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The Size of the Uniformity Trial Affects the Accuracy of Plot Size Estimation in Eggplant

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Abstract

The plot size estimation is based on uniformity trials, however little is known about and how the size of uniformity trial affects the estimate of the plot size. That way, the aim of this study was to determine the influence of uniformity trial size on the estimation of plot size in the eggplant crop. Two uniformity trials were performed with the eggplant culture in a plastic tunnel. The fresh mass of fruit and number of fruits were assessed in six harvests, with a seven-day interval between harvests. For each trial (Tunnel 1 and 2), 25 uniformity trials of different sizes were simulated (3, 4, 5, … 28 BEU) per harvest and harvest row (individual and grouped) since they presented heteroscedasticity. For each planned uniformity trial, bootstrap procedure was used to estimate 3,000 plot sizes by the maximum coefficient of variation curvature method. The mean and 95% confidence interval width was calculated by the difference between the 97.5th and 2.5th percentiles. The AIC95% and plot size averages were higher in individual harvests than grouped harvests. As the size of the simulated uniformity trial increased, it was verified a reduction of the AIC95% of the plot size. However, the mean plot size did not change with increasing uniformity trial size. In this way, it is possible to state that the size of the uniformity trial affects accuracy the plot size estimation because trials with few numbers of basic experimental units present high experimental variability and inaccurate estimates.

Keywords: bootstrap, experimental planning, experimental variability, *Solanum melongena* L.

1. Introduction

The experimental design aims to ensure the experimental accuracy and credibility of the results generated by the research (Lúcio & Benz, 2017). Correct choice of plot size is an important step of experimental planning aiming at increasing the accuracy and reliability of the results generated in the experiments and, at the same time, reducing the use of material, financial and human resources (Lúcio et al., 2016).

The estimation of plot size is based on uniformity trials without treatments (Schwertner et al., 2015a; Schwertner et al., 2015b) and depends directly on the magnitude of the experimental variability (Lúcio & Benz, 2017). The variability of the data in multiple-harvests horticultural crops, such as *Solanum melongena* L., is related to several factors such as (i) heterogeneity of soil fertility; (ii) intensive management; (iii) uneven application irrigation and fertilizers; (iv) occurrence of pests, diseases, and weeds; (v) uneven maturity of fruits; (vi) presence or absence of suitable fruits to be harvested in a given harvest (Lúcio & Sari, 2017; Krysczun et al., 2018).

Several studies are found in the literature aiming at estimating the plot size for horticultural crops such as pepper (Lorentz et al., 2005; Lorentz & Lúcio, 2009), Italian zucchini (Carpes et al., 2010), tomato (Lúcio et al., 2011), bean (Santos et al., 2012), radish (Silva et al., 2002), cherry tomato (Lúcio et al., 2016) and broccoli (Brum et al., 2016). However, in these studies the authors did not have the concern to investigate the accuracy of the plot size estimates obtained in the uniformity trials.

The influence of size of the uniformity trial size on plot size estimation was studied in the potato crop (Storck et al., 2006) who have concluded that the size of the uniformity trial did not influence the plot size estimation. On the other hand, studies that evaluated turnip forage (Cargnelutti Filho et al., 2011), tomato, green beans and Italian zucchini (Schwertner et al., 2015a) and lettuce and pepper (Schwertner et al., 2015b) pointed out that uniformity trials with a few number of basic experimental units (BEU) lead to inaccurate estimates of plot size, and it is important to elucidate the influence of uniformity trial size on plot size estimation.

Information regarding the effect of size of uniformity trial on plot size estimates are scarce for the eggplant crop, thus, there would seem to be value in an investigation to clarify this problem. Based on the observed evidences, our hypothesis is that uniformity trials with few basic experimental units present high variability, reducing the accuracy of plot size estimation. In this context, the aim of this study was to determine the influence of uniformity trial size on the estimation of plot size in the eggplant crop.

2. Method

2.1 Growth Conditions and Experimental Design

Two uniformity trials were conducted with the eggplant crop in the city of Santa Maria, Rio Grande of Sul, Brazil (S: 29°42′23″ W: 53°43'15″ and 95 m above sea level). The climate of the region is Cfa according to the Alvares et al. (2013). The soil of the experimental area is classified as Alfisols (Soil Survey Staff, 1999).

