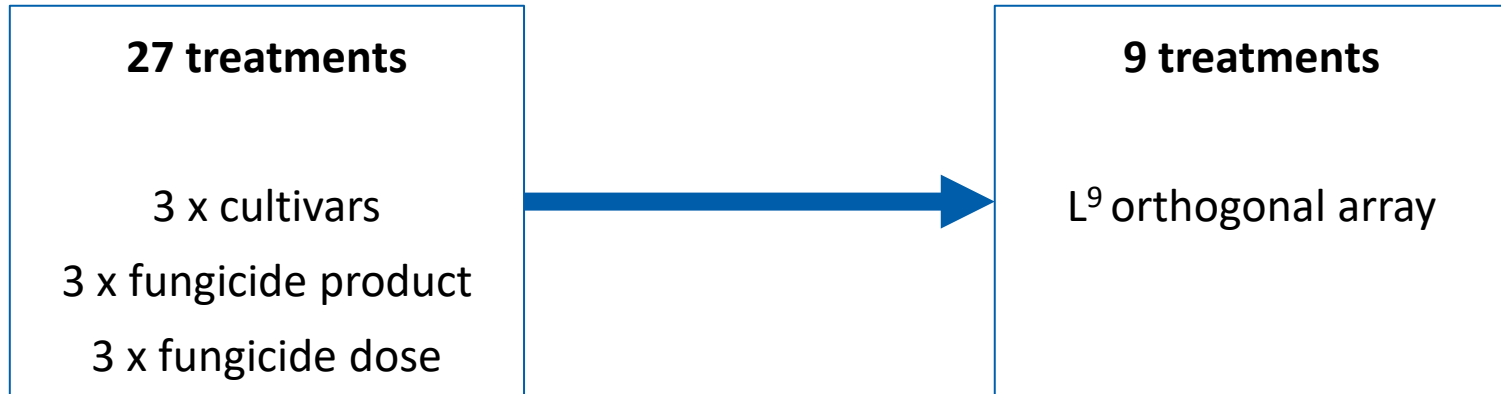
**Is it applicable to agricultural research?**



# Using the Taguchi method



# How did we test the Taguchi method



Two existing late blight datasets – same protocol with 27 treatments

# What is an L<sup>9</sup> orthogonal array

Treatment	Fungicide product	Cultivar	Fungicide dose
1	1	1	1
2	1	2	2
3	1	3	3
4	2	1	2
5	2	2	3
6	2	3	1
7	3	1	3
8	3	2	1
9	3	3	2

# What is an L<sup>9</sup> orthogonal array

Treatment	Fungicide product	Cultivar	Fungicide dose
1	1 (Shirlan)	1 (King Edward)	1 (25%)
2	1 (Shirlan)	2 (Cara)	2 (50%)
3	1 (Shirlan)	3 (Sarpo Mira)	3 (100%)
4	2 (Revus)	1 (King Edward)	2 (50%)
5	2 (Revus)	2 (Cara)	3 (100%)
6	2 (Revus)	3 (Sarpo Mira)	1 (25%)
7	3 (Infinito)	1 (King Edward)	3 (100%)
8	3 (Infinito)	2 (Cara)	1 (25%)
9	3 (Infinito)	3 (Sarpo Mira)	2 (50%)

# Predicted and observed values – Ceredigion and Ayrshire

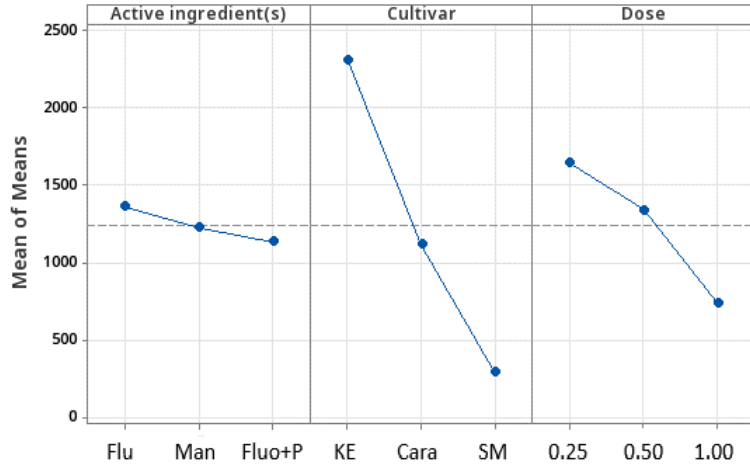


Trt	Observed AUDPC	Predicted AUDPC	Observed AUDPC	Predicted AUDPC
1	2882	2827	1033	984
2	1733	1412	270	226
3	309	684	21	114
4	2705	2385	785	741
5	964	1339	116	208
6	345	290	18	-31
7	1324	1699	525	618
8	658	603	35	-14
9	244	-76	17	-27

