02441 Applied Statistics and Statistical Software

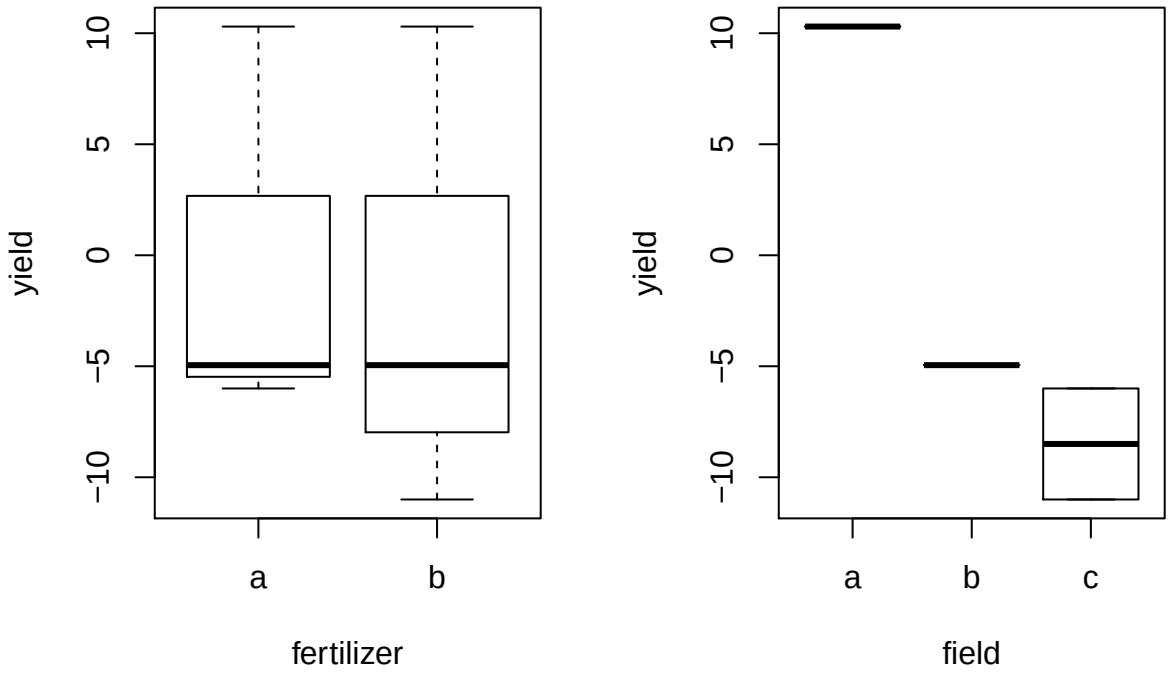
Exercise 3B - Fertilizer

In a pilot study two different fertilizers were tested on three different fields. The yield (compared to a reference) is given in the table below

Fertilizer/Field	a	b	c
a	10.3	-4.95	-6
b	10.3	-4.95	-11

1. Type the data into R so that appropriate analysis can be carried out

```
fer <- data.frame(yield=c(10.3,-4.95,-6,10.3,-4.95,-11),
                  fertilizer=rep(c('a','b'),each=3),
                  field=rep(c('a','b','c'),2))
par(mfrow=c(1,2))
plot(yield~fertilizer, data = fer)
plot(yield~field, data = fer)
```



2. Determine whether Fertilizer and/or Field influence on the yield

Start by making a one-way anova

```
anova(lm(yield~fertilizer,fer))
```

```
## Analysis of Variance Table
##
## Response: yield
```

```
##            Df Sum Sq Mean Sq F value Pr(>F)
## fertilizer  1   4.17   4.167  0.0409 0.8496
## Residuals   4 407.40 101.851
```

```
anova(lm(yield~field,fer))
```

```
## Analysis of Variance Table
##
## Response: yield
##           Df Sum Sq Mean Sq F value   Pr(>F)
## field      2 399.07 199.535  47.888 0.005293 **
## Residuals  3  12.50   4.167
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
anova(lm(yield~.,fer))
```

```
## Analysis of Variance Table
##
## Response: yield
##            Df Sum Sq Mean Sq F value  Pr(>F)
## fertilizer  1   4.17   4.167   1.000 0.42265
## field       2 399.07 199.535  47.888 0.02045 *
## Residuals   2   8.33   4.167
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

3. Is it possible to test for interaction effects between Fertilizer and Field?

```
lm1 <- lm(yield~.^2,fer)
anova(lm1)
```

```
## Warning in anova.lm(lm1): ANOVA F-tests on an essentially perfect fit are
## unreliable
```

```
## Analysis of Variance Table
##
## Response: yield
##                  Df Sum Sq Mean Sq F value Pr(>F)
## fertilizer        1   4.17   4.167
## field             2 399.07 199.535
## fertilizer:field  2   8.33   4.167
## Residuals         0   0.00
```

No. The sample size doesn't allow to test for the interaction. There are not sufficient degrees fo freedom $df(residuals) = 0$.