

### Annex III

Data from Piacco (1954) for cumulative germination of rice (cv. Americano 1600) through time (a subset of the original data is utilized here). The soaking temperature prior to the germination test is the fixed factor under evaluation. The rice dispersal units, i.e. spikelets, were used as ‘seeds’. A seed was considered to have germinated when both the shoot and the radicle were 5 mm in length (this is not recommended as a valid criterion for scientific germination studies, because it delays recording of germination of about one day; such criterion may be sensible when ‘germination’ is rather intended as ‘seedling establishment capability’). Cumulative germination was sequentially assessed for every plate at twelve non-uniform times up to 7 d, when it was assumed to have completed.

Depending on the statistical approach, data can be arranged in two ways: for multivariate analysis, germination responses are in columns, one for every observation time (germination values recorded at different times are therefore considered diverse response variables); for univariate analysis of germination, time of observation is introduced as an additional factor and timepoints are then considered time levels, thus that a single response variable is considered and all germination counts are arranged in a single column.

Three columns are common to the two diverse arrangements; ‘temp’ is the temperature at which seeds were soaked in water for 5 h before testing germination at 30 °C, ‘plate’ is the Petri dish replicate (whose coding is repeated for each treatment), ‘n’ is the total number of seeds sown in each plate (n=100, always). There are 18 aggregate observations (i.e. plates), for a total of 1800 seeds.

#### Data arrangement 1 (multivariate format)

There are two factors, ‘temp’ and ‘plate’, and 12 response variables, ‘d1’ to ‘d7’, for the cumulative germination counts after the indicated number of days (d). The underscore symbol is used in place of the dot to separate decimals because the latter is not accepted in the variable name by the SAS software.

temp	plate	n	0	1	2	3	3_5	4	4_5	5	5_5	6	6_5	7
20	1	100	0	0	5	69	88	92	93	93	94	95	95	95
20	2	100	0	0	3	50	79	88	90	91	92	92	92	92
20	3	100	0	0	4	54	81	94	95	96	96	96	96	96
20	4	100	0	0	3	56	77	85	88	91	91	91	91	91
20	5	100	0	0	5	60	72	83	86	87	87	87	87	87
20	6	100	0	0	5	57	82	92	93	94	94	94	94	94
30	1	100	0	0	8	73	90	93	93	95	95	95	95	95
30	2	100	0	0	9	82	93	94	95	96	96	96	96	96
30	3	100	0	0	9	77	89	92	95	96	96	96	96	96
30	4	100	0	0	10	75	81	86	88	91	91	92	92	93
30	5	100	0	0	10	71	86	93	95	95	95	95	95	95
30	6	100	0	0	11	83	88	92	92	93	93	93	93	93
40	1	100	0	0	16	76	86	88	88	90	90	92	92	92
40	2	100	0	0	15	84	88	91	91	92	92	92	92	92
40	3	100	0	0	20	83	91	92	92	93	93	94	94	95
40	4	100	0	0	22	77	85	88	89	92	92	92	92	92
40	5	100	0	0	20	74	86	92	92	95	95	95	95	96
40	6	100	0	0	20	76	86	92	92	92	93	94	94	95

### Data arrangement 2 (univariate format)

There are three factors, '**temp**', '**plate**' and '**time**' of observation (in days), and a single response variable, '**germ**', i.e. the cumulative germination count after the number of days indicated in the '**time**' column. In addition, a descriptive variable, '**stage**', is introduced to distinguish the lag period, at which imbibition and metabolism resumption take place, from the germination progress curve.

<b>temp</b>	<b>plate</b>	<b>time</b>	<b>n</b>	<b>germ</b>	<b>stage</b>
20	1	0	100	0	lag
20	2	0	100	0	lag
20	3	0	100	0	lag
20	4	0	100	0	lag
20	5	0	100	0	lag
20	6	0	100	0	lag
30	1	0	100	0	lag
30	2	0	100	0	lag
30	3	0	100	0	lag
30	4	0	100	0	lag
30	5	0	100	0	lag
30	6	0	100	0	lag
40	1	0	100	0	lag
40	2	0	100	0	lag
40	3	0	100	0	lag
40	4	0	100	0	lag
40	5	0	100	0	lag
40	6	0	100	0	lag
20	1	1	100	0	lag
20	2	1	100	0	lag
20	3	1	100	0	lag
20	4	1	100	0	lag
20	5	1	100	0	lag
20	6	1	100	0	lag
30	1	1	100	0	lag
30	2	1	100	0	lag
30	3	1	100	0	lag
30	4	1	100	0	lag
30	5	1	100	0	lag
30	6	1	100	0	lag
40	1	1	100	0	lag
40	2	1	100	0	lag
40	3	1	100	0	lag
40	4	1	100	0	lag
40	5	1	100	0	lag
40	6	1	100	0	lag
20	1	2	100	5	progress
20	2	2	100	3	progress
20	3	2	100	4	progress
20	4	2	100	3	progress
20	5	2	100	5	progress
20	6	2	100	5	progress
30	1	2	100	8	progress