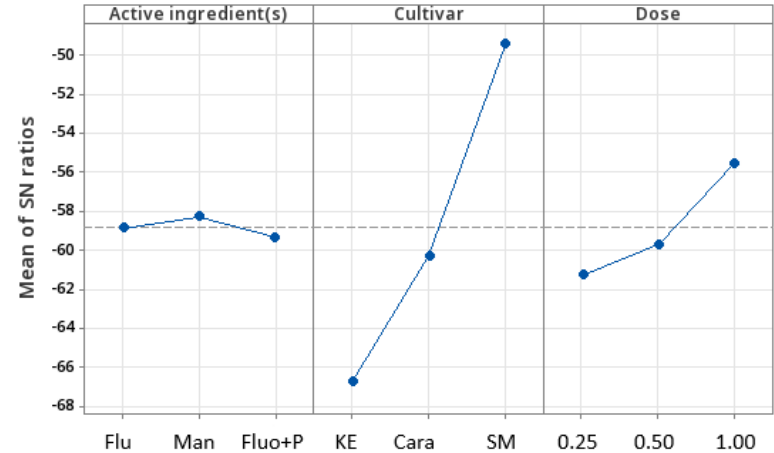
# Mean of means and signal to noise ratio - Ceredigion



## Mean of Means



## Signal to noise ratio



The greater the distance between the means for individual factors, the larger the effect the levels had on the mean. The higher, algebraically, the SNR the greater the effect that level had on the treatment.

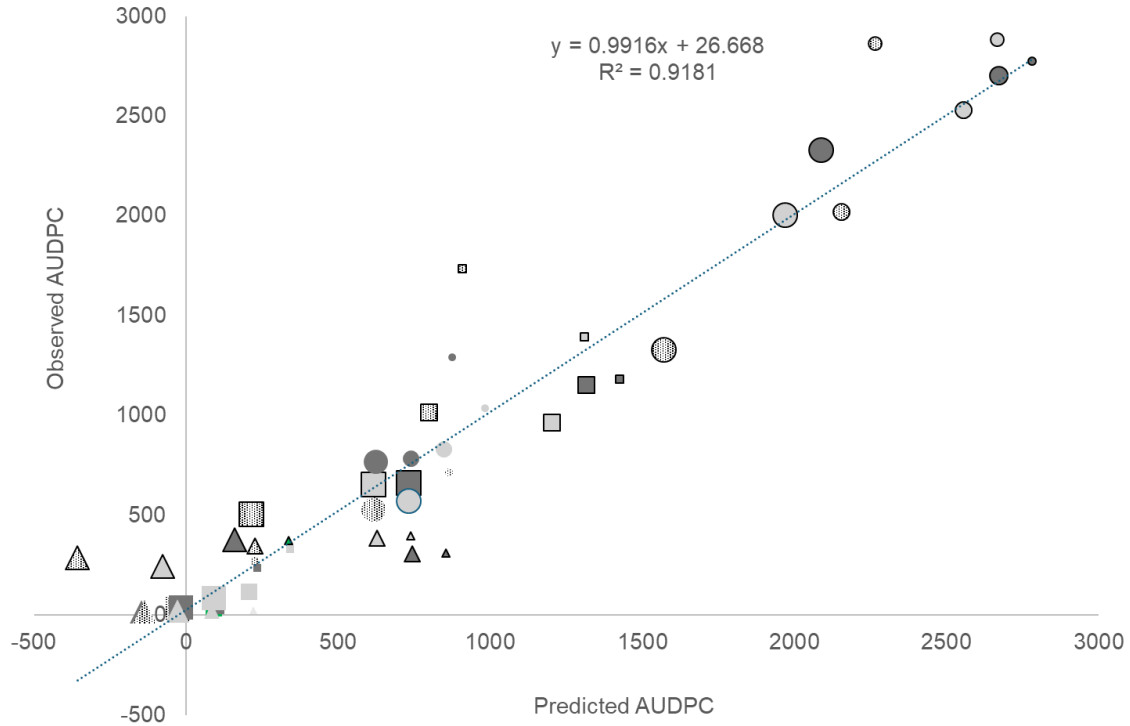


# ANOVA for Mean of Means - Ceredigion



Source	DF	Sum of squares	Mean Squares	F Ratio	P-value	Percentage contribution
Cultivar	2	6093128	3046564	8.26	0.108	<b>82.0</b>
Dose	2	1256028	628014	1.70	0.370	<b>16.9</b>
Active ingredient(s)	2	80108	40054	0.11	0.902	<b>1.1</b>
Residual error	2	737931	368965	-	-	
Total	8	8167194	-			100.0

# Relationship between predicted and observed values – Ayrshire and Ceredigion



- The Taguchi approach can accurately predict the performance of cultivar and fungicide-based integrated disease management strategies.
- Complex strategies can be tested in substantially smaller experiments – not just cultivar/fungicide trials – has potential in other trials e.g. laboratory.
- Test more treatment combinations than is practical in the field e.g.  $L_{16}$  = 256 treatment combinations.
- Speed up our understanding of IPM strategies, identify key factors and aid with fine tuning.



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