

The Effect of Organic and Inorganic Fertilizers on the Growth of Radish

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Abstract: A field experiment was conducted at the Madras Christian College Farm during February- March 2011 to study the effect of various compositions of organic, inorganic fertilizers and their interactions on the growth of white radish plant. A 2² factorial experiment was conducted as a Randomised Completely Block Design in four replications. Four unique combinations of organic and inorganic fertilizers were applied for each replicate. The parameters measured to study the growth are weight, number of leaves and the length of the bulb. The study reveals that inorganic fertilizer had significant impact on the weight and number of leaves but not on the length of the bulb of the radish plant. The interaction of the fertilizers had a significant effect on the length of the bulb of the radish plant.

Keywords: White Radish (*Raphanus sativus*), Organic and Inorganic fertilizers, Interactions, factorial experiment, growth of radish

I. Introduction

Radish is an edible root vegetable of the Brassicaceae family. It is a fast maturing and easy to grow vegetable. It was cultivated about 2700 B.C (Becker, 1962). Radish has many nutritional values. Radish is grown for its young tender tuberous root which is consumed either cooked or raw. It is a good source of vitamin C (ascorbic acid) and minerals like calcium, potassium and phosphorus. Many research experiments have been done to improve the growth and yield of radish plant. The effect of density on the growth and yield has been discussed in literature by Lee and Leong (1981), Bhople et al (1998). Pervez et al (2004) studied the effect of different levels of nitrogen and spacing on growth and yield of radish plant. Azza et al (2008), Islam et al (2011) and Kunzang et al (2012), have discussed the effect of organic and inorganic fertilizers for the quality seeds of radish. Effect of sowing time on the growth and yield of radish was experimented by Salam et al (1999) Khairul (2010) and Ebrahimi (2013). The interactive effect of plant density and Nitrogen application rate on root yield and quality of radish crop was studied by Desuki et al (2005). This experiment was designed to study the effect of organic and inorganic fertilizers and their interaction on growth and the yield of radish plant.

II. Materials And Methods

For the purpose of the study white radish variety was taken for cultivation at the Madras Christian College farm in February 2011. The aim of the study is to determine the effect of the fertilizers on the yield of radish which includes weight, number of leaves and length of the bulb. The land was tilled, well drained with good irrigation facilities. The whole experimental area 20m x 13 m was divided into four equal parts (replicates) and each replicate was further divided into four equal parts. Spacing between the replicates is 0.75 cm. The size of each plot is 2.6 m x 4.3 m with four ridges. The distance between the plots is 0.5 cm. On 8th February 2011 seeds were sown in the sandy clay loam. The fields were irrigated from the third day using drip irrigation technique in the furrows and the growth of the plants was closely monitored. Four unique combinations of Organic and Inorganic fertilizers were applied to each plot on 3rd March, 2011. Field soil and vermin-compost were applied in the ratio (O₁- 4:1) and (O₂- 1:1). Urea, Super phosphate and Potash were used in the ratio (I₁- 2:1:2 and I₂ - 4:2:4).

The fertilizers were applied randomly in the following order as a 2² factorial experiment with Randomised Completely Block Design layout

| REPLICATE I | REPLICATE II | REPLICATE III | REPLICATE IV |
|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| O ₂ I ₂ | O ₁ I ₁ | O ₁ I ₁ | O ₂ I ₂ |
| O ₂ I ₁ | O ₂ I ₂ | O ₂ I ₁ | O ₁ I ₁ |
| O ₁ I ₁ | O ₁ I ₂ | O ₁ I ₂ | O ₁ I ₂ |
| O ₁ I ₂ | O ₂ I ₁ | O ₂ I ₂ | O ₂ I ₁ |

The crops were harvested 37 days after the seeds were sown that is on 18th and 19th March, 2011. A total of 543 radish bulbs along with their leaves were harvested. Measurements on length of the bulb, weight and the number of leaves in each plant were recorded for the study

Results and Discussion

The data was analysed as Generalised Linear Model in SPSS for the weight, number of leaves and the length of the bulb for radish.

