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Analytical Study on Date Production in the Governorates of Iraq Using a Split Plot Design

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Abstract

Dates are among the most important national resources due to their numerous health benefits and significant economic value. Recently, their importance has declined due to a decrease in production quantities. This can be attributed to several factors, including a lack of attention to date palm cultivation and the circumstances experienced by some governorates, which led to a clear variation in production between them. Therefore, this research focuses on comparing the central and southern governorates of Iraq, namely Diala, Baghdad, Babylon, Kerbala, Wasit, Al-Najaf, Al-Qadisiya, Al-Muthanna, Thi-Qar, Mysan, and Basrah. The research compares the average production of each date palm variety (Zahdi, Khistawi, Sayer, Khadrawi, Hillawi, Deary, and others) over consecutive periods (2016-2020). The split-plot design was employed, a factorial empirical design that includes two or more factors. The research concluded that there are significant differences between the Iraqi governorates in terms of date palm production quantities and varieties.

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1. Introduction

Dates are considered one of the most important national resources, alongside other natural resources such as crude oil and other resources in Iraq. The history of the palm tree in Iraq is very old, as historians have differed on determining its place of origin and agreed that Iraq is the oldest place where the palm tree was found, if not its original home.

The Directorate of Agricultural Statistics issues a report on date palm production annually. The report includes production indicators for the most common date palm varieties in Iraq. The statistical work is carried out in cooperation with the Ministry of Agriculture through the agricultural divisions and the statistics directorates in the governorates. The report includes indicators on the number of trees, the average productivity per tree, and the production of different

types of dates at the level of the date-producing governorates. The Zahdi variety is the main variety and constitutes the center of gravity for date palm production in Iraq, contributing about 54% of the total production of Iraq. It is worth noting that the Kurdistan Region and the governorates of Kirkuk and Nineveh are not included due to the lack of palm trees in these governorates.

2. Research Objective

The primary objective of this research is to compare the central and southern governorates of Iraq (Diala, Baghdad, Babylon, Kerbala, Wasit, Al-Najaf, Al-Qadisiya, Al-Muthanna,Thi-Qar, Mysan, and Basrah) in terms of the average production of each date palm variety (Zahdi, Khistawi, Sayer, Khadrawi, Hillawi, Deary, and others) during consecutive periods (2016-2020) using the split-plot design. The focus will be on distributing the levels of the most important factor, which is the date palm varieties, on the subplots and distributing the levels of the less important factor, which is the Iraqi governorates, on the main plots. The research will also observe whether there are significant differences between the production quantities of dates for each Iraqi governorate and whether there are significant differences between date palm varieties or not.

3. Theoretical Side

3.1. Split Plot Design [2,8,9,10]

Split-plot design is one of the factorial experimental designs that include two or more factors. This design was developed by the researcher Fisher in 1925 for use in many agricultural experiments with two factors. This design is used when the experiment requires focusing on studying accurate information about the levels of a specific factor that is more difficult or more important than the levels of the other factor and also focusing on studying the relation between the stages of the most important factor and the stages of the least important factor.

The fundamental concept of this design is to categorize the experimental plots or sectors into two distinct categories of plots. The stages of the primary component (the less significant) are randomly allocated to the principal type of experimental plots, referred to as the major plots. The quantity of primary plots corresponds to the number of stages of the initial component. Subsequently, each primary plot is segmented into several subplots, which constitute the second category of experimental plots. The stages of the second component (the primary component) are randomly allocated to the subplots, and the quantity of subplots inside each main plot corresponds to the number of stages of the second one.

The study of a split-plot experiment is more intricate because of the existence of two categories of random mistakes. The initial type occurs inside the primary plots and is employed to evaluate the impact of the first element. The second type occurs within the subplots and is utilized to examine the impact of the second factor and the impact of interaction between the two elements.

3.2. Split Plot Design in the Case of Completely Randomized Blocks

This study will examine two variables:

- **Factor A**: Denotes the Iraqi governorates (factor A) comprising eleven levels$(a_1, a_2, a_3, \dots, a_{11})$, which are allocated haphazardly to the primary plots.
- **Factor B**: Denotes date palm types (factor B) comprising seven levels$(b_1, b_2, b_3, \dots, b_7)$, which are allocated at random to the subplots of each primary plot. This component is paramount in the investigation and is essential for acquiring precise information regarding it.

The experiment was executed with five replicates (r=5) corresponding to the consecutive years (2016-2020) for the cultivation of seven date palm types. Each replicate was split into a number of main plots distributed over the stages of factor A, and each main plot was divided into a number of subplots distributed over the stages of factor B.

3.3. Mathematical Model [2,9]

The mathematical model for an experiment conducted according to a split-plot design in the case of complete random blocks is as follows:

$$y_{ijk} = \mu + \alpha_k + \tau_i + \epsilon_{ik} + \beta_j + (\tau\beta)_{ij} + \epsilon_{ijk} \quad (1)$$
$$i = 1,2,\dots,11 \quad ، \quad j = 1,2,\dots,7 \quad ، \quad k = 1,2,\dots,5$$

Where:

y_{ijk} : Response of the experimental subplot treated with level (j) of factor B within the main plot treated with level (i) of factor A within sector (replicate) k.

μ : The effect of the general mean where

$$\hat{\mu} = \bar{y}_{..} = \frac{y_{...}}{abr} \quad (2)$$

α_k : The Effect of blocks or replicates

τ_i : The Effect of level (i) of factor A (least important factor)

ϵ_{ik}: Effect of the experimental error of the main plots. This error is independent and normally distributed.

$$\epsilon_{ik} \sim NID(0, \sigma_\epsilon^2) \quad (3)$$

β_j : The Effect of level (j) of factor B (the most important factor)

$(\tau\beta)_{ij}$: The interaction effect of level (i) of factor A with level (j) of factor B

ϵ_{ijk}: Effect of the empirical mistake of the subplots. This error is independent and normally distributed.

$$\epsilon_{ijk} \sim NID(0, \sigma_\epsilon^2) \quad (4)$$

3.4. Mathematical Formulas Used in Research [2,11]

The formulas used in the research can be displayed in the Analysis of Variance (ANOVA) table as shown below:

Table 1: Analysis of Variance Table Formulas (ANOVA)

