

SPLITFACT_M2S1: A SAS MACRO FOR ANALYSIS OF SPLIT-FACTORIAL PLOT DESIGNS (MAIN: A×B, SUB: C)

Introduction

The SAS macro, **splitfact_m2s1.sas** provides a convenient way to analyze the data from Split Factorial (Main: A×B, Sub: C) Plot Designs. The macro produces the output as Rich Text Format (RTF) file. It also gives the list output in SAS Output Window. The macro will run correctly in the version SAS 9.2 or higher. In the sequel, we give some guidelines on How to use this macro?

Dataset Preparation

The macro (**splitfact_m2s1.sas**) requires that the dataset should be prepared as follows:

- Create a SAS dataset with at least 5 variables, one for block or replication, one for main plot- treatment factor 1, one for main plot- treatment factor 2, one for subplot treatment and one for the dependent or analysis variables. If the data on more than one dependent variable is collected in the same experiment, the data on all variables may be entered in additional columns. The macro can analyze data on more than one dependent variable in one go.
- One may give actual levels used for different factors applied in main plot-treatment factor 1, main plot-treatment factor 2 and subplot treatment. Please remember that there should not be any space between a single data value. Main plot-treatment factor 1, main plot-treatment factor 2, subplot treatments and block numbers may be coded as 1, 2, 3 and so on. One can have character values also.

Using Macro **splitfact_m2s1.sas**

- Download **splitfact_m2s1.sas** and **Using_Splitfact_m2s1_Macro.sas** program files to your computer system.
- First file viz. **splitfact_m2s1.sas** contains the macro program and the second one **Using_Splitfact_m2s1_Macro.sas** contains an example experimental data conducted in Split Plot design with two factors in Main plot and one factor in subplot having two dependent variables.
- Copy the “Splitfact_m2s1.sas” in any folder.
- Open Using_Splitfact_m2s1_Macro.sas program in SAS.

The codes for creating the SAS dataset using DATA step are included in the file. If one would like to use the same file, replace the datalines within the DATA step with the data to be analyzed. Remember to add/remove dependent variables in INPUT line of the DATA step. An example of data set preparation with 3 levels of main plot factor 1, 2 levels of main plot-factor 2 and 4 levels of factor applied to subplot arranged in 3 blocks or replications is given below.

```
data split_fact;
input Rep Irrigation Variety Fertilizer yield s_yield;
cards;
1 1 1 1 4.24 14.86450934
1 1 1 2 4.59 16.0834868
1 1 1 3 3.64 12.75980005
1 1 1 4 3.06 10.71647812
1 1 2 1 3.61 12.64579497
1 1 2 2 3.05 10.69016925
1 1 2 3 2.67 9.348417083
1 1 2 4 2.47 8.655616943
```