(i) Dependent variable: Weight of the plant

Descriptive Statistics

| Organic | Inorganic | Mean | Std. Deviation | N |
|---------|-----------|--------|----------------|-----|
| 1 | 1 | .24374 | .094426 | 144 |
| | 2 | .23267 | .092971 | 153 |
| | Total | .23804 | .093684 | 297 |
| 2 | 1 | .25115 | .084332 | 102 |
| | 2 | .21755 | .114588 | 144 |
| | Total | .23148 | .104263 | 246 |
| Total | 1 | .24681 | .090274 | 246 |
| | 2 | .22534 | .104112 | 297 |
| | Total | .23507 | .098579 | 543 |

Hypothesis

There is no difference in weight of the radish due to the effect of fertilizers (Organic, Inorganic and Interaction)

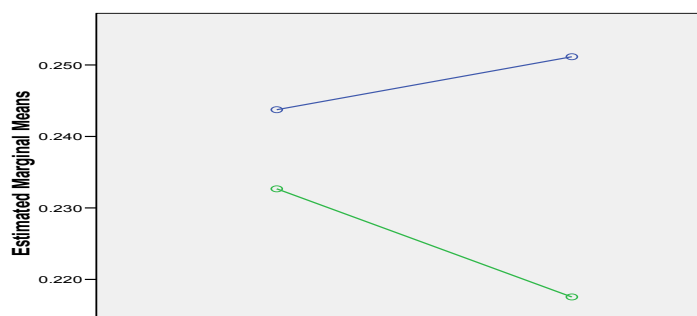
Tests of Between-Subjects Effects

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|---------------------|-------------------------|-----|-------------|----------|------|
| Corrected Model | .082 | 3 | .027 | 2.851 | .037 |
| Intercept | 29.549 | 1 | 29.549 | 3071.841 | .000 |
| Organic | .002 | 1 | .002 | .205 | .651 |
| Inorganic | .066 | 1 | .066 | 6.860 | .009 |
| Organic * Inorganic | .017 | 1 | .017 | 1.747 | .187 |
| Error | 5.185 | 539 | .010 | | |
| Total | 35.271 | 543 | | | |
| Corrected Total | 5.267 | 542 | | | |

From the descriptive statistics table we infer that the mean weight of radish while applying the organic fertilizer (O₂) is 0.23148 gms which is quite higher than the mean weight of radish when (O₁) is applied. Similarly the mean weight of radish is higher when the inorganic fertilizer I₁ is applied. From the ANOVA it is evident that there is no significant difference in the weight due to organic fertilizer and the interaction between organic and inorganic fertilizer. There is a difference in weight due to inorganic fertilizers.

Profile Plots

Estimated Marginal Means of weigh



From the above graph we observe that there is no interaction between the organic and inorganic fertilizers when the weight of the radish is taken into consideration.

(ii)Dependent Variable: Number of leaves

Descriptive Statistics

| Organic | Inorganic | Mean | Std. Deviation | N |
|---------|-----------|---------|----------------|-----|
| 1 | 1 | 15.9722 | 6.34657 | 144 |
| | 2 | 15.5948 | 4.49772 | 153 |
| | Total | 15.7778 | 5.46652 | 297 |
| 2 | 1 | 16.2255 | 6.23454 | 102 |
| | 2 | 14.5486 | 5.44756 | 144 |
| | Total | 15.2439 | 5.83353 | 246 |
| Total | 1 | 16.0772 | 6.28881 | 246 |
| | 2 | 15.0875 | 4.99991 | 297 |
| | Total | 15.5359 | 5.63677 | 543 |

Hypothesis

There is no difference in the number of leaves of the radish due to the effect of fertilizers (Organic, Inorganic and Interaction)

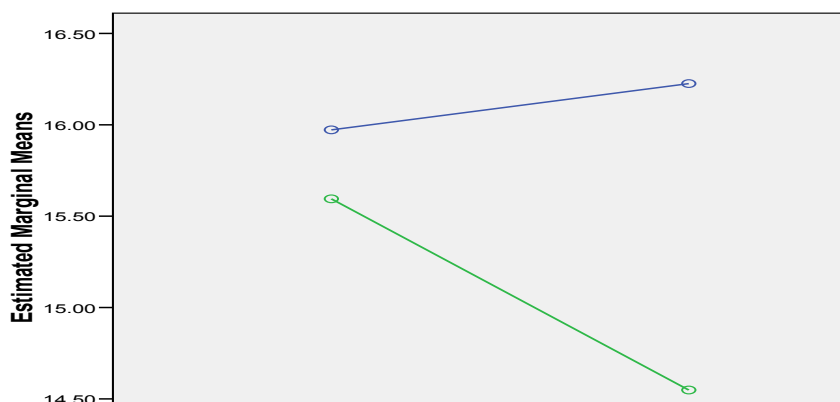
Tests of Between-Subjects Effects

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|---------------------|-------------------------|-----|-------------|----------|------|
| Corrected Model | 216.812 | 3 | 72.271 | 2.291 | .077 |
| Intercept | 128566.714 | 1 | 128566.714 | 4075.305 | .000 |
| Organic | 20.797 | 1 | 20.797 | .659 | .417 |
| Inorganic | 139.611 | 1 | 139.611 | 4.425 | .036 |
| Organic * Inorganic | 55.858 | 1 | 55.858 | 1.771 | .184 |
| Error | 17004.238 | 539 | 31.548 | | |
| Total | 148282.000 | 543 | | | |
| Corrected Total | 17221.050 | 542 | | | |

From the descriptive statistics table the average number of leaves when inorganic fertilizer I₁ is applied is 16, whereas when I₂ fertilizer is applied it is 15. From ANOVA we infer that there is a difference in the number of leaves due to inorganic fertilizers, while there is no difference in the number of leaves due to the application of the organic fertilizer and interaction effect of the fertilizers.