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Replicate	$r-1$	$SS(R) = ab\sum_k (\bar{y}_{..k} - \bar{y}_{...})^2$	$\frac{SS(R)}{r-1}$	
Factor A	$a-1$	$SS(A) = rb\sum_i (\bar{y}_{i..} - \bar{y}_{...})^2$	$\frac{SS(A)}{a-1}$	$\frac{MS(A)}{MS(E_A)}$
Error A	$(r-1)(a-1)$	$SS(E_A) = b\sum_{i,k} (\bar{y}_{i.k} - \bar{y}_{..k} - \bar{y}_{i..} + \bar{y}_{...})^2$	$\frac{SS(E_A)}{(r-1)(a-1)}$	
Factor B	$b-1$	$SS(B) = ra\sum_j (\bar{y}_{.j.} - \bar{y}_{...})^2$	$\frac{SS(B)}{b-1}$	$\frac{MS(B)}{MS(E_B)}$
$A \times B$	$(a-1)(b-1)$	$SS(A\times B) = r\sum_{i,j} (\bar{y}_{ij.} - \bar{y}_{i..} - \bar{y}_{.j.} + \bar{y}_{...})^2$	$\frac{SS(A\times B)}{(a-1)(b-1)}$	$\frac{MS(A\times B)}{MS(E_B)}$
Error B	$a(r-1)(b-1)$	**By Subtraction**	**By Subtraction** $\frac{}{a(r-1)(b-1)}$	
Total	$abr-1$	$SS(TO) = \sum_{ijk} (y_{ijk} - \bar{y}_{...})^2$		

3.5.Multiple Comparisons [1,2]

These tests are usually applied after the significance of the Analysis of Variance (ANOVA) chart is proven by using the F test, where the null hypothesis asserting the equality of all treatment means is declined and the substitution hypothesis that there are at least two means that have significant differences between them is accepted. However, this test does not specify which means resulted in the significant differences. Therefore, post-hoc tests or multiple comparisons are used by conducting several comparisons between treatment means to find out which means resulted in the significant differences. In this research, the Least Significant Difference (LSD) test will be used.

3.5.1. Lest Significant Difference [1,2,9]

This test was proposed by Fisher in 1935 and is considered one of the simplest and most widely used tests. The steps of this test can be summarized in the state of a split-plot design as follows:

1. The absolute distinction between the means of each pair of treatments $(\bar{y}_{i.} - \bar{y}_{i.})$ is calculated and compared to the value of LSD as a table value.
2. The value of the least significant difference (LSD) at a significance level α is extracted using the following equation:

$$LSD = t_{(1-1/\alpha \, , \, d.f \; error)} \, S.E_{(\bar{y}_{i.} - \bar{y}_{i.})} \tag{5}$$

3. The standard error of the distinction between the means of any two treatments $S.E_{(\bar{y}_{i.} - \bar{y}_{i.})}$ is estimated according to the following cases:
   - The standard error of the difference between any two means of the main factor A is given by the formula:

$$S.E_{(\bar{y}_{i.} - \bar{y}_{i.})} = \sqrt{\frac{2\,MSEa}{rb}} \tag{6}$$

   - The standard error of the distinction between any two means of the secondary factor B is given by the formula:

$$S.E_{(\bar{y}_{i.} - \bar{y}_{i.})} = \sqrt{\frac{2\,MSEb}{ra}} \tag{7}$$

   - The standard error of the distinction between any two means of the main factor A at the equivalent level of factor B or at different levels of factor B is given by the formula:

$$S.E_{(\bar{y}_{i.} - \bar{y}_{i.})} = \sqrt{\frac{2\{(b-1)MSEb + MSEa\}}{rb}} \tag{8}$$

The difference in this comparison does not follow the normal (t) distribution, therefore the approximate (t) test $(\acute{t})$ will be used according to the formula:

$$\acute{t} = \frac{(b-1)MSEb(t_1) + MSEa(t_2)}{(b-1)MSEb - MSEa} \tag{9}$$

Where:

t_1 : The table value of t for a significance level of 0.05 or 0.01 and for the error degrees of freedom of factor B.

t_2 : The table value of t for a significance level of 0.05 or 0.01 and for the error degrees of freedom of factor A.

4. The Application Side

In order to achieve the pre-specified research objective, data on the production of date palm varieties in Iraq was obtained from the annual reports of the Directorate of Agricultural Statistics in the Central Statistical Organization of the Ministry of Planning. The data included eleven Iraqi governorates where date palm cultivation is widespread (Diala, Baghdad, Babylon, Kerbala, Wasit, Al-Najaf, Al-Qadisiya, Al-Muthanna,Thi-Qar, Mysan, and Basrah) and seven varieties of dates (Zahdi, Khistawi, Sayer, Khadrawi, Hillawi, Deary, and others) for a consecutive period (2016-2020). The following table represents the data that was obtained: [3,4,5,6,7]

Table 2: Palm Tree Production in Tons by Governorate for the Period (2016 - 2020)

seq.	governorate	varieties	the years				
			2016	2017	2018	2019	2020
1	Diala	Zahdi	49604	49729	50916	22640	50367
2		Khistawi	11002	10728	10914	7875	11974
3		Sayer	3545	3236	3347	3437	3455
4		Khadrawi	2581	2241	2362	1920	2414
5		Hillawi	308	479	465	476	443
6		Deary	5711	5732	5819	5981	9866
7		other types	12246	11157	11616	7964	9602
8	Baghdad	Zahdi	58594	61090	64740	64057	56381
9		Khistawi	14494	14655	14980	14777	13346
10		Sayer	329	364	401	544	544
11		Khadrawi	2100	2176	2258	2247	1930
12		Hillawi	337	360	387	396	382
13		Deary	451	521	600	621	620
14		other types	44591	45010	47227	52570	53029
15	Babylon	Zahdi	66209	68156	67667	61710	80926
16		Khistawi	13188	13559	13850	13308	16076
17		Sayer	1026	1178	1206	1268	1445
18		Khadrawi	2063	2257	2441	2357	2993
19		Hillawi	235	208	224	235	353
20		Deary	3670	4126	4407	4507	5141
21		other types	9959	9238	10204	10220	11013
22	Kerbala	Zahdi	64934	65810	69658	63361	63672
23		Khistawi	8026	8337	8436	8479	8566
24		Sayer	127	139	145	139	138
25		Khadrawi	662	618	676	644	743
26		Hillawi	90	91	98	100	102
27		Deary	450	570	628	640	649
28		other types	6920	6858	7363	7584	6682
29	Wasit	Zahdi	27730	27923	28875	22537	28496
30		Khistawi	5411	5547	5724	3812	6632
31		Sayer	252	257	266	212	420
32		Khadrawi	1403	1441	1483	1159	1709
33		Hillawi	756	867	907	723	1041
34		Deary	362	377	383	287	365
35		other types	7318	7618	7956	5067	10468
36	Al-Najaf	Zahdi	22087	22533	24007	19729	20680
37		Khistawi	3877	3817	4038	3995	4076
38		Sayer	826	762	799	781	796
39		Khadrawi	1514	1498	1536	1529	1547
40		Hillawi	441	391	432	427	436
41		Deary	294	282	286	279	282
42		other types	2844	2583	2626	2636	2647
43	Al-Qadisiya	Zahdi	23418	21849	24317	22192	30016
44		Khistawi	1477	1658	1880	1872	2571
45		Sayer	1610	1824	1905	2760	2795
46		Khadrawi	1025	979	1149	1151	1538
47		Hillawi	432	418	427	430	582
48		Deary	293	307	313	301	304
49		other types	9355	9445	10081	10193	10249