| | | | | | |
|---|---|---|---|------|-------------|
| 1 | 2 | 1 | 1 | 4.22 | 17.21921861 |
| 1 | 2 | 1 | 2 | 3.94 | 16.05630929 |
| 1 | 2 | 1 | 3 | 3.23 | 13.15923697 |
| 1 | 2 | 1 | 4 | 2.89 | 11.77190656 |
| 1 | 2 | 2 | 1 | 2.99 | 12.21054779 |
| 1 | 2 | 2 | 2 | 2.73 | 11.14964807 |
| 1 | 2 | 2 | 3 | 2.12 | 8.650413139 |
| 1 | 2 | 2 | 4 | 1.97 | 8.017953688 |
| 1 | 3 | 1 | 1 | 3.91 | 19.06619529 |
| 1 | 3 | 1 | 2 | 3.71 | 18.06656101 |
| 1 | 3 | 1 | 3 | 2.79 | 13.61696940 |
| 1 | 3 | 1 | 4 | 2.82 | 13.75106668 |
| 1 | 3 | 2 | 1 | 1.87 | 9.106424479 |
| 1 | 3 | 2 | 2 | 1.56 | 7.582591735 |
| 1 | 3 | 2 | 3 | 1.57 | 7.667926368 |
| 1 | 3 | 2 | 4 | 1.26 | 6.156284286 |
| 2 | 1 | 1 | 1 | 4.38 | 15.35560817 |
| 2 | 1 | 1 | 2 | 4.12 | 14.45233710 |
| 2 | 1 | 1 | 3 | 3.54 | 12.42655442 |
| 2 | 1 | 1 | 4 | 2.87 | 10.07629571 |
| 2 | 1 | 2 | 1 | 3.40 | 11.91791634 |
| 2 | 1 | 2 | 2 | 2.93 | 10.28676664 |
| 2 | 1 | 2 | 3 | 2.75 | 9.655353854 |
| 2 | 1 | 2 | 4 | 2.42 | 8.471454880 |
| 2 | 2 | 1 | 1 | 4.12 | 16.82138121 |
| 2 | 2 | 1 | 2 | 3.88 | 15.84208916 |
| 2 | 2 | 1 | 3 | 3.05 | 12.43496889 |
| 2 | 2 | 1 | 4 | 2.62 | 10.69060492 |
| 2 | 2 | 2 | 1 | 2.73 | 11.11904519 |
| 2 | 2 | 2 | 2 | 2.60 | 10.58859533 |
| 2 | 2 | 2 | 3 | 2.00 | 8.170968071 |
| 2 | 2 | 2 | 4 | 1.88 | 7.671121085 |
| 2 | 3 | 1 | 1 | 4.25 | 20.73631598 |
| 2 | 3 | 1 | 2 | 3.63 | 17.70084116 |
| 2 | 3 | 1 | 3 | 3.14 | 15.32366207 |
| 2 | 3 | 1 | 4 | 2.67 | 13.03181763 |
| 2 | 3 | 2 | 1 | 2.42 | 11.77617945 |
| 2 | 3 | 2 | 2 | 1.91 | 9.301475070 |
| 2 | 3 | 2 | 3 | 1.72 | 8.399366086 |
| 2 | 3 | 2 | 4 | 1.53 | 7.460685115 |
| 3 | 1 | 1 | 1 | 4.12 | 14.46110673 |
| 3 | 1 | 1 | 2 | 4.01 | 14.06647373 |
| 3 | 1 | 1 | 3 | 3.44 | 12.04946067 |
| 3 | 1 | 1 | 4 | 3.23 | 11.32158204 |
| 3 | 1 | 2 | 1 | 3.66 | 12.82118741 |
| 3 | 1 | 2 | 2 | 3.21 | 11.26896431 |
| 3 | 1 | 2 | 3 | 2.94 | 10.30430588 |
| 3 | 1 | 2 | 4 | 2.51 | 8.787161273 |
| 3 | 2 | 1 | 1 | 4.46 | 18.19851066 |
| 3 | 2 | 1 | 2 | 4.17 | 16.99479751 |
| 3 | 2 | 1 | 3 | 3.31 | 13.48566765 |
| 3 | 2 | 1 | 4 | 2.96 | 12.07793533 |
| 3 | 2 | 2 | 1 | 3.19 | 13.02662450 |
| 3 | 2 | 2 | 2 | 2.36 | 9.639906151 |
| 3 | 2 | 2 | 3 | 2.20 | 8.976843823 |
| 3 | 2 | 2 | 4 | 2.08 | 8.487197797 |
| 3 | 3 | 1 | 1 | 4.03 | 19.65134707 |
| 3 | 3 | 1 | 2 | 4.19 | 20.40716811 |
| 3 | 3 | 1 | 3 | 3.36 | 16.37205900 |
| 3 | 3 | 1 | 4 | 3.30 | 16.06729245 |
| 3 | 3 | 2 | 1 | 1.89 | 9.228331098 |

| | | | | | |
|---|---|---|---|------|-------------|
| 3 | 3 | 2 | 2 | 1.99 | 9.715957576 |
| 3 | 3 | 2 | 3 | 1.60 | 7.814214312 |
| 3 | 3 | 2 | 4 | 1.63 | 7.948311593 |

```
;run;
```

