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# **CHAPTER 04**

# **RESULTS AND DISCUSSION**

This study was undertaken for the evaluation of optimum seeding rate on seedling vigor and early plant growth of Mechanicaly transplanted rice and compare it with other establishment methods of rice.

## **4.1 Determination of optimum seeding rate for modified dapog nursery**

### **4.1.1 Seedling Growth Parameters**

The seedling growth analysis was considered to be standard approach to study the seedling vigor and early plant growth after field establishment as rapid growth of the seedlings after germination facilitate better establishment of seedlings after field establishment (Sasaki et al., 2005). In this study the estimation of seedling vigor according to the nursery tray seed rate was done using the Seedling Growth Parameters.

#### **4.1.1.1 Seedling Height**

The height of the seedlings in the nursery trays recorded at 3 days interval until 12 days age of two varieties Bg 360 and Bg 374 were presented in Figure 4.1 and 4.2. As regarded with different seed rates T1 (75 g/ tray) contributed to the maximum height in both varieties, as 18.43667 cm in Bg 360 and 19.66333 cm in Bg 374 in 12 Days after Sowing. It was followed by T2 (100 g/ tray) and T3 (150 g/ tray). The shorter seedlings were produced in T4 (200 g/ tray) in both varieties as 9.69cm in Bg 360 and 10.47667 cm in Bg 374. The mean seedling height of the two varieties in 3 DAS, 6 DAS, 9 DAS and 12 DAS showed significant reduction with the increased seed rate at 95% significant level. The similar results were recorded by the Gorgy, 2012, Lal and Roy, 1996 that proved seedling height increased with the reduced seed rate. There was a significant influence by the seed rate on the seedling height. The seedling height showed strong negative correlation with the seed rate in both varieties Bg 360 (R = -0.99045) and 374 (R = -0.95804).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CV** | **0.63859** | **0.42408** | **0.54619** | **1.038917** |

**Figure 4. 1 Mean seedling height at 3 DAS, 6 DAS, 9 DAS, 12 DAS in variety Bg 360**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CV** | **0.492964** | **0.44822** | **1.4570** | **0.957668** |

**Figure 4. 2 Mean seedling height at 3 DAS, 6 DAS, 9 DAS, 12 DAS in variety Bg 374**

#### **4.1.1.2 Seedling Dry weight**

The data pertaining to seedling dry weight (g 10 seedlings-1) of the two varieties at 12 Days after sowing were presented in Figure 4.3 and Figure 4.4. In the variety Bg 360, the seedling dry weight is having a strong negative relationship (R= 0.92226) with the increment of seed rate use for nursery trays. The maximum seedling dry weight was recorded in T1 (75 g/tray) as 0.102283 g, followed by T2 (100 g/tray) 0.101 g. The two mean values of the T1 and T2 were not significantly differ at the 95% significant level. The lowest seedling dry weight was in T4 (200 g/tray). And also, there was no significant difference between the mean seedling dry weights of the T3 (150 g/tray) 0.0656 g and T4 (200 g/tray) 0.0616 g.

In the variety Bg 374 also the seedling dry weight is having a strong negative relationship (R=0.9421) with seed rate. The highest mean seedling dry weight 0.1412 g was in T1. The seedling dry weight of the T1 and T2 were not significantly differ at 95% significant level whereas there was no significant difference between the seedling dry weights of the T2 and T3. The lowest seedling dry weight 0.858 g was recorded in T4. Gorgy, 2012 and Pathania et al., 2016 also recorded the similar findings that there was a significant positive influence on seedling dry matter production by the lower seed rate in the nursery. The seedling dry weight showed a strong positive correlation with the seedling height and the total root length (cm 10 seedlings-1) in both varieties.

a

a

b

b

(Means with the same letter are not significantly different)

**CV - 5.55726**

**Figure 4. 3 Mean seedlings dry weight according to the seed rate at 12 DAS in variety Bg 360**

a

b

ab

c

(Means with the same letter are not significantly different)

**CV – 10.38011**

**Figure 4. 4 Mean seedlings dry weight according to the seed rate in variety Bg 374**

#### **4.1.1.3 Total root length**

The mean total root length of the seedlings (cm 10 seedlings-1) of the two varieties at 12 DAS were illustrated in the Figure 4.5 and Figure 4.6 respectively. There was a strong negative relationship between the mean total root length of seedlings and increment of seed rate in the both varieties Bg 360 (R = 0.9883) and Bg 374 (R = 0.9421).

In the variety Bg 360 there is no significant difference in the mean root lengths of T1, T2 and T3, T4 at the 95% significant level. The highest mean value for total root length was recorded in T1 as 280.6674 cm and the lowest value in T4 which was 167.7248 cm.

In the variety Bg 374 there is no significant difference in the total root length of T1, T2, T3. The longest root length was recorded in T1 and shortest total root length was recorded in T4 which were respectively 369.1555 cm and 309.9864 cm. The similar findings were reported by the Gorgy, 2012 that the root length of the seedlings decreased with increased seed rate. The reason for this was when the seed rate increased the roots are not having the opportunity to penetrate well towards the nursery medium. The adequate root length required for the better establishment of seedlings after transplanted in the field through proper anchorage to the soil.

a

a

b

b

(Means with the same letter are not significantly different)

**CV – 6.7776**

**Figure 4. 5 Mean total Root length of seedlings at 12 DAS in variety Bg 360**

(Means with the same letter are not significantly different)

b

a

a

a

**CV – 6.5529**

**Figure 4. 6 Mean total Root length of seedlings at 12 DAS in variety Bg 374**

The mean total root length of the seedlings (cm 10 seedlings-1) of the two varieties at 12 DAS were illustrated in the Figure 4.5 and Figure 4.6 respectively. There was a strong negative relationship between the mean total root length of seedlings and increment of seed rate in the both varieties Bg 360 (R = 0.9883) and Bg 374 (R = 0.9421).

In the variety Bg 360 there is no significant difference in the mean root lengths of T1, T2 and T3, T4 at the 95% significant level. The highest mean value for total root length was recorded in T1 as 280.6674 cm and the lowest value in T4 which was 167.7248 cm.

In the variety Bg 374 there is no significant difference in the total root length of T1, T2, T3. The longest root length was recorded in T1 and shortest total root length was recorded in T4 which were respectively 369.1555 cm and 309.9864 cm. The similar findings were reported by the Gorgy, 2012 that the root length of the seedlings decreased with increased seed rate. The reason for this was when the seed rate increased the roots are not having the opportunity to penetrate well towards the nursery medium. The adequate root length required for the better establishment of seedlings after transplanted in the field through proper anchorage to the soil.

#### **4.1.1.4 Number of seedlings dispensed per hill**

The mean number of seedlings dispensed per hill in low gear, mid gear and the high gear of the transplanter according to the nursery seed rate in two varieties Bg 360 and Bg 374 were presented in the Figure 4.7 and Figure 4.8. According to the graph, the mean number of seedlings per hill in the low gear, mid gear and high gear was having a strong positive relationship with the increase of nursery tray seed rate in both varieties Bg 360 and Bg 374.

