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Article title: Long-term trends in yield variance of temperate managed grassland; **Journal:** Agronomy for Sustainable Development; **Authors:** Janna Macholdt, Steffen Hadasch, Andrew Macdonald, Sarah Perryman, Hans-Peter Piepho, Tony Scott, Merete Elisabeth Styczen & Jonathan Storkey; **Corresponding author:** Janna Macholdt, Professorship of Agronomy, Martin-Luther-University Halle-Wittenberg (Germany); janna.macholdt@landw.uni-halle.de

Table A6 Supplementary material Model syntax (R version 4.0.0) used for the statistical analysis of trends in mean yield and temporal yield variance (Park Grass Experiment, 1965–2018).

```
require(asreml)
```

```
data=readxl::read_xlsx("C:/Users/Hadasch/Downloads/Datensatz_Park Grass Experiment_ Rothamsted.xlsx", col_types =  
c("text","text","text","text","numerical","numerical","numerical"))
```

```
data$fert_treat=as.factor(data$`Fertilizer_treatment (main plot)`)  
data$fert_treat1=as.factor(data$`Fertilizer_treatment name (main plot)`)  
data$limi_treat=as.factor(data$`Liming_treatment (sub plot)`)  
data$fert_limi_treat=as.factor(paste(data$fert_treat,data$limi_treat,sep="_"))  
data$Year=as.factor(data$Year)  
data$t=as.numeric(as.character(data$Year))  
data$t_cent=(data$t-min(data$t))/max(data$t)  
data$t_cent_sqrt=sqrt(data$t_cent)  
data$y=as.numeric(data$`Total biomass (1st+2nd cut)`)  
print(length(unique(data$fert_limi_treat)))
```

```
data$period=NA  
spl_knots=round(splinek(data$t, k = 10)$knotpoints)
```

```
## Spline: design points closer than 0.0053 have been merged.
```

```
spl_knots[1]=spl_knots[1]-1  
for(k in 1:(length(spl_knots)-1))  
  which(is.na(data$period))
```

```
## integer(0)  
fert_limi_treat=unique(data$fert_limi_treat)  
fert_limi_treat=fert_limi_treat[order(fert_limi_treat)]
```

```
means=c()  
vcs=c()  
for(i in fert_limi_treat) {
```

```
  #i=fert_limi_treat[1]  
  data_i=data[which(data$fert_limi_treat==i),]  
  data_i$period=as.factor(as.character(data_i$period))  
  asrSP <- asreml(y ~ t,  
    random = ~spl(t,k=10),  
    residual = ~dsum(~units|period),  
    options=asreml.options(step.size=.316,maxit=50,workspace  
    ="240mb",pworkspace="240mb"),  
    data = data_i)
```

```
  asrSP=update(asrSP) asrSP=update(asrSP) asrSP=update(asrSP) asrSP=update(asrSP) #asrSP=update(asrSP)  
#asrSP=update(asrSP)  
vcSP=summary(asrSP)$varcomp
```

```
  pSP=predict(asrSP,classify = "t",design.points = list(t = unique(data$t)))  
  means_i=pSP$pvals#[which(preds$pvals$fert_limi_treat==i),]  
  means_i$upper=(means_i$predicted.value+2*means_i$std.error)  
  means_i$lower=(means_i$predicted.value-2*means_i$std.error)  
  means=rbind(means,cbind(i,means_i))  
  vcs=rbind(vcs,cbind(i,vcSP))  
}
```