The different variable names used in the above example are

1. **rep** - Block variable name. In this Example there are 3 blocks numbered as 1, 2 and 3.
2. **Irrigation** - Main Plot treatment Factor1 variable name.
3. **Variety** – Main plot treatment Factor2 variable name.
4. **Fertilizer** - Subplot variable name.
5. **yield s_yield** - One can have several response/dependent variables. In this Example there are two dependent variables, namely yield and s_yield.

For details on assigning values to various macro variables names, please see after this paragraph

```
%let ds = split_fact;
%let dep_var = yield s_yield;
%let block_var = rep;
%let main_plot1 = Irrigation;
%let main_plot2 = Variety;
%let sub_plot = Fertilizer;
%let adjust = t;
%let alpha = 0.05;
%let rtf = Split_Factorial_result.rtf;
```

The macro takes the following arguments. All these are macro variables written after %let statement.

1. **ds** - Write data set name. It should be same as defined in data step.
2. **dep_var** - Write response variable(s) names separated by a single space. In this example there are two dependent variables, namely yield and s_yield. So these are written separated by a space.
3. **block_var** - Write block variable name as given in above dataset. In this example its rep.
4. **main_plot1** - Write main plot treatment factor 1 variable name as defined in above dataset. In this example its Irrigation.
5. **main_plot2** - Write main plot treatment factor 2 variable name as defined in above dataset. In this example its Variety.
6. **sub_plot** - Write subplot treatment variable name as defined in above dataset. In this example its Fertilizer.
7. **adjust** - Enter Multiple Comparison Adjustment variable here. Accepted values are TUKEY for Tuley's Honest Significant Difference or T for Least Significant Difference.
8. **alpha** - Level of Significance (as a fraction) to be used in the multiple comparison test. Typically, 0.01 or 0.05 for 1% and 5% level of significance respectively. One can specify any value for level of significance between 0 and 1.
9. **rtf** - Output file Name. In this Example the output file name is Split_Factorial_result. You may change the folder in which output is desired. Make sure that you have write permissions for the defined folder. It is advisable to save the output file before opening instead of opening before saving. It may be noted that in the Versions earlier than 9.2 file would not open before saving. The important thing to remember the extension .rtf should remain as such.

```
/* Modify to change the path to the file containing Split Factorial Plot
macro. (splitfact_m2s1.sas) */
%include D:\Split Factorial Macro\splitfact_m2s1.sas';
```

This can be used when the directory in which macro is saved is D:\Split Factorial Macro. In case the macro is saved at another location then the path of that location should be completely specified.

If one is not sure of the path of the macro and don't want to use this, then open the file **splitfact_m2s1.sas** and run it once. It will not produce any output. Don't include above statement in program or make it as comment by writing * in the beginning of %include statement.

```
%splitfact_m2s1(ds=&ds, dep=&dep_var, block_var=&block_var,
main1=&main_plot1, main21=&main_plot2, sub1=&sub_plot, adjust=&adjust,
alpha=&alpha, rtffile=&rtf);
```

This above statement is calling the macro. Make sure you are using appropriate macro variables. If you have changed it, make sure that you have changed it here also.

1. **ds=&ds** - passing the name of data set to macro variable ds
2. **dep=&dep_var** - passing the dependent variable(s) to macro variable dep.
3. **block_var=&block_var** - passing the block variable to macro variable block_var.
4. **main1=&main_plot1** - passing the main plot treatment factor 1 variable to macro variable main1.
5. **Main2=&main_plot2** - passing the main plot treatment factor 2 variable to macro variable main2.
6. **Sub1=&sub_plot** - passing the subplot treatment variable to macro variable sub1.
7. **adjust=&adjust** - passing the value of adjust macro variable to adjust.
8. **alpha=&alpha** - passing the value of alpha macro variable to alpha.
9. **rtffile=&rtf** - passing the value of rtf macro variable to rtffile.