As defined by the Islam and Salam, 2017; Negalur and Halepyati, 2017; Oparka and Gates, 1982 the planting of 3 - 4 seedlings per hill significantly increased the growth of plants and the final yield. And also, there was no any impact in use of increased number of seedlings than that optimum level which caused miss use of seedlings resulting and extra expense on it.

As the treatments T2 (100g/tray) and T3 (150g/tray) were selected as optimum seed rate to use for the nursery trays in the varieties respectively Bg 360 and Bg 374, the mid gear which gave average 3 – 4 seedlings per hill in that seed rates were selected for transplanting.

**Figure 4. 7 Mean number of seedlings dispensed per hill in mechanical transplanting according to seed rates in variety Bg 360**

**Figure 4. 8 Mean number of seedlings dispensed per hill in mechanical transplanting according to seed rate in variety Bg 374**

#### **4.1.1.5 Chlorophyll content of the leaves**

The mean chlorophyll content of the leaves in two varieties Bg 360 and Bg 374 were recorded at 12 Days after sowing displayed in the Figure 4.9 and Figure 4.10. There was no significant difference between the mean chlorophyll content of the leaves in the both varieties with the increment in the nursery seed rate at 95% significant level.

(Means with the same letter are not significantly different)

**CV – 5.588561**

**Figure 4. 9 Mean Chlorophyll content of the leaves in variety Bg 360**

(Means with the same letter are not significantly different)

a

a

a

a

**CV – 3.764354**

**Figure 4. 10 Mean Chlorophyll content of the leaves in variety Bg 374**

### **4.1.1.6 Selection of the Optimum Seed rate for Nursery trays**

The seedling vigor can be expressed in terms of root length, seedling height, dry matter production which changes according to the nursery seed rate (Gorgy, 2012; Lal and Roy, 1996; Matsuo and Hoshikawa, 1993; Rajendran et al., 2005)**.** When consider about these parameters the highest vigorous seedlings were produced at low nursery seed rate T1 (75g/tray) in both varieties Bg 360 and Bg 374 because with the increment of the seed rate, the inter plant competition for the resource utilization was high which negatively effects on the seedling vigor.

The seedling height recommended for machine transplanting was 12 cm according to the Mamun et al., 2013. In the variety Bg 360 only the T1 (75g/tray) and T2 (100g/tray) fulfills this requirement. And in Bg 374 T1 (75g/tray), T2 (100g/tray), T3 (150g/tray) produced seedlings with more than 12 cm height.

The nursery tray requirement depends on the seed rate used for the nursery. So, the cost effectiveness also should be considered when selecting the seed rates.

The seed rate used for Mechanical Transplanting according to the recommendation of Department of Agriculture (DOA), Sri Lanka.

Nadu, white intermediate bold (Bg 374) – 15 kg/acre

Samba, white short round (Bg 360) – (10 – 12) kg/acre

(For the nursery tray requirement calculation, the seed rates of two varieties that gives the proper seedling height for Mechanical transplanting were selected)

|  |  |  |  |
| --- | --- | --- | --- |
| Variety | Seed rate | Tray requirement /acre | Cost on trays (Rs) |
| Bg 360 | 75g /tray | 134 | 3752 |
| Bg 360 | 100g /tray | 100 | 2800 |
| Bg 374 | 75g /tray | 200 | 5600 |
| Bg 374 | 100g /tray | 150 | 4200 |
| Bg 374 | 150g /tray | 100 | 2800 |

**Table 4. 1 Tray requirement and cost on tray according to the seed rate**

(Price of one nursery tray used for Mechanical transplanting = Rs 28)

The most economical feasible method is to use 100 trays as 100g /tray in Bg 360 and 150g /try in Bg 374.

**Table 4. 2 Calculation of number of seeds applied to a tray according to the optimum seed rate selected in the both varieties**

|  |  |  |
| --- | --- | --- |
| Variety | Thousand Grain Weight | Number of seeds applied to a tray according to the selected seed rate |
| Bg 360 | 13.26 g | 7541 |
| Bg 374 | 19.57 g | 7664 |

The number of seeds applied to the nursery trays in both varieties Bg 360 and Bg 374 were more or less same.

## **4.2 Comparison of Mechanical Transplanting with other Establishment methods**

The Mechanicaly transplanted rice according to the optimum seed rate selected at the previous experiment were compared with Parachute method, Random Transplanting, Broadcasting by analyzing the growth parameters of seedlings and growth parameters of plants after field established**.**

### **4.2.1 Growth Parameters of Seedlings**

The growth of the seedlings depended on the above ground and below ground morphological characteristics that defined the seedling vigor and better growth of transplanted rice after field establishment (Hoshikawa and Ishi, 1974).

#### **4.2.1.1 Seedling Height**

The mean seedling height of the four establishment methods during the nursery period of two varieties Bg 360 and Bg 374 were indicated in the Figure 4.11 and Figure 4.12. The measurements were taken at 3 days interval until the 12 days after sowing.

In the both varieties the mean seedling height of Broadcasting at 3 days after sowing showed a reduced value which was significantly reduced compared to other methods. The reason for this was nurseries of Random transplanting, Mechanical transplanting and Parachute were covered from coconut leaves during the early period to avoid the damages from the rain. At 12 days after sowing there was a significant difference in the seedling height of the four establishment methods in both varieties Bg 360 and Bg 374 at 0.05 probability level. In Bg 360 and Bg 374 the maximum seedling height was recorded from Broadcasting and the shortest seedling were at wet bed nurseries for Random Transplanting.

(Means with the same letter are not significantly different)

**Figure 4. 11 Mean Seedling height at 3 DAS, 6 DAS, 9 DAS and 12 DAS according to the Establishment method in variety Bg 360**

c

(Means with the same letter are not significantly different)

d

c

b

a

b

b

b

a

bc

b

a

c

b

b

a

**Figure 4. 12 Mean Seedling height at 3 DAS, 6 DAS, 9 DAS and 12 DAS according to the Establishment method in variety Bg 374**

#### **4.2.1.2 Total Root length of seedlings**

The data pertaining to mean total root length of seedlings (cm 10 seedlings-1) of the two varieties at 12 Days after sowing were presented in the Figure 4.13 and Figure 4.14. The seedlings were taken for the measurement of total root length at the time of uprooting for transplanting. In variety Bg 360, the mean total root length of the seedlings in Broadcasting and Parachute nurseries were not significantly differ at the p < 0.05 significant level. According to the statistical analysis the total root length of the wet bed for Random transplanting and Mechanical transplanting, significantly differs from the Broadcasting and Parachute method. Highest mean total root length was recorded from the Broadcasting (558.4719 cm) and the shortest root length was from the Random Transplanting (354.3483 cm).

In the variety Bg 374 also according to the statistical analysis there was no significant difference in the mean total root length of Parachute and Broadcasting methods at the 0.05 probability level. And also, the mean total root length of the Random transplanting and Mechanical transplanting were not significantly differed. The maximum total root length was recorded from Broadcasting (613.0207 cm) and the shortest total root length was at Random transplanting (362.7932 cm).