50	Al-Muthanna	Zahdi	9720	10126	9593	10666	12040
51		Khistawi	2383	2371	2497	2623	2641
52		Sayer	1917	1957	2043	1972	2023
53		Khadrawi	2941	2994	3132	2762	3472
54		Hillawi	1411	×××	1311	1530	1547
55		Deary	4455	4583	4711	5310	4894
56		other types	8230	8369	7868	11191	11628
57	Thi -Qar	Zahdi	7622	7858	7928	7611	9843
58		Khistawi	1458	1527	1698	1731	1739
59		Sayer	6655	6954	7262	6952	6756
60		Khadrawi	11632	12342	14135	12616	14559
61		Hillawi	664	734	801	834	848
62		Deary	4164	4291	4790	4875	4875
63		other types	9262	8006	9527	9651	10977
64	Mysan	Zahdi	1232	1079	1187	1224	1519
65		Khistawi	587	623	672	682	866
66		Sayer	1624	1684	1728	1644	1535
67		Khadrawi	1859	1887	2039	2018	2792
68		Hillawi	118	122	129	132	133
69		Deary	525	520	544	534	637
70		other types	2068	2236	2327	2434	2566
71	Basrah	Zahdi	2011	2104	2670	2637	2918
72		Khistawi	2603	3846	3726	3414	3363
73		Sayer	7399	7227	7523	7337	8099
74		Khadrawi	3053	2983	3294	3067	1933
75		Hillawi	13414	12365	11187	9541	12690
76		Deary	3758	3360	3734	3511	2247
77		other types	6269	5671	5682	3872	4667

4.1. Estimating the Missing Value [2]

We notice from the above data table that there is a missing value for the production of dates in Al-Muthanna Governorate for the Hillawi variety for the year 2017. Due to the unavailability of data for this value according to the annual reports of the Directorate of Agricultural Statistics for the production of dates, this value was estimated according to the formula for evaluating the missing value for the design of split plots as follows:

$$\hat{y}_{ijk} = \frac{r\,y_{i.k} + b y_{ij.} - y_{i..}}{(r-1)(b-1)} = \frac{5(30400) + 7(5799) - (166911)}{(5-1)(7-1)} = 1070$$

4.2. Data Analysis

After estimating the missing value in the previous data table, the data is now complete and ready for statistical analysis. The ready-made statistical program (CoStat) was used to examine the data and the outcomes were as follows:

Table 3: Analysis of Variance table (ANOVA)

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F	P value
Replicate	4	59688702.69	14922176	2.8998484	0.0338*
Factor A	10	9002131030	9.00216e8	174.93974	0.0000***
Error A	40	205833870.6	5145846.8		
Factor B	6	3.574778e10	5.95796e9	1765.1145	0.0000***
$A \times B$	60	3.459489e10	5.76582e8	170.81886	0.0000***
Error B	264	891104883.9	3375397.3		
Total	384	8.050142e10			

We observe from the P-value that the null hypothesis, which states that all treatment means are equivalent, is declined. This means that there are statistically significant differences between the treatment means. We also observe several findings, the most significant of which are:

1. The blocks or replicates represented by the years (2020-2016) have a statistically significant effect on the quantities of date production in Iraq.
2. The primary variable A, denoted by the Iraqi governorates (Diala, Baghdad, Babylon, Kerbala, Wasit, Al-Najaf, Al-Qadisiya, Al-Muthanna, Thi-Qar, Mysan, and Basrah), exerts a statistically significant influence on the volumes of date production in Iraq. This indicates a statistically significant difference between the means of a minimum of two Iraqi governorates for the production amounts of the seven date types.
3. The secondary factor B, represented by the many date types (Zahdi, Khistawei, Sayer, Khadrawi, Hillawi, Deary, and others), exerts a statistically significant influence on date output numbers in Iraq. This indicates a statistically significant difference between the means of at least two kinds of dates, namely among the Iraqi types about their production amounts.
4. The interaction between the primary factor (Iraqi governorates) and the secondary factor (varieties of dates) demonstrates a statistically significant effect on date production amounts in Iraq across its seven varieties.
5. The data analysis revealed that the coefficient of determination (R^2=98%) for the split-plot design model is 0.98, indicating the model's appropriateness for the data. This indicates that 98% of the variations in the dependent variable (quantities of date output) were attributable to alterations in the primary component (Iraqi governorates) and modifications in the secondary component (varieties of dates).

Table 4: Multiple comparisons for the main factor A (Iraqi governorates)

Mean Name	Mean	N	LSD 0.05 = 1095.95296079									
			1243.03	4494.66	4799.46	5233.57	5746.17	6165.26	6376.48	11204.34	11775.28	14474.94
2	18203.11	35	16960.08	13708.45	13403.65	12969.54	12456.94	12037.85	11826.63	6998.77	6427.83	3728.17
3	14474.94	35	13231.91	9980.28	9675.48	9241.37	8728.77	8309.68	8098.46	3270.6	2699.66	
4	11775.28	35	10532.25	7280.62	6975.82	6541.71	6029.11	5610.02	5398.8	570.94		
1	11204.34	35	9961.31	6709.68	6404.88	5970.77	5458.17	5039.08	4827.86			
9	6376.48	35	5133.45	1881.82	1577.02	1142.91	630.31	211.22				
5	6165.26	35	4922.23	1670.6	1365.8	931.69	419.09					
7	5746.17	35	4503.14	1251.51	946.71	512.6						
11	5233.57	35	3990.54	738.91	434.11							
8	4799.46	35	3556.43	304.8								
6	4494.66	35	3251.63									
10	1243.03	35										

6. The findings indicated that the coefficient of variation (C.V=22%) for the split-plot design model is 0.05, signifying a high degree of homogeneity among the data values (amounts of date output) around the mean.

After arranging the means in descending order, multiple comparisons were performed utilizing the Least Significant Difference (LSD) test on the main factor A represented by the Iraqi governorates. This was done by taking the absolute difference between the means of any two governorates to determine which means resulted in statistically significant differences. We note that the majority of the differences gave calculated values greater than the tabulated value of the LSD test at a significance level of 0.05. This signifies that there are statistically significant differences between the means, i.e., some governorates have a better effect on the quantities of date production in Iraq than other governorates with which they were compared. For example, when taking the difference between the mean of Baghdad Governorate and the means of other governorates, all differences appeared statistically significant, i.e., Baghdad Governorate is better than other governorates in affecting the quantities of date production in Iraq. This is also the case when comparing the rest of the governorates, as shown in the table above. However, some differences showed calculated values less than the tabulated value of the LSD test, which were identified and shaded in the table above. This signifies that there are no statistically significant differences

between them, i.e., the two governorates are equivalent in their effect on the quantities of date production in Iraq.