STANDARD ERRORS OF DIFFERENCES AND RESPECTIVE LEAST SIGNIFICANT DIFFERENCES

| No | Type of pair Comparison Between | $s_{\bar{d}}$ | LSD |
|----|--|--|-----------------|
| 1 | Two main-plot-factor1 means | $\sqrt{\frac{2 E_a}{rbc}}$ | S.E.(1) * t_a |
| 2 | Two main plot-factor2 means | $\sqrt{\frac{2 E_a}{rac}}$ | S.E.(2) * t_a |
| 3 | Interaction – main plot treatment factor1 * main plot-factor2 means | $\sqrt{\frac{2 E_a}{rc}}$ | S.E.(3) * t_a |
| 4 | Two Subplot treatment means | $\sqrt{\frac{2 E_b}{rab}}$ | S.E.(4) * t_b |
| 5 | Two main plot treatment factor1 means at the same or different levels of subplot | $\sqrt{\frac{2 [(c - 1) E_b + E_a]}{rbc}}$ | S.E.(5) * TWC |
| 6 | Two main plot treatment factor2 means at the same or different levels of subplot | $\sqrt{\frac{2 [(c - 1) E_b + E_a]}{rac}}$ | S.E.(6) * TWC |
| 7 | Two main plot treatment factor1 * main plot treatment factor2 means at the same or different levels of subplot | $\sqrt{\frac{2 [(c - 1) E_b + E_a]}{rc}}$ | S.E.(7) * TWC |

| | | | |
|----|--|---------------------------|------------------|
| 8 | Two subplot means at the same or different levels of main plot treatment factor1 means | $\sqrt{\frac{2 E_b}{rb}}$ | S.E.(8) * t_b |
| 9 | Two subplot means at the same or different levels of main plot treatment factor2 means | $\sqrt{\frac{2 E_b}{ra}}$ | S.E.(9) * t_b |
| 10 | Two subplot means at the same or different levels of main plot treatment factor 1 * main plot treatment factor 2 means | $\sqrt{\frac{2 E_b}{r}}$ | S.E.(10) * t_b |

where

E_a = Error(a) MS,

E_b = Error(b) MS,

r = number of replications,

a = number of main plot treatment factor1 treatments,

b = number of main plot treatment factor2 treatments,

c = number of subplot treatments,

t_a = t-value at Error(A) df and at desired level of significance

t_b = t-value at Error(B) df and at desired level of significance

$$TWC = \frac{(c-1) E_b * t_b + E_a * t_a}{(c-1) E_b + E_a}$$

If one is interested to obtain Tukey's HSD, then t_a , t_b may be replaced with corresponding Studentized range values.

Output Produced

The outputs are shown for the sample data included in the second file, **Using Splitfact_m2s1_Macro.sas**. The variable names are "rep", "Irrigation", "Variety" and "Fertilizer" for block, main plot-factor1 treatment, main plot-factor2 treatment and sub plot plot treatment respectively and the dependent variables are yield & s_yield.

Split-Factorial Plot Details

This table provides the details of the Split-Factorial Plot Design used.