Bridgit and Potty, 2002 and Naklang et al., 1996 indicated the same findings that higher root length in the direct seeded rice seedlings than the transplanted seedlings. The reason was root system was damaged when uprooted for transplanting. When compared with the three transplanting methods the mean total root length was higher in Parachute method compared to the Mechanical transplanting and Random transplanting as the root system was remained intact at uprooting. The similar findings were reported by Mamun et al., 2013 and Nabii et al., 2003.

(Means with the same letter are not significantly different)

a

b

c

a

**Figure 4. 13 Mean total root length of seedlings at 12 Days after sowing in variety Bg 360**

a

b

b

a

(Means with the same letter are not significantly different)

**Figure 4. 14 Mean total root length of seedlings at 12 Days after sowing in variety Bg 374**

#### **4.2.1.3 Seedling Dry weight**

The data on mean seedling dry weight (g 10 seedlings-1) of two varieties at 12 days after sowing were statistically analyzed and depicted in the Figure 4.15 and 4.16. In the both varieties Bg 360 and Bg 374 the mean total dry weight of the seedlings was not significantly differed at 95% significant level. And also, there was no significant differ between the Random transplanting and Mechanical transplanting. In Bg 360, the highest mean seedling dry weight was recorded from Broadcasting (0.132 g) and lowest mean dry weight in seedlings for Random Transplanting (0.1091 g). The maximum mean seedling dry weight was indicated by the Broadcasting method (0.3033 g) and the minimum seedling dry weight by the Random transplanting (0.12 g) in the variety Bg 374.

#### (Means with the same letter are not significantly different)

a

a

b

b

**Figure 4. 15 Mean dry weight of seedlings at 12 Days after sowing in variety Bg 360**

(Means with the same letter are not significantly different)

**Figure 4. 16 Mean total root length of seedlings at 12 Days after sowing in variety Bg 374**

**4.2.1.4 Chlorophyll content of the leaves**

The data on the mean Chlorophyll content of the both varieties at 12 days after sowing were indicated in the Figure 4.17 and Figure 4.18. According to the statistical analysis at p < 0.05 significant level there was no any significant difference in the mean Chlorophyll content of the leaves in the both varieties.

(Means with the same letter are not significantly different)

a

a

a

a

**Figure 4. 17 Mean chlorophyll content of seedlings at 12 Days after sowing in variety Bg 360**

a

a

a

a

(Means with the same letter are not significantly different)

**Figure 4. 18 Mean Chlorophyll content of seedlings at 12 Days after sowing in variety Bg 374**

### **4.2.2 Plant Growth Parameters**

The analysis of plant growth parameters was considered as a standard approach to study the plant growth and productivity (Wilson, 1981). In this study the early plant growth was analyzed using plant growth parameters. Plant growth parameters allow to study the growth pattern over its growth stage.

**4.2.2.1 Plant Height**

Plant height of two varieties recorded at 7 days interval was statistically analyzed and furnished in the Figure 4.19 and Figure 4.20. The transplanted plants including Random transplanted, Mechanicaly transplanted and Parachute shows significantly low height (P<0.05) at early period after field compared to the Broadcasting in the two varieties Bg 360 and Bg 374. The reason for this may be the growth of the plants was disturbed as roots were damaged when uprooting for field establishment. In the

Mechanicaly transplanted and Random transplanted plants there was no significant difference of plant height in 7 DAE and 14 DAE as the transplanting shock due to the root damages occur in transplanting. A rapid increase in the plant height of the parachute transplanted plants was observed compared to the Mechanicaly transplanted and Random transplanted plants as low percentage of root damage compared to them. So in parachute methods the transplanted plants started early plant growth immediately after transplanting with quick recover from the transplanting shock (Nabii et al., 2003). At 42 DAE a significant different was observed in the plant height of four establishment methods in both varieties at 95% significant level.

In Bg 360 at 42 DAE the maximum mean plant height was observed at Broadcasting (79.4074 cm) and shortest plants at the Random transplanting (68.1889 cm). The Highest mean plant height in Broadcasted plants (89.9417 cm) and the lowest mean plant height was at the Random transplanted plants which was 79.0651 cm. The mean plant height at 42 DAE was having a strong positive correlation with the seedling height, dry weight and the total root length at 12 DAS.

a

c

c

b

b

a

c

c

a

b

c

c

a

b

d

c

a

b

c

d

a

b

c

d

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CV** | **0.67798** | **1.063411** | **0.30483** | **0.438880** | **0.274568** | **0.405788** |

(Means with the same letter are not significantly different)

**Figure 4.19 Mean Plant height at 7 DAE, 14DAE, 21 DAE, 28 DAE, 35 DAE and 42 DAE in variety Bg 360**

(Means with the same letter are not significantly different)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CV** | **1.106379** | **1.19916** | **0.648953** | **0.672118** | **0.479538** | **0.481613** |

a

d

c

a

d

c

a

d

c

a

d

c

a

c

c

b

d

a

c

b

b

b

b

b

**Figure 4.20 Mean Plant height at 7 DAE, 14DAE, 21 DAE, 28 DAE, 35 DAE and 42 DAE in variety Bg 374**

#### **4.2.2.2 Ground Cover Percentage**

Ground Cover % measured in weekly interval during the vegetative phase in both varieties Bg 360 and Bg 374 up to the 42 Days after establishment (6 th week) was illustrated in the Figure 4.21 and Figure 4.22. The Ground Cover % increased above 50 % at 28 days after establishment (4th week) in all the establishment methods of both varieties but always higher in the Broadcasting compared to transplanting methods, which was 100 %. There was no any significant difference in Ground Cover % of Random transplanting, Mechanicaly transplanting and Parachute method of both varieties at 7 days after establishment in 0.05 probability level. In both varieties at 42 days after establishment, when compared with transplanting methods the lowest Ground Cover % was recorded from Mechanical Transplanting but always higher in Random transplanting compared to parachute and Mechanical Transplanting. The Ground Cover % was having a strong positive correlation with the seedling height, root length, seedling dry weight which were taken at the time of uprooting for transplanting (12 Days after sowing) in the both varieties Bg 360 and Bg 374.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CV** | **16.05323** | **12.93648** | **9.670122** | **11.70018** | **10.03575** | **4.277754** |

**Figure 4. 21 Ground Cover percentage at 7 DAE, 14DAE, 21 DAE, 28 DAE, 35 DAE and 42 DAE in the variety Bg 360**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CV** | **16.62948** | **7.105899** | **10.72877** | **8.463176** | **5.799814** | **6.100278** |

**Figure 4. 22 Ground Cover percentage at 7 DAE, 14DAE, 21 DAE, 28 DAE, 35 DAE and 42 DAE in the variety Bg 374**

#### **4.2.2.3 Number plants per Square meter**

The number of plants/ m2 in the two varieties at each establishment method were analyzed statistically displayed in the Figure 4.23 and Figure 4.24. In the both varieties the maximum number of plants per square meter was recorded at Broadcasting than the transplanting. The reason for this was in Broadcasting the spacing between the plants were not maintained properly which caused increased plant density/m2. The lowest average number of plants m-2 was in the Mechanical transplanted blocks in the both varieties Bg 360 and Bg 374 as optimum spacing was maintained between the plants.

