PLS100BL : Lab 7
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Fruit Load Experiment

Aditya Nirgun 999723427

Introduction and Background

As the resulting morphology of successfully fertilized pistils in flowers, fruits are characteristic to angiosperms. Any given fruit contains a seed that is enveloped by an ovule which provides protection and enables dispersal. Fruiting plants invest energy to develop their reproductive structures and given the evolutionary importance of reproduction it is likely that fruit development is a major priority resource sink. This diversion of resources might have some bearing on the progress of a plant's overall vegetative growth, which could be modulated significantly per fruit. Controlling the number of fruit per plant, a value otherwise known as fruit load, could quantify this possible connection within data collected on stem, leaf and fruit quantity and weight.

Methods

On January 10th, 18 tomato plants were trimmed and planted inside the Bowley greenhouse. The 18 plants were divided into three treatments of 6 replicants each. One group was designated to have no development of fruit as a control, the next was allowed one fruit per truss, and in the third the development of fruit was uninhibited. Over the course of seven weeks, the tomato plants in groups 2 and 3 were pollinated at the first sign of flowering according to the treatments (in group 2, only one flower per truss was pollinated).
At the end of seven weeks, the plants were harvested for stems, leaves, and fruit and totals for quantity were recorded. Total fresh weights for each plant structure pile was also documented that day. One week later, after drying, the groups of plant parts were again weighed for dry weight.

Results

All counts and measurements were tabulated. The means and first standard deviations of replicates for each treatment were calculated and presented graphically. In the event that the error bars generated from the standard deviations didn't provide enough evidence to dismiss or confirm the effect of fruit load on the variation in the data, a statistical test was intended to be utilized. The difference of means t test was the statistical significance test chosen to best

analyze data in this situation. The null hypothesis stated that the true mean difference between the means being compared is zero, meaning that the treatment had no significant effect. The alternative hypothesis stated that the difference in means is nonzero, meaning the difference in means had a low likelihood of being caused by random variation. The standard deviations and error bars ended up being sufficient for the analysis in the end.

Treatment	Group/ Replica	Leaf Number (LN)	Stem number (SN)	Fruit number (FN)	Leaf fresh weight (LFW)	Stem fresh weight (SFW)	Fruit fresh weight (FFW)	Total fresh weight	Leaf dry weight (LDW)	Stem dry weight (SDW)	Fruit dry weight (FDW)	Total dry weight
0 (zero fruits)	1	96	24	0	633.5	149.5	0	783	65.5	17.5	0	83
	2	71	6	0	849.5	154	0	1003.5	84	17	0	101
	3	107	13	0	687	186	0	873	70.8	20.3	0	91.1
	4	65	12	0	655.7	178.1	0	833.8	67	20	0	87
	5	151	22	0	596.8	129.5	0	726.3	65.4	18.4	0	83.8
	6	109		0	746.6	184.1	0	930.7	86.5	23.5	0	110
	Average	**99.8**	**15.4**	**0**	**694.85**	**163.5333**	**0**	**858.3833**	**73.2**	**19.45**	**0**	**92.65**
1 (one fruit per truss)	1	79	8	21	537.8	141.4	278.8	958	59.5	21	23	103.5
	2	89	12	16	636	144	154.8	934.8	63.5	17	12.5	93
	3	100	12	40	615.8	216.8	140.2	972.8	63.7	19.7	11.1	94.5
	4	64	9	23	507.3	137	216.5	860.8	55	18.5	17.5	91
	5	92	20	14	706	180.4	147.5	1033.9	78.1	23.6	12.1	113.8
	6	137	9	18	523	9	236.5	768.5	57	18.5	17	92.5
	Average	**93.5**	**11.7**	**22**	**587.65**	**138.1**	**195.7167**	**921.4667**	**62.8**	**19.7167**	**15.5333**	**98.05**
All fruits	1	56	7	50	408.6	77.7	416.4	902.7	48.5	15.5	27	91
	2	57	7	61	546	134	592.9	1272.9	55.5	16	32.5	104
	3	51	5	65	361	93	448	902	38.8	12.9	30.2	81.9
	4	42	6	28	355.7	78.5	482.6	916.8	42.5	13	38.5	94
	5	41	7	43	413.7	128.5	598	1140.2	46.7	18.6	38.4	103.7
	6	67	11	59	404	127	592	1123	45	16	38	99
	Average	**52.3**	**7.2**	**51**	**414.8333**	**106.45**	**521.65**	**1042.933**	**46.1667**	**15.3333**	**34.1**	**95.6**