Split-Factorial (Main-AxB, Sub-C) Plot Design Analysis

Split-Factorial Plot Details

| Details | Number of Levels |
|--|------------------|
| Number of Replications | 3 |
| Number of Main Plots - Factor 1 (Irrigation) | 3 |
| Number of Main Plots - Factor 2 (Variety) | 2 |
| Number of Sub Plots (Fertilizer) | 4 |

ANOVA Table - Dependent Variable: YIELD

| Source | DF | Sum of Squares | Mean Square | F-Ratio | p-Value | Significant |
|---|----|----------------|-------------|---------|---------|-------------|
| rep | 2 | 0.27 | 0.14 | 1.85 | 0.2072 | NS |
| Irrigation | 2 | 6.83 | 3.42 | 46.76 | <.0001 | * |
| Variety | 1 | 27.47 | 27.47 | 375.90 | <.0001 | * |
| Irrigation*Variety | 2 | 2.67 | 1.33 | 18.27 | 0.0005 | * |
| Error(a) | 10 | 0.73 | 0.07 | . | . | |
| Fertilizer | 3 | 12.88 | 4.29 | 179.21 | <.0001 | * |
| Irrigation*Fertilizer | 6 | 0.31 | 0.05 | 2.18 | 0.0683 | NS |
| Variety*Fertilizer | 3 | 0.88 | 0.29 | 12.27 | <.0001 | * |
| Irrigation*Variety*Fertilizer | 6 | 0.17 | 0.03 | 1.20 | 0.3298 | NS |
| Error(b) | 36 | 0.86 | 0.02 | . | . | |
| Total | 71 | 53.08 | . | . | . | |
| * - Significant at 5% (level of significance opted by user), NS - Non Significant p-Value < 0.05 - Significant at 5%, p-Value < 0.01 - Significant at 1% | | | | | | |

The model used for analysis

$$Y_{ijkl} = \mu + r_i + \alpha_j + \beta_k + (\alpha\beta)_{jk} + e_{ijk} + \gamma_l + (\alpha\gamma)_{jl} + (\beta\gamma)_{kl} + (\alpha\beta\gamma)_{jkl} + e_{ijkl}$$

Where:

Y_{ijkl} : Observation corresponding to l^{th} level of subplot treatment factor (C), k^{th} level of main plot treatment factor2 (B), j^{th} level of main plot treatment factor1 (A) and the i^{th} replication.

μ : General mean.

r_i : i^{th} block effect.

α_j : j^{th} main plot treatment factor1 effect.

β_k : k^{th} main plot treatment factor2 effect.

$(\alpha\beta)_{jk}$: Intraction between j^{th} level of main plot treatment factor1 and k^{th} level of main plot treatment factor2 .

γ_l : l^{th} level of subplot treatment factor.

$(\alpha\gamma)_{jl}$: Intraction between j^{th} level of main plot treatment factor1 and l^{th} level of subplot treatment factor.

$(\beta\gamma)_{kl}$: Intraction between k^{th} level of main plot treatment factor2 and l^{th} level of subplot treatment factor.

$(\alpha\beta\gamma)_{jkl}$: Intraction between j^{th} level of main plot treatment factor1, k^{th} level of main plot treatment factor2 and l^{th} level of subplot treatment factor.

e_{ijkl} : The error component e_{ijk} and e_{ijkl} are independently and normally distributed with means 0 and respective variances σ_1^2 and σ_2^2 .

In this model, term e_{ijk} denotes Error(A) But it automatically including lower order interaction i.e. $(r\alpha)_{ij}$ and $(r\beta)_{ik}$.

Note that the last column provides the significance level of each of the sources. A note at the bottom is given for the interpretation. * indicates significant at specified alpha level opted by user. If p-value < 0.05 indicates significant at 5% alpha level and p-Value < 0.01 indicated significant at 1% alpha level and NS indicates non-significant. We can easily conclude that

the Irrigation, Variety, interaction term Irrigation*Variety, Fertilizer and Interaction term - Variety*Fertilizer treatments are significantly different at 5% level of significance.

Mean Interaction Table - Main plot treatment Factor1 vs Main plot treatment Factor2 (Irrigation * Variety)

This is the mean interaction table for Main plot treatment Factor 1 vs Main plot treatment Factor 2 variable. The last horizontal column shows the averaged mean of Main plot treatment Factor 2 levels with grouping letters as superscripts only if Main plot treatment Factor 2 is significant in above ANOVA table. Similarly last vertical column shows the Main plot treatment factor 1 mean with grouping letters as Main plot treatment factor 1 is also significant for dependent variable - yield.