b

a

d

c

(Means with the same letter are not significantly different)

CV - 1.237768

**Figure 4. 23 Number of plants m-2 in variety Bg 360**

b

a

d

c

(Means with the same letter are not significantly different)

CV - 1.976759

**Figure 4. 24 Number of plants m-2 in variety Bg 374**

#### **4.2.2.4 Chlorophyll content of the leaves**

The data on the mean Chlorophyll content of the both varieties at 42 days after field established were illustrated in the Figure 4.25 and Figure 4.26. According to the statistical analysis at 95% significant level there was no any significant difference in the mean Chlorophyll content of the leaves in the both varieties.

a

a

a

a

(Means with the same letter are not significantly different)

CV – 4.47

**Figure 4. 25 Mean Chlorophyll Content of the leaves at 42 DAE in variety Bg 360**

a

a

a

a

(Means with the same letter are not significantly different)

CV – 2.967

**Figure 4. 26 Mean Chlorophyll Content of the leaves at 42 DAE in variety Bg 360**

#### **4.2.2.5 Number of tillers per square meter**

The data pertaining to tiller density (number of tillers m-2) at the end of the vegetative phase of the two varieties were recorded and illustrated in the Figure 4.27 and Figure 4.28. The tiller density was significantly influenced from the method of establishment at 0.05 probability level. Significantly low tiller density in the Broadcasting compared to the transplanting in the both varieties. The similar results were reported by the Awan et al., 2011 and Javaid et al., 2012. An average of 295 tillers/m2 and 194 tillers/m2 were produced at Broadcasting in compared with 322 tillers/m2 and 223 tillers/m2 recorded in Mechanical Transplanting which was the highest tiller density. The number of tillers/m2 was high in Parachute method compared to the Random transplanting in both varieties which concluded the results of Akbar et al., 2007 and Reddy, 2013.

The Mechanical transplanting gave the highest tiller density irrespectively to the lesser number of plants/m2. The number of tillers/m2 was having a strong negative correlation with the number of plants/m2 in the both varieties Bg 360 (R= - 0.86868) and Bg 374 (R= -0.94651). This result agreed with the Illangakoon et al., 2017; Javaid et al. and 2012; Sasaki et al., 2005.

a

b

c

d

(Means with the same letter are not significantly different)

CV - 0.815232

**Figure 4. 27 Number of tillers m-2 in Bg 360**

a

b

c

d

(Means with the same letter are not significantly different)

CV - 1.787364

**Figure 4. 28 Number of tillers m-2 in Bg 360**

**APPENDICES**

**Core relation for V1**

The SAS System 18:31 Wednesday, December 17, 2018 1

The CORR Procedure

6 Variables: trt sheight sdrywgt totalrtln chrlcont spersqmtr

Simple Statistics

Variable N Mean Std Dev Sum Minimum Maximum

trt 12 2.50000 1.16775 30.00000 1.00000 4.00000

sheight 12 13.92083 3.59087 167.05000 9.55000 18.70000

sdrywgt 12 0.08262 0.02031 0.99145 0.05800 0.10800

totalrtln 12 229.61658 57.90442 2755 118.83160 320.38140

chrlcont 12 31.36667 1.64114 376.40000 29.30000 34.10000

spersqmtr 12 217.60795 37.36961 2611 168.52300 271.29320

Pearson Correlation Coefficients, N = 12

Prob > |r| under H0: Rho=0

trt sheight sdrywgt totalrtln chrlcont spersqmtr

trt 1.00000 -0.99045 -0.90536 -0.83578 -0.23244 0.99373

<.0001 <.0001 0.0007 0.4672 <.0001

sheight -0.99045 1.00000 0.94475 0.85458 0.25014 -0.98792

<.0001 <.0001 0.0004 0.4330 <.0001

sdrywgt -0.90536 0.94475 1.00000 0.87115 0.29898 -0.90598

<.0001 <.0001 0.0002 0.3452 <.0001

totalrtln -0.83578 0.85458 0.87115 1.00000 0.21893 -0.85723

0.0007 0.0004 0.0002 0.4942 0.0004

chrlcont -0.23244 0.25014 0.29898 0.21893 1.00000 -0.20292

0.4672 0.4330 0.3452 0.4942 0.5271

spersqmtr 0.99373 -0.98792 -0.90598 -0.85723 -0.20292 1.00000

<.0001 <.0001 <.0001 0.0004 0.5271

**Core relation for Core relation for V2**

The SAS System 18:31 Wednesday, December 17, 2018 2

The CORR Procedure

6 Variables: trt sheight sdrywgt totalrtln chrlcont spersqmtr

Simple Statistics

Variable N Mean Std Dev Sum Minimum Maximum

trt 12 2.50000 1.16775 30.00000 1.00000 4.00000

sheight 12 16.05833 3.67536 192.70000 10.32000 19.86000

sdrywgt 12 0.11605 0.02305 1.39259 0.08030 0.14900

totalrtln 12 338.57693 22.18014 4063 304.02600 372.87560

chrlcont 12 31.74167 1.79365 380.90000 29.50000 35.70000

spersqmtr 12 183.18944 34.77137 2198 138.56406 231.51674

Pearson Correlation Coefficients, N = 12

Prob > |r| under H0: Rho=0

trt sheight sdrywgt totalrtln chrlcont spersqmtr

trt 1.00000 -0.95804 -0.85149 -0.96519 0.13672 0.98857

<.0001 0.0004 <.0001 0.6718 <.0001

sheight -0.95804 1.00000 0.85279 0.92113 -0.32246 -0.94388

<.0001 0.0004 <.0001 0.3067 <.0001

sdrywgt -0.85149 0.85279 1.00000 0.88298 -0.13187 -0.80957

0.0004 0.0004 0.0001 0.6829 0.0014

totalrtln -0.96519 0.92113 0.88298 1.00000 -0.20182 -0.91934

<.0001 <.0001 0.0001 0.5293 <.0001

chrlcont 0.13672 -0.32246 -0.13187 -0.20182 1.00000 0.05189

0.6718 0.3067 0.6829 0.5293 0.8728

spersqmtr 0.98857 -0.94388 -0.80957 -0.91934 0.05189 1.00000

<.0001 <.0001 0.0014 <.0001

**Seedling height 1 V1**

The SAS System 05:18 Thursday, December 15, 2018 1

The ANOVA Procedure

Class Level Information

Class Levels Values

Trt 4 1 2 3 4

Number of Observations Read 12

Number of Observations Used 12

The SAS System 05:18 Thursday, December 15, 2018 2

The ANOVA Procedure

Dependent Variable: hieght1

Sum of

Source DF Squares Mean Square F Value Pr > F

Model 3 2.55209167 0.85069722 607.64 <.0001

Error 8 0.01120000 0.00140000

Corrected Total 11 2.56329167

R-Square Coeff Var Root MSE hieght1 Mean

0.995631 0.638599 0.037417 5.859167

Source DF Anova SS Mean Square F Value Pr > F

Trt 3 2.55209167 0.85069722 607.64 <.0001

The SAS System 05:18 Thursday, December 15, 2018 3

The ANOVA Procedure

t Tests (LSD) for hieght1

NOTE: This test controls the Type I comparison wise error rate, not the experiment wise error rate.