Figure 1: The data collection for the experiment is tabulated above.

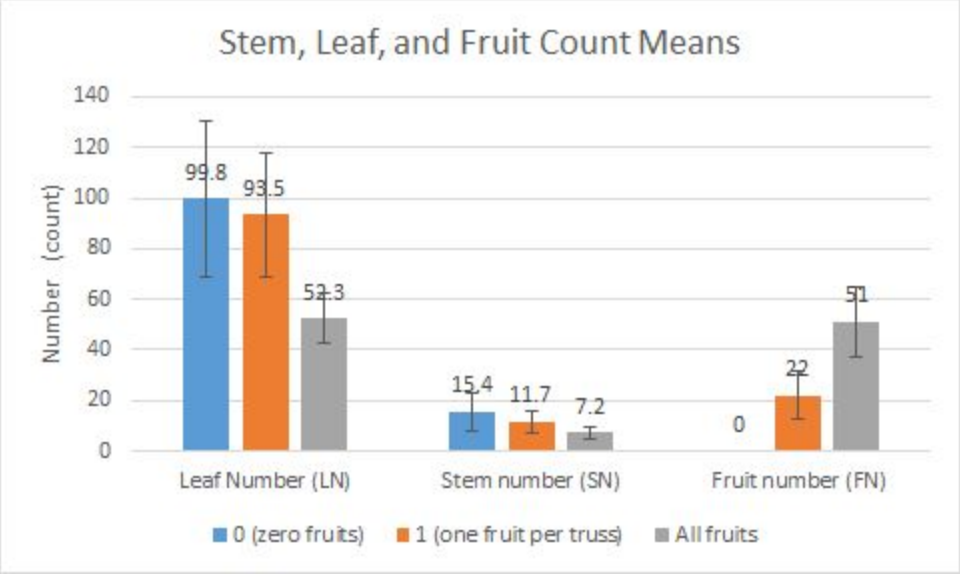

Figure 2: The bar graph above contains the average number of leaves, stems, and fruits on a plant from each treatment.

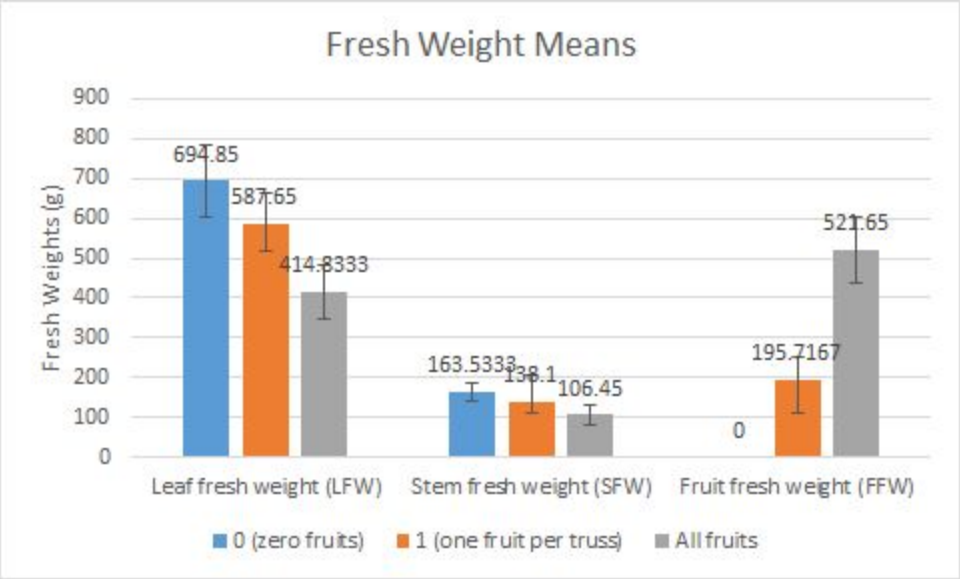

Figure 3: The data collected from the fresh weight measurements on the day of harvest on week 7 are displayed as averages in the bar graph above.

