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*Crop & Pasture Science*

### Supplementary Material

#### Random regression models for multi-environment, multi-time data from crop breeding selection trials

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## Supplementary Material File S1.

### ASReml-R code for fitting the models:

#### Unstructured (Corgh) model

```
# Y17 is the data frame in R that holds the data

# grainwt is the grain weight variable

# Env is a factor for the 6 environments

# ddayc is the degree days (centred) as a variate

# ddayf is a factor for the degree days

# Gen is a factor for the 128 Genotypes

# Rep is a factor for the replicate blocks within each trial

# Row is a factor for the rows within each trial

# Col is a factor for the columns within each trial

asreml(grainwt ~ Env + Env:ddayc,
       random = ~str(~Env:Gen + Env:ddayc:Gen, ~corgh(12):id(128)) + diag(Env):spl(ddayc)
       + diag(Env):ddayf +
       at(Env,c(1,6)):Gen:ddayf +
       at(EnvTime):Rep + at(EnvTime):Row + at(EnvTime):Col + at(Env,4):Plot,
       residual = ~dsum(~ante(ddayf):ar1(Col):ar1(Row) | Env, levels=c(2))+
       dsum(~us(ddayf):ar1(Col):ar1(Row) | Env, levels=c(1,3,5,6))+
       dsum(~corgh(ddayf):id(Col):id(Row) | Env, levels=c(4)),
       data = Y17, maxiter = 50, workspace = "16Gb")
```

#### Factor Analytic (FA) model

(note in asreml-R4 need to include dummy factor to fit FA in str - not required in asreml-R3)

## #FA1

# Define a dummy term Z and include Z:Gen as the last term in str()

```
Y17$Z<-0
```

```
asreml(grainwt ~ Env+Env:ddayc,
```

```
    random = ~str(~Env:Gen + Env:ddayc:Gen + Z:Gen, ~fa(12):id(128)) +  
    diag(Env):spl(ddayc) + diag(Env):ddayf +  
    at(Env,c(1,6)):Gen:ddayf +  
    at(EnvTime):Rep + at(EnvTime):Row + at(EnvTime):Col + at(Env,4):Plot,  
    residual = ~dsum(~ante(ddayf):ar1(Col):ar1(Row) | Env, levels=c(2))+  
    dsum(~us(ddayf):ar1(Col):ar1(Row) | Env, levels=c(1,3,5,6))+  
    dsum(~corgh(ddayf):id(Col):id(Row) | Env, levels=c(4)),  
    data = Y17, maxiter = 50, workspace = "16Gb")
```

## #FA2

# For 2 factors need to define dummy factor with 2 levels (length of Y17)

```
Y17$Z2<-rep(c(1,2),dim(Y17)[1]/2))
```

```
Y17$Z2<-factor(Y17$Z2,levels=c('1','2'))
```

```
asreml(grainwt ~ Env+Env:ddayc,
```

```
    random = ~str(~Env:Gen + Env:ddayc:Gen + Z2:Gen, ~fa(12,2):id(128)) +  
    diag(Env):spl(ddayc) + diag(Env):ddayf +  
    at(Env,c(1,6)):Gen:ddayf +  
    at(EnvTime):Rep + at(EnvTime):Row + at(EnvTime):Col + at(Env,4):Plot,  
    residual = ~dsum(~ante(ddayf):ar1(Col):ar1(Row) | Env, levels=c(2))+  
    dsum(~us(ddayf):ar1(Col):ar1(Row) | Env, levels=c(1,3,5,6))+  
    dsum(~corgh(ddayf):id(Col):id(Row) | Env, levels=c(4)),  
    data = Y17, maxiter = 50, workspace = "16Gb")
```