The trials were carried out in the third week of October and were performed in two plastic tunnels (20-m long, 5-m wide and 3-m high central foot) covered with 150-µm tick low-density polyethylene film with anti-UV protection. The cultivar used was the "Longe Purple", and in both trials the plants were arranged in three cultivation rows (R1, R2 and R3) spaced at 1-m. Each row had 28 plants spaced at 0.7-m where each plant was considered an BEU.

The chemical fertilization was carried out according to the soil analysis and recommendation of fertilization of the eggplant crop. The irrigation was performed by a drip system with one drip tube each row and emitters spaced at 0.30-m. The nominal hydraulic pressure of the system was 8-m of water column providing a water flow of 3.4 l h^{-1} $emitter^{-1}$. Thus, it was possible to obtain a continuous wetting width. Both the irrigation interval and the amount of water to be applied were estimated according to evapotranspiration of eggplant (mm day^{-1}) and stages phenological (Appendix A), respectively, considering the technical information of the irrigation system. All other cultural practices were carried out according to the culture's recommendation.

The fruits were harvested when they had approximately 18-cm length, with a bright color and soft pulp. The fruits harvested in each BEU (plant) were weighing in an analytical balance.

Six harvests were carried out with an interval of seven days between harvests. In each harvest, the fresh mass of fruit (FMF, in g $plant^{-1}$) and the number of fruits (NF, $plant^{-1}$) were assessed in each BEU. The harvests were analyzed individually (H1, H2, H3, H4, H5 and H6) and grouped (H1 + H2, H1 + H2 + H3, H1 + H2 + H3 + H4, H1 + H2 + H3 + H4 + H5 and H1 + H2 + H3 + H4 + H5 + H6), where each ordinal number corresponds to one harvest.

2.2 Statistical Analysis

For both assessed variables and analyzed harvests (individually and grouped), between and within-row variance homogeneity was analyzed by Bartlett's test (Bartlett, 1937) since the data followed normal distribution according to the previous Shapiro-Wilk test (Shapiro & Wilk, 1965). For both tunnels, cultivation row, harvests (individually and grouped) and assessed variables, the following statistics were estimated for each BEU: minimum, average, maximum, percentage of plants with zero values and coefficient of variation (CV%).

For each variable, cultivation row and harvests (individually and grouped), 25 UTs of sizes 3, 4, … 28 BEU were planned, since it was observed heteroscedasticity between the harvests. For each planned uniformity trial, 3,000 plot sizes were estimated by using bootstrap procedure with replacement. For this, a plant was randomly selected in each cultivation row and the adjacent plants were used to setup the uniformity trial. For example, considering a planned uniformity trial of three BEU, let $S = \{1, 2, \dots 28\}$ be the sample space to be sampled; assuming that the sampled BEU was the BEU 3, then the first uniformity trial would consist of the BEUs {3, 4, and 5}. In the second bootstrap cycle, a new BEU was randomly selected, and assuming that the selected BEU was the BEU 23, the uniformity trial would consist of the BEUs {23, 24 and 25}. The same procedure was followed for the remaining 2,998 cycles with three BEUs and the other planned uniformity trials.

For each bootstrap cycle, the plot sizes were estimated by the maximum curvature method of the coefficient of variation proposed by Paranaiba et al. (2009):

$$\hat{X}_0 = \frac{10\sqrt[3]{2(1-\hat{\rho}^2)s^2\overline{Y}}}{\overline{Y}} \tag{1}$$

where, $\hat{X}_0$: is the plot size; s^2: is the variance of the sample; $\overline{Y}$: is the mean of the BEUs; $\hat{\rho}$: is the first-order spatial autocorrelation, estimated by the equation:

$$\hat{\rho} = \frac{\sum_{i=1}^{rc}(\hat{\varepsilon}_i - \overline{\varepsilon})(\hat{\varepsilon}_{i-1} - \overline{\varepsilon})}{\sum_{i=1}^{rc}(\hat{\varepsilon}_i - \overline{\varepsilon})^2} \tag{2}$$

where, $\hat{\varepsilon}$ is the experimental error associated with each observation.