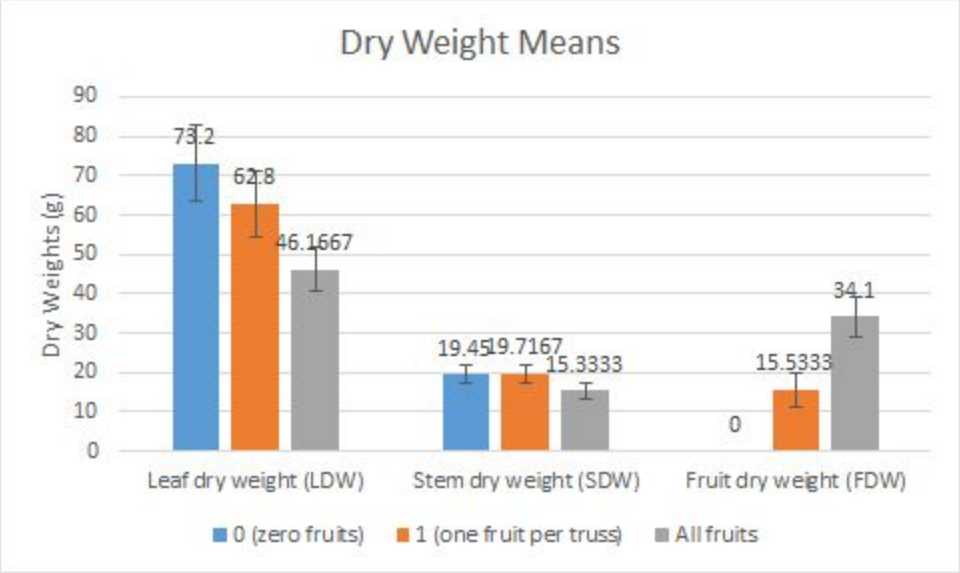

Figure 4: A week after the harvest, the dry weight measurements were recorded and the averages are found in the bar graph above.

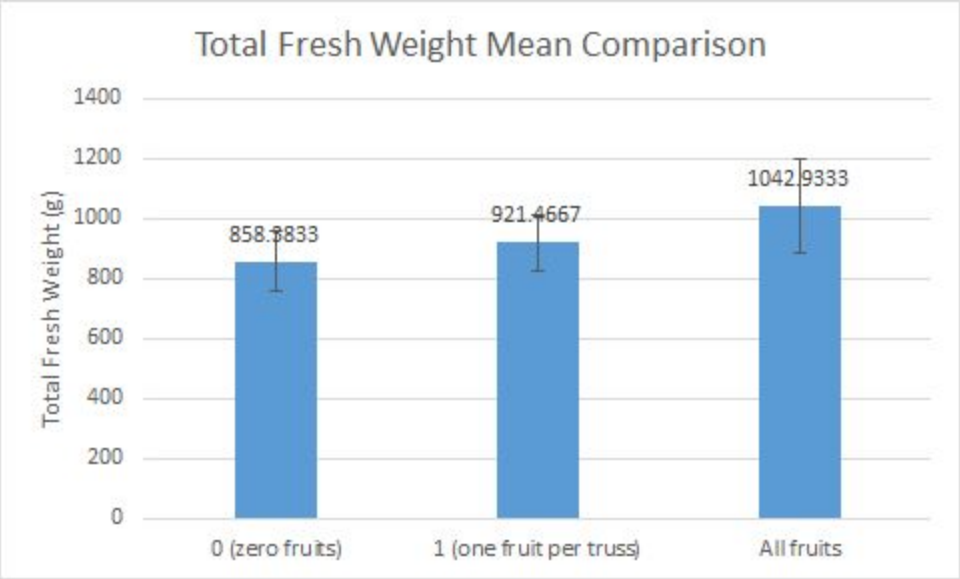

Figure 5: Total Fresh Weight measured on the day of the harvest is depicted above.

