The female flower and the seed of two African plants are widely used in traditional medicine for the treatment of people with certain diseases. It has been claimed, however, that use of these traditional remedies in combination can temporarily impair vision by reducing the patient's field of vision. The measurements provided in the following table were collected from 18 subjects randomly assigned in groups of two to different combinations of flower and seed concentrations. The goal here is to thoroughly answer the question: how do the plants appear to affect field of vision? Report all necessary assumptions, (exact) test statistics and p-values, the results of relevant diagnostics, along with a thorough analysis of the data, and be sure to identify the type of design and the appropriate analysis in your analysis.

<table>
<thead>
<tr>
<th>Flower</th>
<th>Seed</th>
<th>Field of Vision</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25 g</td>
<td>0.001 g</td>
<td>67 66</td>
</tr>
<tr>
<td></td>
<td>0.005 g</td>
<td>65 61</td>
</tr>
<tr>
<td></td>
<td>0.009 g</td>
<td>62 64</td>
</tr>
<tr>
<td>2.50 g</td>
<td>0.001 g</td>
<td>68 65</td>
</tr>
<tr>
<td></td>
<td>0.005 g</td>
<td>68 61</td>
</tr>
<tr>
<td></td>
<td>0.009 g</td>
<td>55 53</td>
</tr>
<tr>
<td>5.00 g</td>
<td>0.001 g</td>
<td>65 64</td>
</tr>
<tr>
<td></td>
<td>0.005 g</td>
<td>62 63</td>
</tr>
<tr>
<td></td>
<td>0.009 g</td>
<td>49 47</td>
</tr>
</tbody>
</table>

**Interaction Plot (data means) for fovision**

```plaintext
data one;
  do flower=0.25,2.5,5;
  do seed=0.001,0.005,0.009;
  do rep=1,2;
```
input fovisibility @@; output;
end; end; end; datalines;
67 66 65 61 62 64 68 65 68 61 55 53 65 64 62 63 49 47;
proc glm;
class flower seed;
model fovisibility=flower seed flower*seed;
run;

The GLM Procedure

Class Level Information

Class          Levels      Values
flower          3          0.25 2.5 5
seed            3    0.001 0.005 0.009
Number of Observations Read       18
Number of Observations Used        18

Dependent Variable: fovisibility

Sum of Source          DF    Squares    Mean Square  F Value    Pr > F
Model                   8   623.7777778  77.9722222 15.77    <.0001
Error                   9   44.5000000   4.9444444
Corrected Total        17  668.2777778

R-Square     Coeff Var   Root MSE  fovisibility Mean
0.933411      3.622171    2.223611    61.38889

Source          DF   Type I SS    Mean Square  F Value    Pr > F
flower          2   102.7777778  51.3888889 10.39    <.0001
seed            2   386.1111111 193.0555556 39.04    <.0001
flower*seed     4   134.8888889  33.7222222  6.82    0.0083

Source          DF   Type III SS   Mean Square  F Value    Pr > F
flower          2   102.7777778  51.3888889 10.39    <.0001
seed            2   386.1111111 193.0555556 39.04    <.0001
flower*seed     4   134.8888889  33.7222222  6.82    0.0083

data two;
do trt=1 to 9;
do rep=1,2;
    input fovisibility @@; output;
end; end; datalines;
67 66 65 61 62 64 68 65 68 61 55 53 65 64 62 63 49 47;
proc glm data=two;
class trt;
model fovisibility=trt;
contrast 'in flower 0.25' trt 1 0 -1 0 0 0 0 0 0, trt 1 -2 1 0 0 0 0 0 0;
contrast 'in flower 2.50' trt 0 0 0 1 0 -1 0 0 0, trt 0 0 0 1 -2 1 0 0 0;
contrast 'in flower 5.00' trt 0 0 0 0 0 0 1 0 -1, trt 0 0 0 0 0 0 1 -2 1;
contrast 'linear in flower 0.25' trt 1 0 -1 0 0 0 0 0 0;
contrast 'quad in flower 0.25' trt 1 -2 1 0 0 0 0 0 0;
contrast 'linear in flower 2.50' trt 0 0 0 1 0 -1 0 0 0;
contrast 'quad in flower 2.50' trt 0 0 0 1 -2 1 0 0 0;
contrast 'linear in flower 5.00' trt 0 0 0 0 0 0 1 0 -1;
contrast ' quad in flower 5.00' trt 0 0 0 0 0 1 -2 1;
run;

The GLM Procedure

Class Level Information
Class          Levels    Values
trt                9    1 2 3 4 5 6 7 8 9
Number of Observations Read          18
Number of Observations Used          18

Dependent Variable: fovision

Sum of
Source                      DF         Squares     Mean Square    F Value    Pr > F
Model                        8       623.7777778      77.9722222      15.77    0.0002
Error                        9       44.5000000       4.9444444
Corrected Total             17     668.2777778

R-Square Coeff Var Root MSE fovision Mean
0.933411      3.622171      2.223611         61.38889

Source                      DF       Type I SS     Mean Square    F Value    Pr > F
trt                          8     623.7777778      77.9722222      15.77    0.0002

Source                      DF     Type III SS     Mean Square    F Value    Pr > F
trt                          8     623.7777778      77.9722222      15.77    0.0002

Contrast                     DF     Contrast SS     Mean Square    F Value    Pr > F
    in flower 0.25         2      16.333333       8.1666667       1.65    0.2449
    in flower 2.50         2     180.333333       90.1666667      18.24    0.0007
    in flower 5.00         2     324.333333      162.1666667      32.80    <.0001
linear in flower 0.25       1      12.250000     12.2500000       2.48    0.1499
quad in flower 0.25         1       4.0833333       4.0833333       0.83    0.3872
linear in flower 2.50       1     156.2500000   156.2500000      31.60    0.0003
quad in flower 2.50         1     24.0833333    24.0833333       4.87    0.0547
linear in flower 5.00       1     272.2500000   272.2500000      55.06    <.0001
quad in flower 5.00         1     52.0833333    52.0833333      10.53    0.0101

Residuals Versus the Fitted Values
(response is fovision)