Table 5: Multiple Comparisons for Secondary Factor B (Date Varieties)

Mean Name	Mean	n	LSD 0.05 = 689.826258133					
			1546.54	**2395.33**	**2410.34**	**2979.16**	**6072.85**	**11175.27**
1	30512.69	55	28966.15	28117.36	28102.35	27533.53	24439.84	19337.42
7	11175.27	55	9628.73	8779.94	8764.93	8196.11	5102.42	
2	6072.85	55	4526.31	3677.52	3662.51	3093.69		
4	2979.16	55	1432.62	583.83	568.82			
3	2410.34	55	863.8	15.01				
6	2395.33	55	848.79					
5	1546.54	55						

After arranging the means in descending order, multiple comparisons were performed using the Least Significant Difference (LSD) test on the secondary factor B represented by the seven varieties of dates. This was done by taking the absolute difference between the means of any two varieties to determine which means resulted in statistically significant differences. We also note that the majority of the differences gave calculated values greater than the tabulated value of the LSD test at a significance level of 0.05. This means that there are statistically significant differences between the means, i.e., some varieties of dates have a better effect on the quantities of date production in Iraq than other varieties with which they were compared. For example, when taking the difference between the mean of the Zahdi variety and the means of other varieties, all differences appeared statistically significant, i.e., the Zahdi variety is better than other varieties in affecting the quantities of date production in Iraq. This is also the case when comparing the rest of the varieties, as shown in the table above. However, some differences showed calculated values less than the tabulated value of the LSD test, which were identified and shaded in the table above. This signifies that there are no statistically significant differences between them, i.e., the two varieties are equivalent in their effect on the quantities of date production in Iraq.

The Least Significant Difference (LSD) test was also applied for multiple comparisons of the joint interaction effect between the main factor A and the secondary factor B. This was done by taking the absolute distinction between the means of any two treatments resulting from the interaction between the two factors. We also note that the majority of the differences gave calculated values greater than the tabulated value of the LSD test at a significance level of 0.05. This signifies that there are statistically significant differences between the means, i.e., these differences have a statistically significant effect on the quantities of date production in Iraq. However, some differences showed calculated values less than the tabulated value of the LSD test, which signifies that there are no statistically significant differences between them, i.e., they are equivalent in their effect on the quantities of date production in Iraq, as shown in the table below:

Table 6: Multiple Comparisons for Interaction between the two Factors

Mean	LSD 0.05 = 2287.89487294																
68933.6	68837.4	68806.8	68796	68682.6	68652.2	68649	68630	68578.8	68561.2	68508.2	68499.4	68497.2	68475.8	68381.6	68371	68346.2	68265
65487	65390.8	65360.2	65349.4	65236	65205.6	65202.4	65183.4	65132.2	65114.6	65061.6	65052.8	65050.6	65029.2	64935	64924.4	64899.6	64818.4
60972.4	60876.2	60845.6	60834.8	60721.4	60691	60687.8	60668.8	60617.6	60600	60547	60538.2	60536	60514.6	60420.4	60409.8	60385	60303.8
48485.4	48389.2	48358.6	48347.8	48234.4	48204	48200.8	48181.8	48130.6	48113	48060	48051.2	48049	48027.6	47933.4	47922.8	47898	47816.8
44651.2	44555	44524.4	44513.6	44400.2	44369.8	44366.6	44347.6	44296.4	44278.8	44225.8	44217	44214.8	44193.4	44099.2	44088.6	44063.8	43982.6
27112.2	27016	26985.4	26974.6	26861.2	26830.8	26827.6	26808.6	26757.4	26739.8	26686.8	26678	26675.8	26654.4	26560.2	26549.6	26524.8	26443.6
24358.4	24262.2	24231.6	24220.8	24107.4	24077	24073.8	24054.8	24003.6	23986	23933	23924.2	23922	23900.6	23806.4	23795.8	23771	23689.8
21807.2	21711	21680.4	21669.6	21556.2	21525.8	21522.6	21503.6	21452.4	21434.8	21381.8	21373	21370.8	21349.4	21255.2	21244.6	21219.8	21138.6
14450.4	14354.2	14323.6	14312.8	14199.4	14169	14165.8	14146.8	14095.6	14078	14025	14016.2	14014	13992.6	13898.4	13887.8	13863	13781.8
13996.2	13900	13869.4	13858.6	13745.2	13714.8	13711.6	13692.6	13641.4	13623.8	13570.8	13562	13559.8	13538.4	13444.2	13433.6	13408.8	13327.6
13056.8	12960.6	12930	12919.2	12805.8	12775.4	12772.2	12753.2	12702	12684.4	12631.4	12622.6	12620.4	12599	12504.8	12494.2	12469.4	12388.2
11839.4	11743.2	11712.6	11701.8	11588.4	11558	11554.8	11535.8	11484.6	11467	11414	11405.2	11403	11381.6	11287.4	11276.8	11252	11170.8
10517	10420.8	10390.2	10379.4	10266	10235.6	10232.4	10213.4	10162.2	10144.6	10091.6	10082.8	10080.6	10059.2	9965	9954.4	9929.6	9848.4
10498.6	10402.4	10371.8	10361	10247.6	10217.2	10214	10195	10143.8	10126.2	10073.2	10064.4	10062.2	10040.8	9946.6	9936	9911.2	9830
10429	10332.8	10302.2	10291.4	10178	10147.6	10144.4	10125.4	10074.2	10056.6	10003.6	9994.8	9992.6	9971.2	9877	9866.4	9841.6	9760.4
10126.8	10030.6	10000	9989.2	9875.8	9845.4	9842.2	9823.2	9772	9754.4	9701.4	9692.6	9690.4	9669	9574.8	9564.2	9539.4	9458.2
9864.6	9768.4	9737.8	9727	9613.6	9583.2	9580	9561	9509.8	9492.2	9439.2	9430.4	9428.2	9406.8	9312.6	9302	9277.2	9196
9484.6	9388.4	9357.8	9347	9233.6	9203.2	9200	9181	9129.8	9112.2	9059.2	9050.4	9048.2	9026.8	8932.6	8922	8897.2	8816
9457.2	9361	9330.4	9319.6	9206.2	9175.8	9172.6	9153.6	9102.4	9084.8	9031.8	9023	9020.8	8999.4	8905.2	8894.6	8869.8	8788.6
8368.8	8272.6	8242	8231.2	8117.8	8087.4	8084.2	8065.2	8014	7996.4	7943.4	7934.6	7932.4	7911	7816.8	7806.2	7781.4	7700.2
8172.4	8076.2	8045.6	8034.8	7921.4	7891	7887.8	7868.8	7817.6	7800	7747	7738.2	7736	7714.6	7620.4	7609.8	7585	7503.8
7685.4	7589.2	7558.6	7547.8	7434.4	7404	7400.8	7381.8	7330.6	7313	7260	7251.2	7249	7227.6	7133.4	7122.8	7098	7016.8
7517	7420.8	7390.2	7379.4	7266	7235.6	7232.4	7213.4	7162.2	7144.6	7091.6	7082.8	7080.6	7059.2	6965	6954.4	6929.6	6848.4
7081.4	6985.2	6954.6	6943.8	6830.4	6800	6796.8	6777.8	6726.6	6709	6656	6647.2	6645	6623.6	6529.4	6518.8	6494	6412.8
6915.8	6819.6	6789	6778.2	6664.8	6634.4	6631.2	6612.2	6561	6543.4	6490.4	6481.6	6479.4	6458	6363.8	6353.2	6328.4	6247.2
6621.8	6525.6	6495	6484.2	6370.8	6340.4	6337.2	6318.2	6267	6249.4	6196.4	6187.6	6185.4	6164	6069.8	6059.2	6034.4	5953.2
5425.2	5329	5298.4	5287.6	5174.2	5143.8	5140.6	5121.6	5070.4	5052.8	4999.8	4991	4988.8	4967.4	4873.2	4862.6	4837.8	4756.6
5232.2	5136	5105.4	5094.6	4981.2	4950.8	4947.6	4928.6	4877.4	4859.8	4806.8	4798	4795.8	4774.4	4680.2	4669.6	4644.8	4563.6
4790.6	4694.4	4663.8	4653	4539.6	4509.2	4506	4487	4435.8	4418.2	4365.2	4356.4	4354.2	4332.8	4238.6	4228	4203.2	4122
4599	4502.8	4472.2	4461.4	4348	4317.6	4314.4	4295.4	4244.2	4226.6	4173.6	4164.8	4162.6	4141.2	4047	4036.4	4011.6	3930.4
4370.2	4274	4243.4	4232.6	4119.2	4088.8	4085.6	4066.6	4015.4	3997.8	3944.8	3936	3933.8	3912.4	3818.2	3807.6	3782.8	3701.6
3960.6	3864.4	3833.8	3823	3709.6	3679.2	3676	3657	3605.8	3588.2	3535.2	3526.4	3524.2	3502.8	3408.6	3398	3373.2	3292
3404	3307.8	3277.2	3266.4	3153	3122.6	3119.4	3100.4	3049.2	3031.6	2978.6	2969.8	2967.6	2946.2	2852	2841.4	2816.6	2735.4
3390.4	3294.2	3263.6	3252.8	3139.4	3109	3105.8	3086.8	3035.6	3018	2965	2956.2	2954	2932.6	2838.4	2827.8	2803	2721.8
3322	3225.8	3195.2	3184.4	3071	3040.6	3037.4	3018.4	2967.2	2949.6	2896.6	2887.8	2885.6	2864.2	2770	2759.4	2734.6	2653.4
3060.2	2964	2933.4	2922.6	2809.2	2778.8	2775.6	2756.6	2705.4	2687.8	2634.8	2626	2623.8	2602.4	2508.2	2497.6	2472.8	2391.6
2866	2769.8	2739.2	2728.4	2615	2584.6	2581.4	2562.4	2511.2	2493.6	2440.6	2431.8	2429.6	2408.2	2314	2303.4	2278.6	2197.4
2667.2	2571	2540.4	2529.6	2416.2	2385.8	2382.6	2363.6	2312.4	2294.8	2241.8	2233	2230.8	2209.4	2115.2	2104.6	2079.8	1998.6
2503	2406.8	2376.2	2365.4	2252	2221.6	2218.4	2199.4	2148.2	2130.6	2077.6	2068.8	2066.6	2045.2	1951	1940.4	1915.6	1834.4
2468	2371.8	2341.2	2330.4	2217	2186.6	2183.4	2164.4	2113.2	2095.6	2042.6	2033.8	2031.6	2010.2	1916	1905.4	1880.6	1799.4
2422.2	2326	2295.4	2284.6	2171.2	2140.8	2137.6	2118.6	2067.4	2049.8	1996.8	1988	1985.8	1964.4	1870.2	1859.6	1834.8	1753.6