Alpha 0.05

Error Degrees of Freedom 8

Error Mean Square 0.0014

Critical Value of t 2.30600

Least Significant Difference 0.0704

Means with the same letter are not significantly different.

t Grouping Mean N Trt

A 6.36667 3 1

B 6.18333 3 2

C 5.71000 3 3

D 5.17667 3 4

**Seedling height 2 V1**

The SAS System 05:18 Thursday, December 15, 2018 4

The ANOVA Procedure

Class Level Information

Class Levels Values

Trt 4 1 2 3 4

Number of Observations Read 12

Number of Observations Used 12

The SAS System 05:18 Thursday, December 15, 2018 5

The ANOVA Procedure

Dependent Variable: hieght2

Sum of

Source DF Squares Mean Square F Value Pr > F

Model 3 40.16669167 13.38889722 11727.5 <.0001

Error 8 0.00913333 0.00114167

Corrected Total 11 40.17582500

R-Square Coeff Var Root MSE hieght2 Mean

0.999773 0.424080 0.033789 7.967500

Source DF Anova SS Mean Square F Value Pr > F

Trt 3 40.16669167 13.38889722 11727.5 <.0001

The SAS System 05:18 Thursday, December 15, 2018 6

The ANOVA Procedure

t Tests (LSD) for hieght2

NOTE: This test controls the Type I comparison wise error rate, not the experiment wise error rate.

Alpha 0.05

Error Degrees of Freedom 8

Error Mean Square 0.001142

Critical Value of t 2.30600

Least Significant Difference 0.0636

Means with the same letter are not significantly different.

t Grouping Mean N Trt

A 10.18000 3 1

B 9.28000 3 2

C 6.73333 3 3

D 5.67667 3 4

**Seedling height 3 V1**

The SAS System 05:18 Thursday, December 15, 2018 7

The ANOVA Procedure

Class Level Information

Class Levels Values

Trt 4 1 2 3 4

Number of Observations Read 12

Number of Observations Used 12

The SAS System 05:18 Thursday, December 15, 2018 8

The ANOVA Procedure

Dependent Variable: hieght3

Sum of

Source DF Squares Mean Square F Value Pr > F

Model 3 136.3042250 45.4347417 14856.0 <.0001

Error 8 0.0244667 0.0030583

Corrected Total 11 136.3286917

R-Square Coeff Var Root MSE hieght3 Mean

0.999821 0.546419 0.055302 10.12083

Source DF Anova SS Mean Square F Value Pr > F

Trt 3 136.3042250 45.4347417 14856.0 <.0001

The SAS System 05:18 Thursday, December 15, 2018 9

The ANOVA Procedure

t Tests (LSD) for hieght3

NOTE: This test controls the Type I comparison wise error rate, not the experiment wise error rate.

Alpha 0.05

Error Degrees of Freedom 8

Error Mean Square 0.003058

Critical Value of t 2.30600

Least Significant Difference 0.1041

Means with the same letter are not significantly different.

t Grouping Mean N Trt

A 14.85000 3 1

B 11.69000 3 2

C 7.59333 3 3

D 6.35000 3 4

**Seedling height 4 V1**

The SAS System 05:18 Thursday, December 15, 2018 13

The ANOVA Procedure

Class Level Information

Class Levels Values

Trt 4 1 2 3 4

Number of Observations Read 12

Number of Observations Used 12

The SAS System 05:18 Thursday, December 15, 2018 14

The ANOVA Procedure

Dependent Variable: hieght4

Sum of

Source DF Squares Mean Square F Value Pr > F

Model 3 141.6703583 47.2234528 2257.69 <.0001

Error 8 0.1673333 0.0209167

Corrected Total 11 141.8376917

R-Square Coeff Var Root MSE hieght4 Mean

0.998820 1.038917 0.144626 13.92083

Source DF Anova SS Mean Square F Value Pr > F

Trt 3 141.6703583 47.2234528 2257.69 <.0001

The SAS System 05:18 Thursday, December 15, 2018 15

The ANOVA Procedure

t Tests (LSD) for hieght4

NOTE: This test controls the Type I comparison wise error rate, not the experiment wise error rate.

Alpha 0.05

Error Degrees of Freedom 8

Error Mean Square 0.020917

Critical Value of t 2.30600

Least Significant Difference 0.2723

Means with the same letter are not significantly different.

t Grouping Mean N Trt

A 18.4367 3 1

B 15.8867 3 2

C 11.6700 3 3

D 9.6900 3 4

**Seedling height 1 V2**

The SAS System 05:18 Thursday, December 15, 2018 16

The ANOVA Procedure

Class Level Information

Class Levels Values

Trt 4 1 2 3 4

Number of Observations Read 12

Number of Observations Used 12

The SAS System 05:18 Thursday, December 15, 2018 17

The ANOVA Procedure

Dependent Variable: hieght1

Sum of

Source DF Squares Mean Square F Value Pr > F

Model 3 2.15015833 0.71671944 627.78 <.0001

Error 8 0.00913333 0.00114167

Corrected Total 11 2.15929167

R-Square Coeff Var Root MSE hieght1 Mean

0.995770 0.492964 0.033789 6.854167

Source DF Anova SS Mean Square F Value Pr > F

Trt 3 2.15015833 0.71671944 627.78 <.0001

The SAS System 05:18 Thursday, December 15, 2018 18

The ANOVA Procedure

t Tests (LSD) for hieght1

NOTE: This test controls the Type I comparison wise error rate, not the experiment wise error rate.

Alpha 0.05

Error Degrees of Freedom 8

Error Mean Square 0.001142

Critical Value of t 2.30600

Least Significant Difference 0.0636

Means with the same letter are not significantly different.

t Grouping Mean N Trt

A 7.36333 3 1

B 7.18000 3 2

C 6.47333 3 3

D 6.40000 3 4

**Seedling height 2 V2**

The SAS System 05:18 Thursday, December 15, 2018 19

The ANOVA Procedure

Class Level Information

Class Levels Values

Trt 4 1 2 3 4

Number of Observations Read 12

Number of Observations Used 12

The SAS System 05:18 Thursday, December 15, 2018 20

The ANOVA Procedure

Dependent Variable: hieght2

Sum of

Source DF Squares Mean Square F Value Pr > F

Model 3 58.82442500 19.60814167 9804.07 <.0001

Error 8 0.01600000 0.00200000

Corrected Total 11 58.84042500

R-Square Coeff Var Root MSE hieght2 Mean

0.999728 0.448222 0.044721 9.977500

Source DF Anova SS Mean Square F Value Pr > F

Trt 3 58.82442500 19.60814167 9804.07 <.0001

The SAS System 05:18 Thursday, December 15, 2018 21

The ANOVA Procedure

t Tests (LSD) for hieght2

NOTE: This test controls the Type I comparison wise error rate, not the experiment wise error rate.