For each one of the 3300 different scenarios {25 UTs × 3 cultivation rows × 2 tunnels × 2 variables × 11 harvests (individually and grouped)} the following statistics were calculated with the 3000 values of PS ($\hat{X}_0$) estimated by the bootstrap procedures: mean and amplitude of the 95% confidence interval (AIC95%). The AIC95% was estimated by the difference between the 97.5th and 2.5th percentiles. The size of the uniformity trial (in BEU) was determined starting from the initial uniformity trial size (three BEU) and considering as the sufficient uniformity trial size the number of BEUs from which the AIC95% was less than or equal to two BEUs. The uniformity trial size determined from *bootstrap* confidence intervals, with replacement, is a suitable procedure, mainly because it is independent of the probability distribution of the data (Ferreira, 2009). All analyzes were performed using the R 3.4.2 software (R Core Team, 2017).

3. Results

3.1 Variance Homogeneity

The analyzes revealed heterogeneous variances for the analyzed variables between the crop rows considering individual harvest in both tunnels. Thus, when the harvests were grouped, there was no heteroscedasticity.

3.2 Estimates of Descriptive Statistics

Analyzing the individual harvests, it can be seen high percentages of plants with zeros values, reaching 46% in tunnel 1 and 42% in tunnel 2, and high CV in relation to the grouped harvests, for all variables, cultivation rows and tunnels (Tables 1 and 2).

Considering the individual harvests, the maximum and minimum number of fruits were eight and zero fruits per plant^{-1}, respectively (Table 1). For the grouped harvests, these values were 20 and 3 fruits per plant^{-1}, respectively.

Table 1. Estimates of the statistics minimum values (Min), maximum values (Max), percentage of zero (% of 0), coefficient of variation (CV%) and mean of number of fruits obtained in the individual and grouped harvests in the two plastic tunnels

Row	Harvests	Tunnel 1					Tunnel 2				
		Max	Min	% of 0	CV%	Mean	Max	Min	% of 0	CV%	Mean
1	H1	3	1	0	37	1.86	2	0	4	33	1.67
	H2	4	0	11	58	1.71	4	0	14	75	1.71
	H3	2	0	39	98	0.71	3	0	32	95	0.88
	H4	4	0	25	72	1.82	5	0	4	48	2.42
	H5	8	0	14	66	3.18	4	0	4	43	2.21
	H6	3	0	25	79	1.18	5	0	14	68	2.13
	H1+H2	6	1	0	35	3.57	6	0	4	45	3.38
	H1+H2+H3	7	1	0	33	4.29	8	0	4	40	4.25
	H1+H2+H3+H4	10	1	0	35	6.11	10	3	0	30	6.67
	H1+H2+H3+H4+H5	14	6	0	22	9.29	13	4	0	27	8.88
	H1+H2+H3+H4+H5+H6	16	7	0	22	10.46	18	6	0	23	11.00
2	H1	3	0	4	41	1.89	3	0	11	54	1.64
	H2	4	0	4	44	2.00	3	0	14	61	1.40
	H3	2	0	32	81	0.86	4	0	42	127	0.80
	H4	4	0	7	51	2.25	5	0	14	70	1.96
	H5	4	0	21	77	1.50	4	0	32	90	1.44
	H6	3	0	21	76	1.46	4	0	7	55	2.16
	H1+H2	6	1	0	35	3.89	5	0	7	44	3.04
	H1+H2+H3	8	2	0	32	4.75	9	0	7	50	3.84
	H1+H2+H3+H4	12	4	0	28	7.00	14	1	0	46	5.80
	H1+H2+H3+H4+H5	15	4	0	28	8.50	17	2	0	43	7.24
	H1+H2+H3+H4+H5+H6	16	6	0	27	9.96	20	3	0	38	9.40
3	H1	3	1	0	32	2.00	3	0	21	54	1.74
	H2	3	0	21	69	1.67	4	0	4	42	2.04
	H3	1	0	46	109	0.46	4	0	14	72	1.52
	H4	5	0	14	67	1.92	5	1	0	35	2.96
	H5	5	0	11	67	2.04	3	0	19	76	1.30
	H6	5	0	14	66	2.08	6	0	7	55	2.43
	H1+H2	6	1	0	39	3.67	6	1	0	36	3.78
	H1+H2+H3	7	1	0	39	4.13	9	1	0	37	5.30
	H1+H2+H3+H4	11	3	0	33	6.04	11	4	0	23	8.26
	H1+H2+H3+H4+H5	13	4	0	30	8.08	13	4	0	25	9.57
	H1+H2+H3+H4+H5+H6	17	5	0	26	10.17	18	7	0	23	12.00