2326.2	2230	2199.4	2188.6	2075.2	2044.8	2041.6	2022.6	1971.4	1953.8	1900.8	1892	1889.8	1868.4	1774.2	1763.6	1738.8	1657.6
2303.6	2207.4	2176.8	2166	2052.6	2022.2	2019	2000	1948.8	1931.2	1878.2	1869.4	1867.2	1845.8	1751.6	1741	1716.2	1635
2178.8	2082.6	2052	2041.2	1927.8	1897.4	1894.2	1875.2	1824	1806.4	1753.4	1744.6	1742.4	1721	1626.8	1616.2	1591.4	1510.2
2142.2	2046	2015.4	2004.6	1891.2	1860.8	1857.6	1838.6	1787.4	1769.8	1716.8	1708	1705.8	1684.4	1590.2	1579.6	1554.8	1473.6
2119	2022.8	1992.2	1981.4	1868	1837.6	1834.4	1815.4	1764.2	1746.6	1693.6	1684.8	1682.6	1661.2	1567	1556.4	1531.6	1450.4
1982.4	1886.2	1855.6	1844.8	1731.4	1701	1697.8	1678.8	1627.6	1610	1557	1548.2	1546	1524.6	1430.4	1419.8	1395	1313.8
1891.6	1795.4	1764.8	1754	1640.6	1610.2	1607	1588	1536.8	1519.2	1466.2	1457.4	1455.2	1433.8	1339.6	1329	1304.2	1223
1643	1546.8	1516.2	1505.4	1392	1361.6	1358.4	1339.4	1288.2	1270.6	1217.6	1208.8	1206.6	1185.2	1091	1080.4	1055.6	974.4
1630.6	1534.4	1503.8	1493	1379.6	1349.2	1346	1327	1275.8	1258.2	1205.2	1196.4	1194.2	1172.8	1078.6	1068	1043.2	962
1524.8	1428.6	1398	1387.2	1273.8	1243.4	1240.2	1221.2	1170	1152.4	1099.4	1090.6	1088.4	1067	972.8	962.2	937.4	856.2
1439	1342.8	1312.2	1301.4	1188	1157.6	1154.4	1135.4	1084.2	1066.6	1013.6	1004.8	1002.6	981.2	887	876.4	851.6	770.4
1373.8	1277.6	1247	1236.2	1122.8	1092.4	1089.2	1070.2	1019	1001.4	948.4	939.6	937.4	916	821.8	811.2	786.4	705.2
1248.2	1152	1121.4	1110.6	997.2	966.8	963.6	944.6	893.4	875.8	822.8	814	811.8	790.4	696.2	685.6	660.8	579.6
1224.6	1128.4	1097.8	1087	973.6	943.2	940	921	869.8	852.2	799.2	790.4	788.2	766.8	672.6	662	637.2	556
1168.4	1072.2	1041.6	1030.8	917.4	887	883.8	864.8	813.6	796	743	734.2	732	710.6	616.4	605.8	581	499.8
858.8	762.6	732	721.2	607.8	577.4	574.2	555.2	504	486.4	433.4	424.6	422.4	401	306.8	296.2	271.4	190.2
792.8	696.6	666	655.2	541.8	511.4	508.2	489.2	438	420.4	367.4	358.6	356.4	335	240.8	230.2	205.4	124.2
776.2	680	649.4	638.6	525.2	494.8	491.6	472.6	421.4	403.8	350.8	342	339.8	318.4	224.2	213.6	188.8	107.6
686	589.8	559.2	548.4	435	404.6	401.4	382.4	331.2	313.6	260.6	251.8	249.6	228.2	134	123.4	98.6	17.4
668.6	572.4	541.8	531	417.6	387.2	384	365	313.8	296.2	243.2	234.4	232.2	210.8	116.6	106	81.2	0
587.4	491.2	460.6	449.8	336.4	306	302.8	283.8	232.6	215	162	153.2	151	129.6	35.4	24.8	0	
562.6	466.4	435.8	425	311.6	281.2	278	259	207.8	190.2	137.2	128.4	126.2	104.8	10.6	0		
552	455.8	425.2	414.4	301	270.6	267.4	248.4	197.2	179.6	126.6	117.8	115.6	94.2	0			
457.8	361.6	331	320.2	206.8	176.4	173.2	154.2	103	85.4	32.4	23.6	21.4	0				
436.4	340.2	309.6	298.8	185.4	155	151.8	132.8	81.6	64	11	2.2	0					
434.2	338	307.4	296.6	183.2	152.8	149.6	130.6	79.4	61.8	8.8	0						
425.4	329.2	298.6	287.8	174.4	144	140.8	121.8	70.6	53	0							
372.4	276.2	245.6	234.8	121.4	91	87.8	68.8	17.6	0								
354.8	258.6	228	217.2	103.8	73.4	70.2	51.2	0									
303.6	207.4	176.8	166	52.6	22.2	19	0										
284.6	188.4	157.8	147	33.6	3.2	0											
281.4	185.2	154.6	143.8	30.4	0												
251	154.8	124.2	113.4	0													
137.6	41.4	10.8	0														
126.8	30.6	0															

