2-factor CRD versus 1-factor RCBD

2-factor completely randomized design: $Y_{ijl} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \varepsilon_{ijl}$,

where $i = 1, \ldots, a$ indexes factor A, $j = 1, \ldots, b$ indexes factor B, and $l = 1, \ldots, n$ indexes experimental units for each treatment combination.

$$
\begin{aligned}
\text{SSA} &= bn\sum_{i=1}^{a}(\bar{y}_{i\cdot\cdot} - \bar{y}_{\cdot\cdot\cdot})^2 \qquad \text{SSB} = an\sum_{j=1}^{b}(\bar{y}_{\cdot j\cdot} - \bar{y}_{\cdot\cdot\cdot})^2 \\
\text{SSAB} &= n\sum_{i=1}^{a}\sum_{j=1}^{b}(\bar{y}_{ij\cdot} - \bar{y}_{i\cdot\cdot} - \bar{y}_{\cdot j\cdot} + \bar{y}_{\cdot\cdot\cdot})^2 \\
\text{SSError} &= \sum_{i=1}^{a}\sum_{j=1}^{b}\sum_{l=1}^{n}(y_{ijl} - \bar{y}_{ij\cdot})^2 \\
\text{SSTotal} &= \sum_{i=1}^{a}\sum_{j=1}^{b}\sum_{l=1}^{n}(y_{ijl} - \bar{y}_{\cdot\cdot\cdot})^2
\end{aligned}
$$

Source	df	SS	MS	$\mathbb{E}$(MS)
A	$a-1$	SSA	MSA	$\sigma_\varepsilon^2 + bn\sum\alpha_i^2/(a-1)$
B	$b-1$	SSB	MSB	$\sigma_\varepsilon^2 + an\sum\beta_j^2/(b-1)$
AB	$(a-1)(b-1)$	SSAB	MSAB	$\sigma_\varepsilon^2 + n\sum\sum(\alpha\beta)_{ij}^2/[(a-1)(b-1)]$
Error	$ab(n-1)$	SSError	MSError	σ_ε^2
Total	$abn-1$	SSTotal		

1-factor randomized complete block design: $Y_{ij} = \mu + \alpha_i + \beta_j + e_{ij}$,

where $i = 1, \ldots, a$ indexes the treatment factor A and $j = 1, \ldots, b$ indexes blocks.

$$
\begin{aligned}
\text{SSA} &= b\sum_{i=1}^{a}(\bar{y}_{i\cdot} - \bar{y}_{\cdot\cdot})^2 \qquad \text{SSBlk} = a\sum_{j=1}^{b}(\bar{y}_{\cdot j} - \bar{y}_{\cdot\cdot})^2 \\
\text{SSErr} &= \sum_{i=1}^{a}\sum_{j=1}^{b}(y_{ij} - \bar{y}_{i\cdot} - \bar{y}_{\cdot j} + \bar{y}_{\cdot\cdot})^2 \\
\text{SSTotal} &= \sum_{i=1}^{a}\sum_{j=1}^{b}(y_{ij} - \bar{y}_{\cdot\cdot})^2
\end{aligned}
$$

Source	df	SS	MS	$\mathbb{E}$(MS)
A	$a-1$	SSA	MSA	$\sigma_\varepsilon^2 + b\sum\alpha_i^2/(a-1)$
Block	$b-1$	SSBlk	MSBlk	$\sigma_\varepsilon^2 + a\sum\beta_j^2/(b-1)$
Error	$(a-1)(b-1)$	SSErr	MSErr	σ_ε^2
Total	$ab-1$	SSTotal		

Conclusion: the ANOVA for an RCBD with 1 factor is like a CRD with 2 factors, and $n = 1$.