Analyzing the fresh mass of fruit in the individual harvests, maximum and minimum fruit production were of 3105 and zero g plant^{-1}, respectively (Table 2). For the grouped harvests (at the end of the productive cycle), these values were of 8015 and 1190 g plant^{-1}, respectively.

By observing the percentage of zeros (Table 1 and 2), for the first grouped harvest (H1 + H2), the percentage of zero was null, that is, no observation with zeros values were observed. Harvesting grouping is a simple and effective way of reducing the variability in the dataset of experiments with multiple-harvests horticultural crops.

Table 2. Estimates of the statistics minimum values (Min), maximum values (Max), percentage of zero (% of 0), coefficient of variation (CV%) and mean of fresh mass of fruits obtained in the individual and grouped harvests in the two plastic tunnels

Row	Harvests	Tunnel 1					Tunnel 2				
		Max	Min	% of 0	CV%	Mean	Max	Min	% of 0	CV%	Mean
1	H1	2045	302	0	38	1078	1551	0	4	48	858
	H2	1655	0	11	64	727	1578	0	14	69	638
	H3	931	0	39	101	293	1088	0	32	102	298
	H4	1780	0	25	74	733	2245	0	4	53	972
	H5	3105	0	14	70	1134	1957	0	4	54	888
	H6	1412	0	25	82	507	2295	0	14	64	972
	H1+H2	3301	574	0	38	1806	2762	0	4	47	1496
	H1+H2+H3	3351	574	0	36	2098	3782	0	4	45	1793
	H1+H2+H3+H4	4844	574	0	36	2832	4177	1116	0	33	2765
	H1+H2+H3+H4+H5	5770	1922	0	24	3966	5847	1507	0	31	3654
	H1+H2+H3+H4+H5+H6	7149	1922	0	25	4473	7701	1896	0	25	4626
2	H1	2228	0	4	51	1130	1470	0	11	53	782
	H2	1824	0	4	46	802	1140	0	14	59	518
	H3	867	0	32	82	332	1378	0	42	128	287
	H4	1605	0	7	53	802	1741	0	14	68	659
	H5	1300	0	21	77	557	1588	0	32	102	513
	H6	1504	0	21	78	615	1644	0	7	51	929
	H1+H2	3331	288	0	40	1931	2361	0	7	41	1300
	H1+H2+H3	4127	633	0	35	2263	3739	0	7	49	1587
	H1+H2+H3+H4	5732	1568	0	31	3064	5480	925	0	44	2246
	H1+H2+H3+H4+H5	6853	1568	0	30	3622	6597	925	0	44	2759
	H1+H2+H3+H4+H5+H6	7243	2468	0	28	4237	8015	1190	0	37	3688
3	H1	1955	437	0	35	1148	1759	0	21	66	823
	H2	1288	0	21	72	631	1423	0	4	57	688
	H3	577	0	46	110	194	1460	0	14	73	556
	H4	1867	0	14	65	771	1838	290	0	45	936
	H5	2019	0	11	73	768	1437	0	19	81	551
	H6	2544	0	14	68	852	2761	0	7	51	1093
	H1+H2	3182	465	0	37	1778	2767	0	0	48	1511
	H1+H2+H3	3532	500	0	36	1972	3908	0	0	48	2067
	H1+H2+H3+H4	4437	1209	0	31	2743	4673	290	0	37	3003
	H1+H2+H3+H4+H5	6204	1767	0	29	3511	5449	736	0	36	3473
	H1+H2+H3+H4+H5+H6	6496	2182	0	26	4362	7918	1635	0	30	4547

3.3 Confidence Interval

The AIC95% and plot size averages were higher in individual harvests than grouped harvests, regardless of the variables, tunnels and cultivation row (Figures 1 to 4). This result is due to the high amounts of observations with null values (% of 0) between the individual crops (Tables 1 and 2).