*Mean Interaction Table - Irrigation * Variety*

| Irrigation_Variety | MP2₁ | MP2₂ | Main Plot-Factor 1 Mean |
|--|------------------------|------------------------|--------------------------------|
| MP1 ₁ | 3.77 | 2.97 | 3.37 ^A |
| MP1 ₂ | 3.57 | 2.40 | 2.99 ^B |
| MP1 ₃ | 3.48 | 1.75 | 2.61 ^C |
| Main Plot-Factor 2 Mean | 3.61 ^A | 2.37 ^B | General Mean=2.99 |
| MP1 - Main Plot-Factor 1, MP2 - Main Plot-Factor 2 | | | |

*Mean Interaction Table - Irrigation * Fertilizer*

| Irrigation_Fertilizer | SP1₁ | SP1₂ | SP1₃ | SP1₄ | Main Plot-Factor 1 Mean |
|--|------------------------|------------------------|------------------------|------------------------|--------------------------------|
| MP1 ₁ | 3.90 | 3.65 | 3.16 | 2.76 | 3.37 ^A |
| MP1 ₂ | 3.62 | 3.28 | 2.65 | 2.40 | 2.99 ^B |
| MP1 ₃ | 3.06 | 2.83 | 2.36 | 2.20 | 2.61 ^C |
| Sub Plot Mean | 3.53 ^A | 3.25 ^B | 2.73 ^C | 2.45 ^D | General Mean=2.99 |
| MP1 - Main Plot-Factor 1, SP1 - Sub Plot | | | | | |

*Mean Interaction Table - Variety * Fertilizer*

| Variety_Fertilizer | SP1₁ | SP1₂ | SP1₃ | SP1₄ | Main Plot-Factor 2 Mean |
|--|------------------------|------------------------|------------------------|------------------------|--------------------------------|
| MP2 ₁ | 4.19 | 4.03 | 3.28 | 2.94 | 3.61 ^A |
| MP2 ₂ | 2.86 | 2.48 | 2.17 | 1.97 | 2.37 ^B |
| Sub Plot Mean | 3.53 ^A | 3.25 ^B | 2.73 ^C | 2.45 ^D | General Mean=2.99 |
| MP2 - Main Plot-Factor 2, SP1 - Sub Plot | | | | | |

Mean Interaction Table - Irrigation * Variety * Fertilizer

| Irrigation_Variety_Fertilizer | MP1 ₁ | | | MP1 ₂ | | | MP1 ₃ | | | Sub Plot Mean |
|--|------------------|------------------|------|------------------|------------------|------|------------------|------------------|------|-------------------|
| | MP2 ₁ | MP2 ₂ | Mean | MP2 ₁ | MP2 ₂ | Mean | MP2 ₁ | MP2 ₂ | Mean | |
| SP1 ₁ | 4.25 | 3.56 | 3.90 | 4.27 | 2.97 | 3.62 | 4.06 | 2.06 | 3.06 | 3.53 |
| SP1 ₂ | 4.24 | 3.06 | 3.65 | 4.00 | 2.56 | 3.28 | 3.84 | 1.82 | 2.83 | 3.25 |
| SP1 ₃ | 3.54 | 2.79 | 3.16 | 3.20 | 2.11 | 2.65 | 3.10 | 1.63 | 2.36 | 2.73 |
| SP1 ₄ | 3.05 | 2.47 | 2.76 | 2.82 | 1.98 | 2.40 | 2.93 | 1.47 | 2.20 | 2.45 |
| Mean | 3.77 | 2.97 | 3.37 | 3.57 | 2.40 | 2.99 | 3.48 | 1.75 | 2.61 | General Mean=2.99 |
| MP1 - Main Plot-Factor 1, MP2 - Main Plot-Factor 2, SP1 - Sub Plot | | | | | | | | | | |

Following note is coming below the Mean Interaction Table only when one use **adjust=t** in **Using Splitfact_m2s1_Macro.sas** and if any of the Main plot treatment Factor1, Main plot treatment Factor2 and Subplot is coming significant.

