perplexity

Estimation of Heterosis Using Line × Tester Data

Heterosis, or hybrid vigor, is the phenomenon where hybrids (crosses) exhibit greater biomass, yield, or other traits compared to their parents. In Line × Tester mating design analysis, heterosis is commonly estimated as follows:

Types of Heterosis

1. **Mid-parent heterosis** — deviation of the hybrid from the mean of both parents.
2. **Better-parent heterosis** — deviation of the hybrid from the better-performing parent.
3. **Standard heterosis** — deviation of the hybrid from a standard (commercial) check.

Step-by-Step Estimation in R

Suppose your data frame (`ltdata`) includes columns for line, tester, the cross mean, and parental means.

1. Calculating Mid-Parent and Better-Parent Heterosis

Formulas:

- **Mid-parent heterosis (%)** = $\frac{F_1 - MP}{MP} \times 100$
  - Where F_1 = mean of the hybrid (line × tester cross), MP = mean of the two parents.
- **Better-parent heterosis (%)** = $\frac{F_1 - BP}{BP} \times 100$
  - Where BP = higher mean of the two parents.

2. Example R Script

Assume your data frame (`ltdata`) contains:

- `line`, `tester`, `hybrid_mean`, `line_mean`, `tester_mean`

```
# Example calculation of heterosis
ltdata$midparent_mean <- (ltdata$line_mean + ltdata$tester_mean) / 2

ltdata$midparent_heterosis <- ((ltdata$hybrid_mean - ltdata$midparent_mean) / ltdata$midp

ltdata$betterparent_mean <- pmax(ltdata$line_mean, ltdata$tester_mean)

ltdata$betterparent_heterosis <- ((ltdata$hybrid_mean - ltdata$betterparent_mean) / ltdat

# To view the results
ltdata[, c("line", "tester", "midparent_heterosis", "betterparent_heterosis")]
```

3. For Standard Heterosis

If you have a column `check_mean` (standard check/hybrid):

```
ltdata$standard_heterosis <- ((ltdata$hybrid_mean - ltdata$check_mean) / ltdata$check_mea
```

Practical Notes

- Usually, you extract parental and hybrid means from your experimental data after running an appropriate Line × Tester analysis.
- You can run these calculations across all your crosses to generate a heterosis table for reporting and selection.
- Positive heterosis values suggest the hybrid outperforms parents/check.

Summary Table Example

Line	Tester	Mid-parent Heterosis (%)	Better-parent Heterosis (%)	Standard Heterosis (%)
1	1	12.8	7.9	12.2
1	2	9.1	4.5	10.6

In plant breeding, significant positive heterosis indicates promising hybrid combinations for further evaluation and use.
Adapt the above R script for your data—replace column names as appropriate for your dataset. If you have specific data or wish to automate this, let me know!

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