Mean	LSD 0.05 = 2287.89487294																
68933.6	68247.6	68157.4	68140.8	68074.8	67765.2	67709	67685.4	67559.8	67494.6	67408.8	67303	67290.6	67042	66951.2	66814.6	66791.4	66754.8
65487	64801	64710.8	64694.2	64628.2	64318.6	64262.4	64238.8	64113.2	64048	63962.2	63856.4	63844	63595.4	63504.6	63368	63344.8	63308.2
60972.4	60286.4	60196.2	60179.6	60113.6	59804	59747.8	59724.2	59598.6	59533.4	59447.6	59341.8	59329.4	59080.8	58990	58853.4	58830.2	58793.6
48485.4	47799.4	47709.2	47692.6	47626.6	47317	47260.8	47237.2	47111.6	47046.4	46960.6	46854.8	46842.4	46593.8	46503	46366.4	46343.2	46306.6
44651.2	43965.2	43875	43858.4	43792.4	43482.8	43426.6	43403	43277.4	43212.2	43126.4	43020.6	43008.2	42759.6	42668.8	42532.2	42509	42472.4
27112.2	26426.2	26336	26319.4	26253.4	25943.8	25887.6	25864	25738.4	25673.2	25587.4	25481.6	25469.2	25220.6	25129.8	24993.2	24970	24933.4
24358.4	23672.4	23582.2	23565.6	23499.6	23190	23133.8	23110.2	22984.6	22919.4	22833.6	22727.8	22715.4	22466.8	22376	22239.4	22216.2	22179.6
21807.2	21121.2	21031	21014.4	20948.4	20638.8	20582.6	20559	20433.4	20368.2	20282.4	20176.6	20164.2	19915.6	19824.8	19688.2	19665	19628.4
14450.4	13764.4	13674.2	13657.6	13591.6	13282	13225.8	13202.2	13076.6	13011.4	12925.6	12819.8	12807.4	12558.8	12468	12331.4	12308.2	12271.6
13996.2	13310.2	13220	13203.4	13137.4	12827.8	12771.6	12748	12622.4	12557.2	12471.4	12365.6	12353.2	12104.6	12013.8	11877.2	11854	11817.4
13056.8	12370.8	12280.6	12264	12198	11888.4	11832.2	11808.6	11683	11617.8	11532	11426.2	11413.8	11165.2	11074.4	10937.8	10914.6	10878
11839.4	11153.4	11063.2	11046.6	10980.6	10671	10614.8	10591.2	10465.6	10400.4	10314.6	10208.8	10196.4	9947.8	9857	9720.4	9697.2	9660.6
10517	9831	9740.8	9724.2	9658.2	9348.6	9292.4	9268.8	9143.2	9078	8992.2	8886.4	8874	8625.4	8534.6	8398	8374.8	8338.2
10498.6	9812.6	9722.4	9705.8	9639.8	9330.2	9274	9250.4	9124.8	9059.6	8973.8	8868	8855.6	8607	8516.2	8379.6	8356.4	8319.8
10429	9743	9652.8	9636.2	9570.2	9260.6	9204.4	9180.8	9055.2	8990	8904.2	8798.4	8786	8537.4	8446.6	8310	8286.8	8250.2
10126.8	9440.8	9350.6	9334	9268	8958.4	8902.2	8878.6	8753	8687.8	8602	8496.2	8483.8	8235.2	8144.4	8007.8	7984.6	7948
9864.6	9178.6	9088.4	9071.8	9005.8	8696.2	8640	8616.4	8490.8	8425.6	8339.8	8234	8221.6	7973	7882.2	7745.6	7722.4	7685.8
9484.6	8798.6	8708.4	8691.8	8625.8	8316.2	8260	8236.4	8110.8	8045.6	7959.8	7854	7841.6	7593	7502.2	7365.6	7342.4	7305.8
9457.2	8771.2	8681	8664.4	8598.4	8288.8	8232.6	8209	8083.4	8018.2	7932.4	7826.6	7814.2	7565.6	7474.8	7338.2	7315	7278.4
8368.8	7682.8	7592.6	7576	7510	7200.4	7144.2	7120.6	6995	6929.8	6844	6738.2	6725.8	6477.2	6386.4	6249.8	6226.6	6190
8172.4	7486.4	7396.2	7379.6	7313.6	7004	6947.8	6924.2	6798.6	6733.4	6647.6	6541.8	6529.4	6280.8	6190	6053.4	6030.2	5993.6
7685.4	6999.4	6909.2	6892.6	6826.6	6517	6460.8	6437.2	6311.6	6246.4	6160.6	6054.8	6042.4	5793.8	5703	5566.4	5543.2	5506.6
7517	6831	6740.8	6724.2	6658.2	6348.6	6292.4	6268.8	6143.2	6078	5992.2	5886.4	5874	5625.4	5534.6	5398	5374.8	5338.2
7081.4	6395.4	6305.2	6288.6	6222.6	5913	5856.8	5833.2	5707.6	5642.4	5556.6	5450.8	5438.4	5189.8	5099	4962.4	4939.2	4902.6
6915.8	6229.8	6139.6	6123	6057	5747.4	5691.2	5667.6	5542	5476.8	5391	5285.2	5272.8	5024.2	4933.4	4796.8	4773.6	4737
6621.8	5935.8	5845.6	5829	5763	5453.4	5397.2	5373.6	5248	5182.8	5097	4991.2	4978.8	4730.2	4639.4	4502.8	4479.6	4443
5425.2	4739.2	4649	4632.4	4566.4	4256.8	4200.6	4177	4051.4	3986.2	3900.4	3794.6	3782.2	3533.6	3442.8	3306.2	3283	3246.4
5232.2	4546.2	4456	4439.4	4373.4	4063.8	4007.6	3984	3858.4	3793.2	3707.4	3601.6	3589.2	3340.6	3249.8	3113.2	3090	3053.4
4790.6	4104.6	4014.4	3997.8	3931.8	3622.2	3566	3542.4	3416.8	3351.6	3265.8	3160	3147.6	2899	2808.2	2671.6	2648.4	2611.8
4599	3913	3822.8	3806.2	3740.2	3430.6	3374.4	3350.8	3225.2	3160	3074.2	2968.4	2956	2707.4	2616.6	2480	2456.8	2420.2
4370.2	3684.2	3594	3577.4	3511.4	3201.8	3145.6	3122	2996.4	2931.2	2845.4	2739.6	2727.2	2478.6	2387.8	2251.2	2228	2191.4
3960.6	3274.6	3184.4	3167.8	3101.8	2792.2	2736	2712.4	2586.8	2521.6	2435.8	2330	2317.6	2069	1978.2	1841.6	1818.4	1781.8
3404	2718	2627.8	2611.2	2545.2	2235.6	2179.4	2155.8	2030.2	1965	1879.2	1773.4	1761	1512.4	1421.6	1285	1261.8	1225.2