Note: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

The following footnote also appears below the table:

Means with at least one letter common are not statistically significant. In case, treatment effect is non-significant, no grouping letter is produced in the output

Note that when the treatment effect is not significant, there would be no grouping letter as it is meaningless to conduct multiple comparison test when the treatment effects are not significant.

The group letters are produced using the macro, PDGLM800.SAS by Arnold M. Saxton (asaxton@utk.edu) University of Tennessee, Knoxville TN 37996-4500.

p-Value, CV and R-Square for Dependent Variable YIELD

| Source | p-Value | CV% | R-Square |
|-------------------------------|---------|---------|----------|
| Irrigation | <.0001 | 9.03921 | 0.983751 |
| Variety | <.0001 | 9.03921 | . |
| Irrigation*Variety | 0.0005 | 9.03921 | . |
| Fertilizer | <.0001 | 5.17603 | . |
| Irrigation*Fertilizer | 0.0683 | 5.17603 | . |
| Variety*Fertilizer | <.0001 | 5.17603 | . |
| Irrigation*Variety*Fertilizer | 0.3298 | 5.17603 | . |

The above table provides the p-Value of the corresponding effects, CV% for Main plot treatment factor 1, Main plot treatment factor 2, sub plot variables respectively. It also gives the Model R-Square value.

Standard Errors

This table provides the standard error of difference between various combinations along with t-value and CD (**Tukey's HSD**) at given alpha level. Note that NS is shown for the corresponding source if its non-significant in above ANOVA table.

Standard Errors for YIELD

| Source | S.E. of Difference | Studentized Range value at 5% | Tukey's HSD at 5% |
|---|--------------------|-------------------------------|-------------------|
| Main plot treatment Factor 1 - Irrigation means | 0.08 | 3.88 | 0.21 |
| Main plot treatment Factor 2 - Variety means | 0.06 | 3.88 | 0.17 |
| Interaction - Irrigation*Variety means | 0.11 | 3.88 | 0.30 |
| Sub Plot - Fertilizer means | 0.05 | 2.87 | 0.10 |
| Irrigation at the same or different level of Fertilizer | 0.11 | 3.38 | NS |
| Variety at the same or different level of Fertilizer | 0.09 | 3.38 | 0.21 |
| Irrigation*Variety at the same or different level of Fertilizer | 0.16 | 3.38 | NS |
| Fertilizer at the same level of Irrigation | 0.09 | 2.87 | NS |
| Fertilizer at the same level of Variety | 0.07 | 2.87 | 0.15 |
| Fertilizer at the same level of Irrigation*Variety | 0.13 | 2.87 | NS |
| NS - Non Significant | | | |

Similar output was generated for dependent variable - S_YIELD also.

Following table appears in the last of output generated by the macro **Splitfact_M2S1**.

| |
|---|
| Macro Developed under Strengthening Statistical Computing for NARS by Rajender Parsad and Pramod Kumar at IASRI |
| Grouping letters on treatments were made using pdglm800.sas which can be downloaded from http://animalscience.ag.utk.edu/FacultyStaff/ArnoldSaxton.html#software |
| Output Produced using macro Splitfact_M2S1 developed on: 05MAR2014 |

Errors in Log Files

When you are running the macro, it is better to check the log files to make sure that the macro runs correctly. Some basic checks such as number of parameters, acceptable values are included in the program. However, the following warning may appear in the SAS Log if you run “**splitfact_m2s1.sas**” macro:

WARNING: DATA step interface is preproduction in this release.

This error can be safely ignored.