Alpha 0.05

Error Degrees of Freedom 8

Error Mean Square 0.002

Critical Value of t 2.30600

Least Significant Difference 0.0842

Means with the same letter are not significantly different.

t Grouping Mean N Trt

A 12.25333 3 1

B 11.72333 3 2

C 9.25000 3 3

D 6.68333 3 4

**Seedling height 3 V2**

The SAS System 05:18 Thursday, December 15, 2018 22

The ANOVA Procedure

Class Level Information

Class Levels Values

Trt 4 1 2 3 4

Number of Observations Read 12

Number of Observations Used 12

The SAS System 05:18 Thursday, December 15, 2018 23

The ANOVA Procedure

Dependent Variable: hieght3

Sum of

Source DF Squares Mean Square F Value Pr > F

Model 3 134.4644917 44.8214972 1238.16 <.0001

Error 8 0.2896000 0.0362000

Corrected Total 11 134.7540917

R-Square Coeff Var Root MSE hieght3 Mean

0.997851 1.457861 0.190263 13.05083

Source DF Anova SS Mean Square F Value Pr > F

Trt 3 134.4644917 44.8214972 1238.16 <.0001

The SAS System 05:18 Thursday, December 15, 2018 24

The ANOVA Procedure

t Tests (LSD) for hieght3

NOTE: This test controls the Type I comparison wise error rate, not the experiment wise error rate.

Alpha 0.05

Error Degrees of Freedom 8

Error Mean Square 0.0362

Critical Value of t 2.30600

Least Significant Difference 0.3582

Means with the same letter are not significantly different.

t Grouping Mean N Trt

A 16.1200 3 1

A

A 15.7733 3 2

B 12.5233 3 3

C 7.7867 3 4

**Seedling height 4 V2**

The SAS System 05:18 Thursday, December 15, 2018 25

The ANOVA Procedure

Class Level Information

Class Levels Values

Trt 4 1 2 3 4

Number of Observations Read 12

Number of Observations Used 12

The SAS System 05:18 Thursday, December 15, 2018 26

The ANOVA Procedure

Dependent Variable: hieght4

Sum of

Source DF Squares Mean Square F Value Pr > F

Model 3 148.4019667 49.4673222 2091.64 <.0001

Error 8 0.1892000 0.0236500

Corrected Total 11 148.5911667

R-Square Coeff Var Root MSE hieght4 Mean

0.998727 0.957668 0.153786 16.05833

Source DF Anova SS Mean Square F Value Pr > F

Trt 3 148.4019667 49.4673222 2091.64 <.0001

The SAS System 05:18 Thursday, December 15, 2018 27

The ANOVA Procedure

t Tests (LSD) for hieght4

NOTE: This test controls the Type I comparison wise error rate, not the experiment wise error rate.

Alpha 0.05

Error Degrees of Freedom 8

Error Mean Square 0.02365

Critical Value of t 2.30600

Least Significant Difference 0.2896

Means with the same letter are not significantly different.

t Grouping Mean N Trt

A 19.6633 3 1

B 18.3433 3 2

C 15.7500 3 3

D 10.4767 3 4

**Dry weight - Bg 360**

The SAS System 20:26 Wednesday, December 8, 2018 61

The ANOVA Procedure

Class Level Information

Class Levels Values

Trt 4 1 2 3 4

Number of Observations Read 12

Number of Observations Used 12

The SAS System 20:26 Wednesday, December 8, 2018 62

The ANOVA Procedure

Dependent Variable: Drywgt

Sum of

Source DF Squares Mean Square F Value Pr > F

Model 3 0.00436798 0.00145599 69.07 <.0001

Error 8 0.00016865 0.00002108

Corrected Total 11 0.00453663

R-Square Coeff Var Root MSE Drywgt Mean

0.962824 5.557260 0.004591 0.082621

Source DF Anova SS Mean Square F Value Pr > F

Trt 3 0.00436798 0.00145599 69.07 <.0001

The SAS System 20:26 Wednesday, December 8, 2018 63

The ANOVA Procedure

t Tests (LSD) for Drywgt

NOTE: This test controls the Type I comparison wise error rate, not the experiment wise error rate.

Alpha 0.05

Error Degrees of Freedom 8

Error Mean Square 0.000021

Critical Value of t 2.30600

Least Significant Difference 0.0086

Means with the same letter are not significantly different.

t Grouping Mean N Trt

A 0.102283 3 1

A

A 0.101000 3 2

B 0.065600 3 3

B

B 0.061600 3 4

**Dry weight - Bg 374**

The SAS System 20:26 Wednesday, December 8, 2018 6

The ANOVA Procedure

Class Level Information

Class Levels Values

Trt 4 1 2 3 4

Number of Observations Read 12

Number of Observations Used 12

The SAS System 20:26 Wednesday, December 8, 2018

74

The ANOVA Procedure

Dependent Variable: Drywgt

Sum of

Source DF Squares Mean Square F Value Pr > F

Model 3 0.00468366 0.00156122 10.76 0.0035

Error 8 0.00116086 0.00014511

Corrected Total 11 0.00584452

R-Square Coeff Var Root MSE Drywgt Mean

0.801377 10.38011 0.012046 0.116049

Source DF Anova SS Mean Square F Value Pr > F

Trt 3 0.00468366 0.00156122 10.76 0.0035

The SAS System 20:26 Wednesday, December 8, 2018 7

The ANOVA Procedure

t Tests (LSD) for Drywgt

NOTE: This test controls the Type I comparison wise error rate, not the experiment wise error rate.

Alpha 0.05

Error Degrees of Freedom 8

Error Mean Square 0.000145

Critical Value of t 2.30600

Least Significant Difference 0.0227

Means with the same letter are not significantly different.