As the size of the planned uniformity trial increased, it was found that, regardless of the variables, tunnels, cropping rows and harvests (individually and grouped), there was a reduction of the AIC95% of the plot size. However, the mean PS did not change significantly with increasing UT size (Figures 1 to 4).

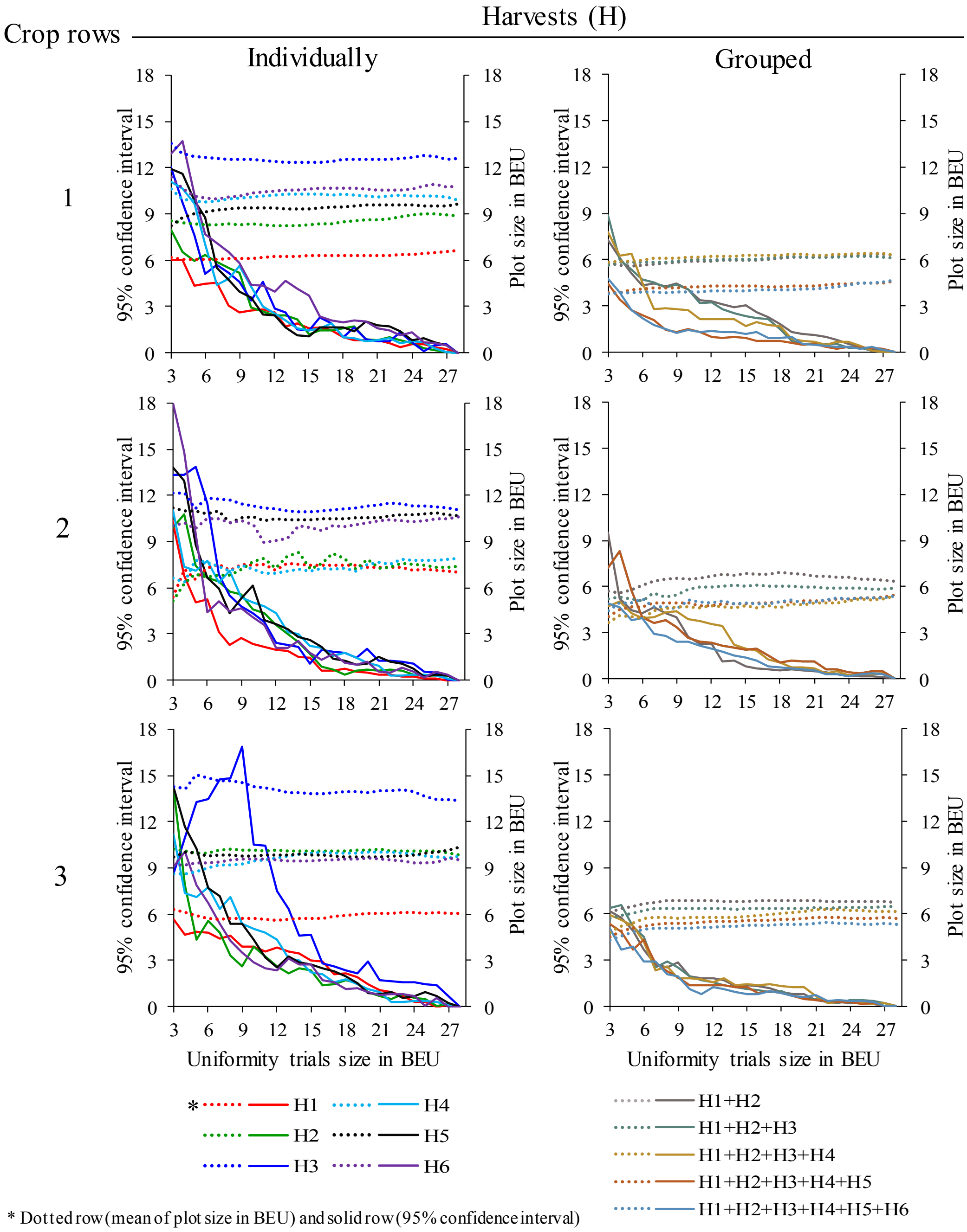

Figure 1. Amplitude of the 95% confidence interval and mean of the 3,000 plot size estimates, in basic experimental unit (BEU), to evaluate the number of fruits in the uniformity trial performed in the plastic tunnel 1

