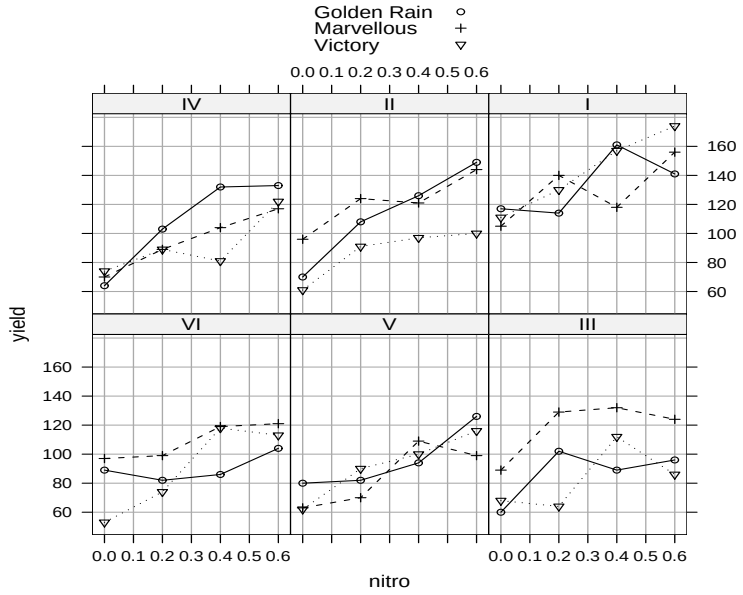
Stat 8311, Fall 2006 – Split plot design

This handout uses the Oats data from Pinhero and Bates.

```
> data(Oats, package = "nlme")
> head(Oats)
```

```
  Block     Variety nitro yield
1     I     Victory   0.0   111
2     I     Victory   0.2   130
3     I     Victory   0.4   157
4     I     Victory   0.6   174
5     I Golden Rain   0.0   117
6     I Golden Rain   0.2   114
```

```
> library(lattice)
> library(lme4)
> print(xyplot(yield ~ nitro | Block, groups = ~Variety, type = c("g",
+     "l", "p"), data = Oats, auto.key = T))
```



Standard AOV approach

```
> summary(a1 <- aov(yield ~ Variety + Block + Error(Variety:Block) +
+     factor(nitro) + factor(nitro):Variety, data = Oats))
```

```
Error: Variety:Block
          Df  Sum Sq Mean Sq F value  Pr(>F)
Variety    2  1786.4   893.2  1.4853 0.27239
Block      5 15875.3  3175.1  5.2801 0.01244
Residuals 10  6013.3   601.3

Error: Within
                     Df  Sum Sq Mean Sq F value    Pr(>F)
```

```
factor(nitro)          3 20020.5  6673.5 37.6856 2.458e-12
Variety:factor(nitro)  6   321.7    53.6  0.3028    0.9322
Residuals             45  7968.7   177.1
```

lmer

```
> m1 <- lmer(yield ~ factor(nitro) * Variety + (1 | Block),
+     data = Oats)
> anova(m1)

Analysis of Variance Table
                     Df  Sum Sq Mean Sq
factor(nitro)         3 20020.5  6673.5
Variety               2  1786.4   893.2
factor(nitro):Variety 6   321.7    53.6

> m2 <- lmer(yield ~ factor(nitro) + Variety + (1 | Block),
+     data = Oats)
> m3 <- lmer(yield ~ nitro + Variety + (1 | Block), data = Oats)
> m4 <- lmer(yield ~ nitro + (1 | Block), data = Oats)
> anova(m4, m3, m2, m1)

Data: Oats
Models:
m4: yield ~ nitro + (1 | Block)
m3: yield ~ nitro + Variety + (1 | Block)
m2: yield ~ factor(nitro) + Variety + (1 | Block)
m1: yield ~ factor(nitro) * Variety + (1 | Block)
   Df     AIC     BIC  logLik  Chisq Chi Df Pr(>Chisq)
m4  3  622.40  629.23 -308.20
m3  5  618.85  630.23 -304.42 7.5512      2    0.02292
m2  7  620.63  636.57 -303.31 2.2169      2    0.33006
m1 13  631.10  660.70 -302.55 1.5302      6    0.95746

> (coefs <- coef(m3))

An object of class coef.lmer
[[1]]
    (Intercept)    nitro VarietyMarvellous VarietyVictory
VI     75.24867 73.66667          5.291667         -6.875
V      70.30963 73.66667          5.291667         -6.875
III    74.93998 73.66667          5.291667         -6.875
IV     77.02364 73.66667          5.291667         -6.875
II     85.43545 73.66667          5.291667         -6.875
I     111.44262 73.66667          5.291667         -6.875
```