t Grouping Mean N Trt

A 0.141167 3 1

A

B A 0.119600 3 2

B

B 0.117633 3 3

C 0.085797 3 4

**Chlorophyll content Bg 360**

The SAS System 19:15 Wednesday, December 24, 2018 8

The ANOVA Procedure

Class Level Information

Class Levels Values

Trt 4 1 2 3 4

Number of Observations Read 12

Number of Observations Used 12

The SAS System 19:15 Wednesday, December 24, 2018 30

The ANOVA Procedure

Dependent Variable: Chrlcont

Sum of

Source DF Squares Mean Square F Value Pr > F

Model 3 1.69666667 0.56555556 0.18 0.9049

Error 8 24.71333333 3.08916667

Corrected Total 11 26.41000000

R-Square Coeff Var Root MSE Chrlcont Mean

0.064243 5.588561 1.757603 31.45000

Source DF Anova SS Mean Square F Value Pr > F

Trt 3 1.69666667 0.56555556 0.18 0.9049

**Chlorophyll content Bg 374**

The SAS System 20:26 Wednesday, December 8, 2018 9

The ANOVA Procedure

Class Level Information

Class Levels Values

Trt 4 1 2 3 4

Number of Observations Read 12

Number of Observations Used 12

The SAS System 19:15 Wednesday, December 24, 2018 33

The ANOVA Procedure

Dependent Variable: Chrlcont

Sum of

Source DF Squares Mean Square F Value Pr > F

Model 3 0.66916667 0.22305556 0.15 0.9257

Error 8 11.76000000 1.47000000

Corrected Total 11 12.42916667

R-Square Coeff Var Root MSE Chrlcont Mean

0.053838 3.764354 1.212436 32.20833

Source DF Anova SS Mean Square F Value Pr > F

Trt 3 0.66916667 0.22305556 0.15 0.9257

**Root length V1**

The SAS System 20:26 Wednesday, December 8, 2018 1

The ANOVA Procedure

Class Level Information

Class Levels Values

Trt 4 1 2 3 4

Number of Observations Read 12

Number of Observations Used 12

The SAS System 20:26 Wednesday, December 8, 2018 2

The ANOVA Procedure

Dependent Variable: Rootlength

Sum of

Source DF Squares Mean Square F Value Pr > F

Model 3 26294.51752 8764.83917 5.98 0.0193

Error 8 11717.38520 1464.67315

Corrected Total 11 38011.90271

R-Square Coeff Var Root MSE Rootlength Mean

0.691744 16.77760 38.27105 228.1080

Source DF Anova SS Mean Square F Value Pr > F

Trt 3 26294.51752 8764.83917 5.98 0.0193

The SAS System 20:26 Wednesday, December 8, 2018 3

The ANOVA Procedure

t Tests (LSD) for Rootlength

NOTE: This test controls the Type I comparison wise error rate, not the experiment wise error rate.

Alpha 0.05

Error Degrees of Freedom 8

Error Mean Square 1464.673

Critical Value of t 2.30600

Least Significant Difference 72.058

Means with the same letter are not significantly different.

t Grouping Mean N Trt

A 274.63 3 1

A

A 272.84 3 2

B 197.23 3 3

B

B 167.72 3 4

**Root length V2**

The SAS System 20:26 Wednesday, December 8, 2018 46

The ANOVA Procedure

Class Level Information

Class Levels Values

Trt 4 1 2 3 4

Number of Observations Read 12

Number of Observations Used 12

The SAS System 20:26 Wednesday, December 8, 2018 47

The ANOVA Procedure

Dependent Variable: Rootlength

Sum of

Source DF Squares Mean Square F Value Pr > F

Model 3 8795.56212 2931.85404 6.11 0.0182

Error 8 3837.02239 479.62780

Corrected Total 11 12632.58451

R-Square Coeff Var Root MSE Rootlength Mean

0.696260 6.552229 21.90041 334.2436

Source DF Anova SS Mean Square F Value Pr > F

Trt 3 8795.562116 2931.854039 6.11 0.0182

The SAS System 20:26 Wednesday, December 8, 2018 48

The ANOVA Procedure

t Tests (LSD) for Rootlength

NOTE: This test controls the Type I comparison wise error rate, not the experiment wise error rate.

Alpha 0.05

Error Degrees of Freedom 8

Error Mean Square 479.6278

Critical Value of t 2.30600

Least Significant Difference 41.235

Means with the same letter are not significantly different.

t Grouping Mean N Trt

A 368.49 3 1

A

A 339.01 3 3

A

A 336.83 3 2

B 292.65 3 4

**Core relation for V1**

The SAS System 18:31 Wednesday, December 17, 2018 1

The CORR Procedure

6 Variables: trt sheight sdrywgt totalrtln chrlcont spersqmtr

Simple Statistics

Variable N Mean Std Dev Sum Minimum Maximum

trt 12 2.50000 1.16775 30.00000 1.00000 4.00000

sheight 12 13.92083 3.59087 167.05000 9.55000 18.70000

sdrywgt 12 0.08262 0.02031 0.99145 0.05800 0.10800

totalrtln 12 229.61658 57.90442 2755 118.83160 320.38140

chrlcont 12 31.36667 1.64114 376.40000 29.30000 34.10000

spersqmtr 12 217.60795 37.36961 2611 168.52300 271.29320

Pearson Correlation Coefficients, N = 12

Prob > |r| under H0: Rho=0

trt sheight sdrywgt totalrtln chrlcont spersqmtr

trt 1.00000 -0.99045 -0.90536 -0.83578 -0.23244 0.99373

<.0001 <.0001 0.0007 0.4672 <.0001

sheight -0.99045 1.00000 0.94475 0.85458 0.25014 -0.98792

<.0001 <.0001 0.0004 0.4330 <.0001

sdrywgt -0.90536 0.94475 1.00000 0.87115 0.29898 -0.90598

<.0001 <.0001 0.0002 0.3452 <.0001

totalrtln -0.83578 0.85458 0.87115 1.00000 0.21893 -0.85723

0.0007 0.0004 0.0002 0.4942 0.0004

chrlcont -0.23244 0.25014 0.29898 0.21893 1.00000 -0.20292

0.4672 0.4330 0.3452 0.4942 0.5271

spersqmtr 0.99373 -0.98792 -0.90598 -0.85723 -0.20292 1.00000

<.0001 <.0001 <.0001 0.0004 0.5271

**Core relation for Core relation for V2**

The SAS System 18:31 Wednesday, December 17, 2018 2

The CORR Procedure

6 Variables: trt sheight sdrywgt totalrtln chrlcont spersqmtr

Simple Statistics

Variable N Mean Std Dev Sum Minimum Maximum

trt 12 2.50000 1.16775 30.00000 1.00000 4.00000

sheight 12 16.05833 3.67536 192.70000 10.32000 19.86000

sdrywgt 12 0.11605 0.02305 1.39259 0.08030 0.14900

totalrtln 12 338.57693 22.18014 4063 304.02600 372.87560

chrlcont 12 31.74167 1.79365 380.90000 29.50000 35.70000

spersqmtr 12 183.18944 34.77137 2198 138.56406 231.51674

Pearson Correlation Coefficients, N = 12

Prob > |r| under H0: Rho=0

trt sheight sdrywgt totalrtln chrlcont spersqmtr

trt 1.00000 -0.95804 -0.85149 -0.96519 0.13672 0.98857

<.0001 0.0004 <.0001 0.6718 <.0001

sheight -0.95804 1.00000 0.85279 0.92113 -0.32246 -0.94388

<.0001 0.0004 <.0001 0.3067 <.0001

sdrywgt -0.85149 0.85279 1.00000 0.88298 -0.13187 -0.80957

0.0004 0.0004 0.0001 0.6829 0.0014

totalrtln -0.96519 0.92113 0.88298 1.00000 -0.20182 -0.91934

<.0001 <.0001 0.0001 0.5293 <.0001

chrlcont 0.13672 -0.32246 -0.13187 -0.20182 1.00000 0.05189

0.6718 0.3067 0.6829 0.5293 0.8728

spersqmtr 0.98857 -0.94388 -0.80957 -0.91934 0.05189 1.00000

<.0001 <.0001 0.0014 <.0001

**Data during nursery period until 12 days**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Broadcasting | Random Transplanting | Mechanical Transplanting | Parachute |
| 3 | 4.03 | 5.17 | 5.13 | 5.22 |
| 6 | 7.57 | 7.43 | 7.883333333 | 7.95 |
| 9 | 10.99 | 10.82333333 | 11.03666667 | 11.07466667 |
| 12 | 16.15666667 | 15.86333333 | 16.00666667 | 16.10333333 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DAS | Broadcasting | Random Transplanting | Mechanical Transplanting | Parachute |
| 3 | 4.503 | 5.386666667 | 5.266 | 5.266666667 |
| 6 | 8.34 | 8.28 | 8.37 | 8.456666667 |
| 9 | 11.34 | 11.28333333 | 11.31333333 | 11.43666667 |
| 12 | 17.34 | 16.88333333 | 17.08333333 | 17.17 |