3390.4	2704.4	2614.2	2597.6	2531.6	2222	2165.8	2142.2	2016.6	1951.4	1865.6	1759.8	1747.4	1498.8	1408	1271.4	1248.2	1211.6
3322	2636	2545.8	2529.2	2463.2	2153.6	2097.4	2073.8	1948.2	1883	1797.2	1691.4	1679	1430.4	1339.6	1203	1179.8	1143.2
3060.2	2374.2	2284	2267.4	2201.4	1891.8	1835.6	1812	1686.4	1621.2	1535.4	1429.6	1417.2	1168.6	1077.8	941.2	918	881.4
2866	2180	2089.8	2073.2	2007.2	1697.6	1641.4	1617.8	1492.2	1427	1341.2	1235.4	1223	974.4	883.6	747	723.8	687.2
2667.2	1981.2	1891	1874.4	1808.4	1498.8	1442.6	1419	1293.4	1228.2	1142.4	1036.6	1024.2	775.6	684.8	548.2	525	488.4
2503	1817	1726.8	1710.2	1644.2	1334.6	1278.4	1254.8	1129.2	1064	978.2	872.4	860	611.4	520.6	384	360.8	324.2
2468	1782	1691.8	1675.2	1609.2	1299.6	1243.4	1219.8	1094.2	1029	943.2	837.4	825	576.4	485.6	349	325.8	289.2
2422.2	1736.2	1646	1629.4	1563.4	1253.8	1197.6	1174	1048.4	983.2	897.4	791.6	779.2	530.6	439.8	303.2	280	243.4
2326.2	1640.2	1550	1533.4	1467.4	1157.8	1101.6	1078	952.4	887.2	801.4	695.6	683.2	434.6	343.8	207.2	184	147.4
2303.6	1617.6	1527.4	1510.8	1444.8	1135.2	1079	1055.4	929.8	864.6	778.8	673	660.6	412	321.2	184.6	161.4	124.8
2178.8	1492.8	1402.6	1386	1320	1010.4	954.2	930.6	805	739.8	654	548.2	535.8	287.2	196.4	59.8	36.6	0
2142.2	1456.2	1366	1349.4	1283.4	973.8	917.6	894	768.4	703.2	617.4	511.6	499.2	250.6	159.8	23.2	0	
2119	1433	1342.8	1326.2	1260.2	950.6	894.4	870.8	745.2	680	594.2	488.4	476	227.4	136.6	0		
1982.4	1296.4	1206.2	1189.6	1123.6	814	757.8	734.2	608.6	543.4	457.6	351.8	339.4	90.8	0			
1891.6	1205.6	1115.4	1098.8	1032.8	723.2	667	643.4	517.8	452.6	366.8	261	248.6	0				
1643	957	866.8	850.2	784.2	474.6	418.4	394.8	269.2	204	118.2	12.4	0					
1630.6	944.6	854.4	837.8	771.8	462.2	406	382.4	256.8	191.6	105.8	0						
1524.8	838.8	748.6	732	666	356.4	300.2	276.6	151	85.8	0							
1439	753	662.8	646.2	580.2	270.6	214.4	190.8	65.2	0								
1373.8	687.8	597.6	581	515	205.4	149.2	125.6	0									
1248.2	562.2	472	455.4	389.4	79.8	23.6	0										
1224.6	538.6	448.4	431.8	365.8	56.2	0											
1168.4	482.4	392.2	375.6	309.6	0												
858.8	172.8	82.6	66	0													
792.8	106.8	16.6	0														
776.2	90.2	0															
686	0																