30	2	2	100	9	progress
30	3	2	100	9	progress
30	4	2	100	10	progress
30	5	2	100	10	progress
30	6	2	100	11	progress
40	1	2	100	16	progress
40	2	2	100	15	progress
40	3	2	100	20	progress
40	4	2	100	22	progress
40	5	2	100	20	progress
40	6	2	100	20	progress
20	1	3	100	69	progress
20	2	3	100	50	progress
20	3	3	100	54	progress
20	4	3	100	56	progress
20	5	3	100	60	progress
20	6	3	100	57	progress
30	1	3	100	73	progress
30	2	3	100	82	progress
30	3	3	100	77	progress
30	4	3	100	75	progress
30	5	3	100	71	progress
30	6	3	100	83	progress
40	1	3	100	76	progress
40	2	3	100	84	progress
40	3	3	100	83	progress
40	4	3	100	77	progress
40	5	3	100	74	progress
40	6	3	100	76	progress
20	1	3.5	100	88	progress
20	2	3.5	100	79	progress
20	3	3.5	100	81	progress
20	4	3.5	100	77	progress
20	5	3.5	100	72	progress
20	6	3.5	100	82	progress
30	1	3.5	100	90	progress
30	2	3.5	100	93	progress
30	3	3.5	100	89	progress
30	4	3.5	100	81	progress
30	5	3.5	100	86	progress
30	6	3.5	100	88	progress
40	1	3.5	100	86	progress
40	2	3.5	100	88	progress
40	3	3.5	100	91	progress
40	4	3.5	100	85	progress
40	5	3.5	100	86	progress
40	6	3.5	100	86	progress
20	1	4	100	92	progress
20	2	4	100	88	progress
20	3	4	100	94	progress
20	4	4	100	85	progress

20	5	4	100	83	progress
20	6	4	100	92	progress
30	1	4	100	93	progress
30	2	4	100	94	progress
30	3	4	100	92	progress
30	4	4	100	86	progress
30	5	4	100	93	progress
30	6	4	100	92	progress
40	1	4	100	88	progress
40	2	4	100	91	progress
40	3	4	100	92	progress
40	4	4	100	88	progress
40	5	4	100	92	progress
40	6	4	100	92	progress
20	1	4.5	100	93	progress
20	2	4.5	100	90	progress
20	3	4.5	100	95	progress
20	4	4.5	100	88	progress
20	5	4.5	100	86	progress
20	6	4.5	100	93	progress
30	1	4.5	100	93	progress
30	2	4.5	100	95	progress
30	3	4.5	100	95	progress
30	4	4.5	100	88	progress
30	5	4.5	100	95	progress
30	6	4.5	100	92	progress
40	1	4.5	100	88	progress
40	2	4.5	100	91	progress
40	3	4.5	100	92	progress
40	4	4.5	100	89	progress
40	5	4.5	100	92	progress
40	6	4.5	100	92	progress
20	1	5	100	93	progress
20	2	5	100	91	progress
20	3	5	100	96	progress
20	4	5	100	91	progress
20	5	5	100	87	progress
20	6	5	100	94	progress
30	1	5	100	95	progress
30	2	5	100	96	progress
30	3	5	100	96	progress
30	4	5	100	91	progress
30	5	5	100	95	progress
30	6	5	100	93	progress
40	1	5	100	90	progress
40	2	5	100	92	progress
40	3	5	100	93	progress
40	4	5	100	92	progress
40	5	5	100	95	progress
40	6	5	100	92	progress
20	1	5.5	100	94	progress

20	2	5.5	100	92	progress
20	3	5.5	100	96	progress
20	4	5.5	100	91	progress
20	5	5.5	100	87	progress
20	6	5.5	100	94	progress
30	1	5.5	100	95	progress
30	2	5.5	100	96	progress
30	3	5.5	100	96	progress
30	4	5.5	100	91	progress
30	5	5.5	100	95	progress
30	6	5.5	100	93	progress
40	1	5.5	100	90	progress
40	2	5.5	100	92	progress
40	3	5.5	100	93	progress
40	4	5.5	100	92	progress
40	5	5.5	100	95	progress
40	6	5.5	100	93	progress
20	1	6	100	95	progress
20	2	6	100	92	progress
20	3	6	100	96	progress
20	4	6	100	91	progress
20	5	6	100	87	progress
20	6	6	100	94	progress
30	1	6	100	95	progress
30	2	6	100	96	progress
30	3	6	100	96	progress
30	4	6	100	92	progress
30	5	6	100	95	progress
30	6	6	100	93	progress
40	1	6	100	92	progress
40	2	6	100	92	progress
40	3	6	100	94	progress
40	4	6	100	92	progress
40	5	6	100	95	progress
40	6	6	100	94	progress
20	1	6.5	100	95	progress
20	2	6.5	100	92	progress
20	3	6.5	100	96	progress
20	4	6.5	100	91	progress
20	5	6.5	100	87	progress
20	6	6.5	100	94	progress
30	1	6.5	100	95	progress
30	2	6.5	100	96	progress
30	3	6.5	100	96	progress
30	4	6.5	100	92	progress
30	5	6.5	100	95	progress
30	6	6.5	100	93	progress
40	1	6.5	100	92	progress
40	2	6.5	100	92	progress
40	3	6.5	100	94	progress
40	4	6.5	100	92	progress

40	5	6.5	100	95	progress
40	6	6.5	100	94	progress
20	1	7	100	95	progress
20	2	7	100	92	progress
20	3	7	100	96	progress
20	4	7	100	91	progress
20	5	7	100	87	progress
20	6	7	100	94	progress
30	1	7	100	95	progress
30	2	7	100	96	progress
30	3	7	100	96	progress
30	4	7	100	93	progress
30	5	7	100	95	progress
30	6	7	100	93	progress
40	1	7	100	92	progress
40	2	7	100	92	progress
40	3	7	100	95	progress
40	4	7	100	92	progress
40	5	7	100	96	progress
40	6	7	100	95	progress

## References

Piacco R. (1954). Ricerche sui metodi di analisi delle sementi di riso (*Oryza sativa* L.) nei riguardi della facoltà germinativa. *Annali della Stazione Sperimentale di Riscoltura e delle Colture Irrigue di Vercelli* 2: 111-179.