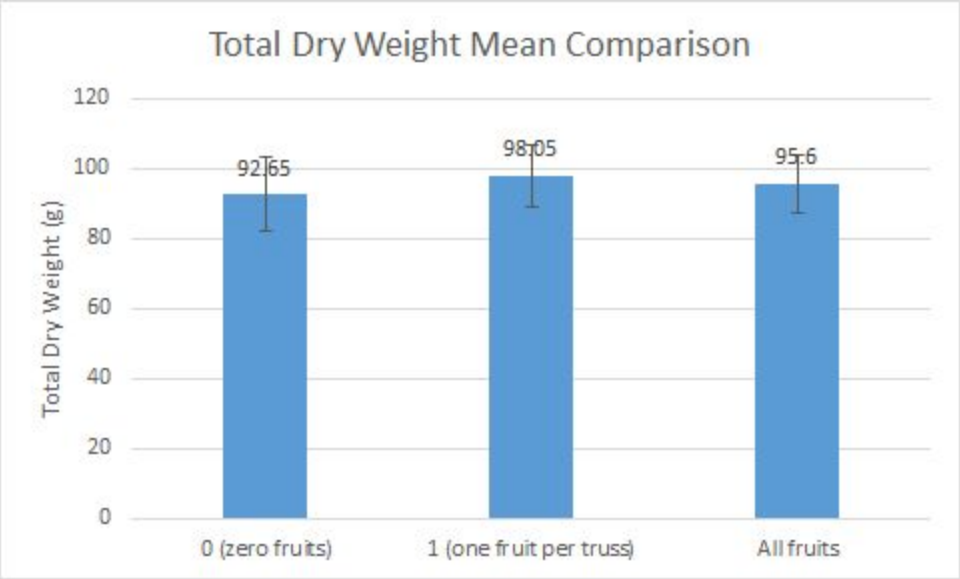

Figure 6: After drying for a week, the plant material was weighed and the results were as they appear above.

Discussion

The data that was presented by our results suffers from large margins of error and insignificant differences between many of the treatments. As expected from a low resolution unit, the counts for leaf and stem number had the highest error margins of all the data. No data from the stem counts could be used as evidence of fruit load effects but the leaf count for the all-fruit treatment is lower than a large standard deviation from the mean of the leaf count on subjects of the zero-fruit treatment. This could be indicative of fruit load affecting total leaf count. Fresh and dry

weight data appeared to be similar in its relations between treatments. Leaves appeared to demonstrate a relationship with fruit load as average leaf weight increased regularly from all-fruit, to one-fruit, to no-fruit treatment. Stem dry weight did not exhibit the same correlation as one-fruit treatment reported the highest average dry weight. This average however still falls under high error margins of all the treatments so no conclusive remarks can be made for the stem dry weight data. The total fresh and dry weight averages were even less significant without the partitioning of plant components. No average demonstrated a clear lead over the others in these bar graphs. As expected, fruit number and weight was greatest on the all-fruit treatment. Overall, the strongest observation we can make from this data appears to be that complete fruit removal correlates with some leaf growth. This is compatible with our readings and background information concerning the presence of fruit as a sink for internal plant resources and products. The removal of fruit succeeding in promoting leaf growth could lead to greater vegetative growth and would thusly be a principle useful to some crop production. To obtain more significant results, it would be necessary to increase sample sizes and it might be helpful to increase the number of treatments to include a range of fruit counts between complete fruit removal, partial fruit removal, and no removal.