Profile Plots

Estimated Marginal Means of noofle



From the above graph of the estimated marginal means of the number of leaves we infer that there is no interaction between the organic and inorganic fertilizers

(iii) Dependent Variable: Length of the bulb

Descriptive Statistics

| Organic | Inorganic | Mean | Std. Deviation | N |
|---------|-----------|---------|----------------|-----|
| 1 | 1 | 22.6326 | 5.22020 | 144 |
| | 2 | 24.8797 | 4.81776 | 153 |
| | Total | 23.7902 | 5.13317 | 297 |
| 2 | 1 | 22.9882 | 4.24776 | 102 |
| | 2 | 21.7736 | 5.06003 | 144 |
| | Total | 22.2772 | 4.76888 | 246 |
| Total | 1 | 22.7801 | 4.83472 | 246 |
| | 2 | 23.3737 | 5.16783 | 297 |
| | Total | 23.1048 | 5.02380 | 543 |

Hypothesis

There is no difference in the length of the bulb of the radish due to the effect of fertilizers (Organic, Inorganic and Interaction)

Tests of Between-Subjects Effects

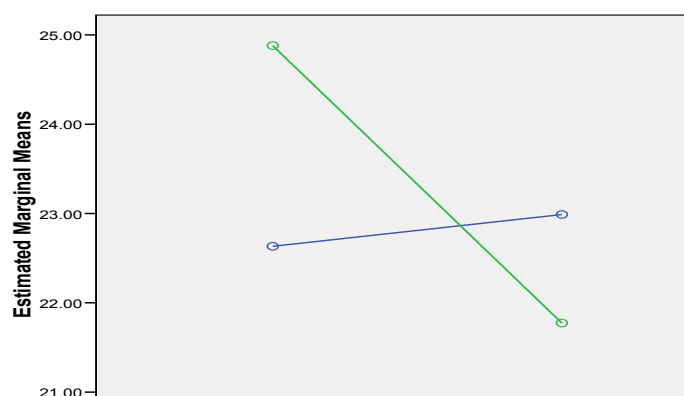
| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|---------------------|-------------------------|-----|-------------|-----------|------|
| Corrected Model | 770.678(a) | 3 | 256.893 | 10.727 | .000 |
| Intercept | 281669.936 | 1 | 281669.936 | 11761.150 | .000 |
| Organic | 250.272 | 1 | 250.272 | 10.450 | .001 |
| Inorganic | 35.265 | 1 | 35.265 | 1.472 | .225 |
| Organic * Inorganic | 396.428 | 1 | 396.428 | 16.553 | .000 |
| Error | 12908.609 | 539 | 23.949 | | |
| Total | 303549.650 | 543 | | | |
| Corrected Total | 13679.288 | 542 | | | |

R Squared = .056 (Adjusted R Squared = .051)

From the descriptive statistics table the average length of the bulb when O₁ fertilizer is applied is 23.79 cms which is quite higher than O₂ (22.27 cms) whereas while examining the average length of the bulb when inorganic fertilizer applied is I₂ (23.37 cms) which is higher than I₁(22.78). From the ANOVA it is evident that there is a significant difference in the length of the bulb due to organic fertilizer and interaction effect and there is no significant difference in the length of the bulb due to inorganic fertilizer.

Profile Plots

Estimated Marginal Means of length of bulb



From the above graph, we infer that there is an interaction effect between the organic and inorganic fertilizer on the length of the bulb.

III. Conclusion

A field experiment was conducted at the Madras Christian College farm to study the effect of organic and inorganic fertilizers on the growth and yield of radish plants. A 2² factorial experiment design was used for the study. The assumption of the homogeneity of variances is being met while studying the weight, number of leaves and the length of the bulb. The findings are given below.

The inorganic fertilizer had significant impact on the weight and the number of leaves of the radish plant. Although the inorganic fertilizer did not have significant impact on the length of the bulb, in reality, the length of the bulb does not determine a better yield. The interaction effect of the organic and inorganic fertilizers did not have a significant effect on the weight and the number of leaves, however, it has an impact on the length of the bulb.