|  |  |
| --- | --- |
| **Treatment** | **Total root length (cm)** |
| BC | 549.6874 |
| RT | 319.4599 |
| MT | 359.8712 |
| PA | 539.1324 |

|  |  |
| --- | --- |
| **Treatment** | **Total root length (cm)** |
| BC | 558.4719 |
| RT | 354.3483 |
| MT | 426.9147 |
| PA | 552.5194 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Broadcasting | Random Transplanting | Mechanical Transplanting | Parachute |
| SDW | 0.132133333 | 0.109066667 | 0.107666667 | 0.122733333 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Broadcasting | Random Transplanting | Mechanical Transplanting | Parachute |
| SDW | 0.3033 | 0.12 | 0.143833333 | 0.291766667 |

**Data after field establishment**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | BC | RT | MT | PA |
| 7 | 30.35952381 | 25.10277778 | 25.2 | 28.15925926 |
| 14 | 43.66944444 | 31.68888889 | 31.84391534 | 35.3952381 |
| 21 | 48.33333333 | 40 | 40.25833333 | 44.91111111 |
| 28 | 56.75714286 | 47.55833333 | 48.06666667 | 51.46666667 |
| 35 | 68.59925926 | 57.23333333 | 58.2 | 60.06666667 |
| 42 | 79.40740741 | 68.18888889 | 69.06666667 | 70.5 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | BC | RT | MT | PA |
| 7 | 43.19333333 | 32.18181818 | 32.87037037 | 34.32424242 |
| 14 | 49.03333333 | 40.2 | 41.7 | 43.2 |
| 21 | 58.0976431 | 49.43333333 | 50.38518519 | 55.15016835 |
| 28 | 66.66296296 | 60.04242424 | 61.11111111 | 63.53333333 |
| 35 | 78.3 | 70.44550265 | 71.23037037 | 73.53181818 |
| 42 | 89.94166667 | 79.06507937 | 79.93518519 | 82.95707071 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | BC | RT | MT | PA |
| 7 | 64.16666667 | 28.33333333 | 16.66666667 | 25 |
| 14 | 70 | 56.19 | 25 | 35.83333333 |
| 21 | 85.83333333 | 75.419 | 35 | 59.16666667 |
| 28 | 100 | 81.66666667 | 70 | 76.66666667 |
| 35 | 100 | 81.66666667 | 72.5 | 76.66666667 |
| 42 | 100 | 90.83333333 | 90 | 90.83333333 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | BC | RT | MT | PA |
| 7 | 41.666667 | 31.66666667 | 15.83333333 | 19.16666667 |
| 14 | 83.333333 | 40.83333333 | 18.33333333 | 25 |
| 21 | 89.166667 | 89.16666667 | 38.33333333 | 47.5 |
| 28 | 100 | 65.83333333 | 50.83333333 | 100 |
| 35 | 100 | 77.5 | 67.5 | 65.83333333 |
| 42 | 100 | 90.83333333 | 76.66666667 | 79.16666667 |

The Ground Cover increased above 50% in all the establishment methods at 28 Days after establishment (4th week), but always high in Broadcasting of rice compared to the transplanting methods of rice. The lowest ground cover percentage was observed at the Mechanicaly transplanted blocks in the early period which emphasize the requirement of proper weed management options. The ground coverage reached 100% in Broadcasted blocks of two varieties Bg 360 and Bg 374 at 28 Days after establishment.

V1

The SAS System 05:41 Thursday, December 22, 2018 1

The CORR Procedure

5 Variables: dwgt trl height12 height42DAS GC

Simple Statistics

Variable N Mean Std Dev Sum Minimum Maximum

dwgt 12 0.11790 0.01182 1.41480 0.10530 0.13850

trl 12 473.06358 93.86506 5677 331.86470 594.79730

height12 12 16.03250 0.12520 192.39000 15.80000 16.19000

height42DAS 12 71.79074 4.67993 861.48889 68.16667 80.00000

GC 12 92.91667 5.62395 1115 82.50000 100.00000

Pearson Correlation Coefficients, N = 12

Prob > |r| under H0: Rho=0

dwgt trl height12 height42DAS GC

dwgt 1.00000 0.76432 0.75327 0.78870 0.63363

0.0038 0.0047 0.0023 0.0269

trl 0.76432 1.00000 0.84659 0.68634 0.45028

0.0038 0.0005 0.0137 0.1419

height12 0.75327 0.84659 1.00000 0.71793 0.61166

0.0047 0.0005 0.0086 0.0346

height42DAS 0.78870 0.68634 0.71793 1.00000 0.74278

0.0023 0.0137 0.0086 0.0056

GC 0.63363 0.45028 0.61166 0.74278 1.00000

0.0269 0.1419 0.0346 0.0056

V2

The SAS System 05:41 Thursday, December 22, 2018 2

The CORR Procedure

5 Variables: dwgt trl height12 height42DAS GC

Simple Statistics

Variable N Mean Std Dev Sum Minimum Maximum

dwgt 12 0.21473 0.08929 2.57670 0.11050 0.30800

trl 12 442.03775 109.42677 5304 296.85490 563.34520

height12 12 17.11917 0.17428 205.43000 16.86000 17.39000

height42DAS 12 82.97475 4.48151 995.69701 78.66667 90.30000

GC 12 86.66667 10.57083 1040 70.00000 100.00000

Pearson Correlation Coefficients, N = 12

Prob > |r| under H0: Rho=0

dwgt trl height12 height42DAS GC

dwgt 1.00000 0.96249 0.84978 0.81412 0.28880

<.0001 0.0005 0.0013 0.3626

trl 0.96249 1.00000 0.85424 0.82458 0.21145

<.0001 0.0004 0.0010 0.5094

height12 0.84978 0.85424 1.00000 0.89288 0.32775

0.0005 0.0004 <.0001 0.2983

height42DAS 0.81412 0.82458 0.89288 1.00000 0.60462

0.0013 0.0010 <.0001 0.0373

GC 0.28880 0.21145 0.32775 0.60462 1.00000

0.3626 0.5094 0.2983 0.0373