Mean	LSD 0.05 = 2287.89487294																
68933.6	62311.8	62017.8	61852.2	61416.6	61248.2	60761.2	60564.8	59476.4	59449	59069	58806.8	58504.6	58435	58416.6	57094.2	55876.8	54937.4
65487	58865.2	58571.2	58405.6	57970	57801.6	57314.6	57118.2	56029.8	56002.4	55622.4	55360.2	55058	54988.4	54970	53647.6	52430.2	51490.8
60972.4	54350.6	54056.6	53891	53455.4	53287	52800	52603.6	51515.2	51487.8	51107.8	50845.6	50543.4	50473.8	50455.4	49133	47915.6	46976.2
48485.4	41863.6	41569.6	41404	40968.4	40800	40313	40116.6	39028.2	39000.8	38620.8	38358.6	38056.4	37986.8	37968.4	36646	35428.6	34489.2
44651.2	38029.4	37735.4	37569.8	37134.2	36965.8	36478.8	36282.4	35194	35166.6	34786.6	34524.4	34222.2	34152.6	34134.2	32811.8	31594.4	30655
27112.2	20490.4	20196.4	20030.8	19595.2	19426.8	18939.8	18743.4	17655	17627.6	17247.6	16985.4	16683.2	16613.6	16595.2	15272.8	14055.4	13116
24358.4	17736.6	17442.6	17277	16841.4	16673	16186	15989.6	14901.2	14873.8	14493.8	14231.6	13929.4	13859.8	13841.4	12519	11301.6	10362.2
21807.2	15185.4	14891.4	14725.8	14290.2	14121.8	13634.8	13438.4	12350	12322.6	11942.6	11680.4	11378.2	11308.6	11290.2	9967.8	8750.4	7811
14450.4	7828.6	7534.6	7369	6933.4	6765	6278	6081.6	4993.2	4965.8	4585.8	4323.6	4021.4	3951.8	3933.4	2611	1393.6	454.2
13996.2	7374.4	7080.4	6914.8	6479.2	6310.8	5823.8	5627.4	4539	4511.6	4131.6	3869.4	3567.2	3497.6	3479.2	2156.8	939.4	0
13056.8	6435	6141	5975.4	5539.8	5371.4	4884.4	4688	3599.6	3572.2	3192.2	2930	2627.8	2558.2	2539.8	1217.4	0	
11839.4	5217.6	4923.6	4758	4322.4	4154	3667	3470.6	2382.2	2354.8	1974.8	1712.6	1410.4	1340.8	1322.4	0		
10517	3895.2	3601.2	3435.6	3000	2831.6	2344.6	2148.2	1059.8	1032.4	652.4	390.2	88	18.4	0			
10498.6	3876.8	3582.8	3417.2	2981.6	2813.2	2326.2	2129.8	1041.4	1014	634	371.8	69.6	0				
10429	3807.2	3513.2	3347.6	2912	2743.6	2256.6	2060.2	971.8	944.4	564.4	302.2	0					
10126.8	3505	3211	3045.4	2609.8	2441.4	1954.4	1758	669.6	642.2	262.2	0						
9864.6	3242.8	2948.8	2783.2	2347.6	2179.2	1692.2	1495.8	407.4	380	0							
9484.6	2862.8	2568.8	2403.2	1967.6	1799.2	1312.2	1115.8	27.4	0								
9457.2	2835.4	2541.4	2375.8	1940.2	1771.8	1284.8	1088.4	0									
8368.8	1747	1453	1287.4	851.8	683.4	196.4	0										
8172.4	1550.6	1256.6	1091	655.4	487	0											
7685.4	1063.6	769.6	604	168.4	0												
7517	895.2	601.2	435.6	0													
7081.4	459.6	165.6	0														
6915.8	294	0															
6621.8	0																

Mean	LSD 0.05 = 2287.89487294							
68933.6	54483.2	47126.4	44575.2	41821.4	24282.4	20448.2	7961.2	3446.6
65487	51036.6	43679.8	41128.6	38374.8	20835.8	17001.6	4514.6	0
60972.4	46522	39165.2	36614	33860.2	16321.2	12487	0	
48485.4	34035	26678.2	24127	21373.2	3834.2	0		
44651.2	30200.8	22844	20292.8	17539	0			
27112.2	12661.8	5305	2753.8	0				
24358.4	9908	2551.2	0					
21807.2	7356.8	0						
14450.4	0							

5. Conclusions

We conclude from this research several things, the most important of which are:

1. Through the outcomes of the ANOVA table, there were statistically significant differences between the central and southern Iraqi governorates (Diala, Baghdad, Babylon, Kerbala, Wasit, Al-Najaf, Al-Qadisiya, Al-Muthanna, Thi-Qar, Mysan, and Basrah) in terms of their impact on the quantities of date production.
2. There are statistically significant differences between the varieties of dates (Zahdi, Khistawei, Sayer, Khadrawi, Hillawi, Deary, and Other) in terms of their impact on the quantities of production.
3. There are statistically significant differences in the joint interaction between the factor of Iraqi governorates and the factor of varieties of dates in terms of their impact on the quantities of production.
4. The results of the Least Significant Difference (LSD) test for the main factor (A) represented by the Iraqi governorates showed that the majority of the differences gave calculated values greater than the tabulated value of the LSD test at a significance level of 0.05. This denotes the existence of substantial disparities between the means, meaning that most of the Iraqi governorates have an effective effect in increasing the quantities of production of dates in Iraq from other governorates with which they were compared. For example, when taking the difference between the means of Baghdad Governorate and the means of other governorates, all differences appeared significant, meaning that Baghdad Governorate is one of the governorates that has an effective impact in increasing the quantities of date production of its various types, while some differences showed lower calculated values From the tabular value of the LSD test, which was determined and shaded in the table above, this denotes that there are no significant distinctions between them, meaning that the two governorates are equivalent in affecting the production quantities of dates of their different varieties.
5. The results of the Least Significant Difference (LSD) test for the secondary factor B) represented by the seven date varieties (Zahdi, Khistawi, Sayer, Khadrawi, Hillawi, Deary, and other types) showed that the majority of the differences gave calculated values greater than the tabulated value of the LSD test at a significance level of 0.05. This indicates that there are significant differences between the means, meaning that some varieties of dates are produced in large quantities compared to the other varieties that were compared with them. For example, when taking the difference between the means of the Al-Zahdi variety and the means of the other varieties, all differences appeared significant, meaning that the Al-Zahdi variety is one of the varieties that is produced in large quantities, while some differences appeared. The computed values are inferior to the tabulated value of the LSD test, as indicated and highlighted in the aforementioned table. This indicates that there are no substantial differences between them, signifying that the two varieties are comparable in their impact on amounts of date output in Iraq.
6. The outcomes of the Least Significant Difference (LSD) test for the joint relationship between the primary component A and the secondary component B indicated that most differences yielded computed values exceeding the tabulated LSD value at a significance level of 0.05. This indicates substantial disparities between the means, signifying that the combined interaction of the two elements significantly influences the enhancement of date production quantities. Some discrepancies exhibited computed values lower than the tabulated LSD test value, indicating no significant differences between them, therefore suggesting equivalence in their impact on date production amounts.

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دراسة تحليلية عن إنتاج التمور في محافظات العراق باستخدام تصميم القطع المنشقة

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المستخلص

تعد التمور من أهم الموارد الوطنية لما لها من فوائد صحية عديدة وقيمة اقتصادية كبيرة، في السنوات الأخيرة تراجعت أهميتها بسبب انخفاض كميات إنتاجها ويعود ذلك إلى عدة عوامل منها عدم الاهتمام بزراعة النخيل والظروف التي مرت بها بعض المحافظات مما أدى إلى تباين واضح في الإنتاج بينها، لذا يركز هذا البحث على مقارنة محافظات وسط وجنوب العراق وهي (ديالى وبغداد وبابل وكربلاء وواسط والنجف والقادسية والمثنى وذي قار وميسان والبصرة) من حيث متوسط إنتاج كل صنف من أصناف النخيل (زهدي، خستاوي، ساير، خضراوي، حلاوي، ديري، أنواع أخرى) خلال فترات متعاقبة (2016-2020)، حيث تم استخدام تصميم القطع المنشقة (Split Plot Design) وهو أحد تصاميم التجارب العاملية التي تتضمن عاملين أو أكثر، توصل البحث إلى وجود فروق معنوية بين المحافظات العراقية من حيث كميات إنتاج النخيل والأصناف.

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