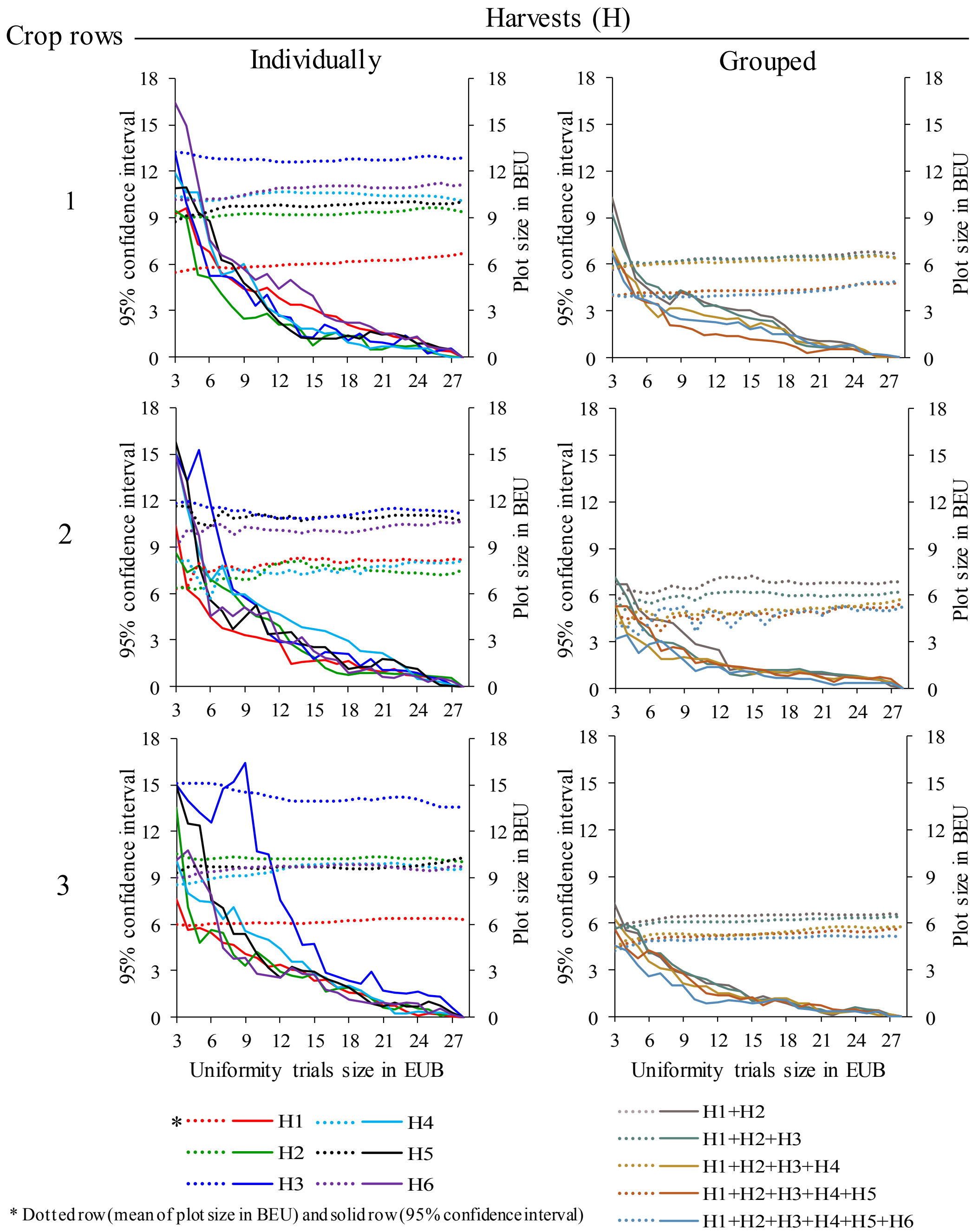

Figure 2. Amplitude of the 95% confidence interval and mean of the 3,000 plot size estimates, in basic experimental unit (BEU), to evaluate the fresh mass of fruit in the uniformity trial performed in the plastic tunnel 1

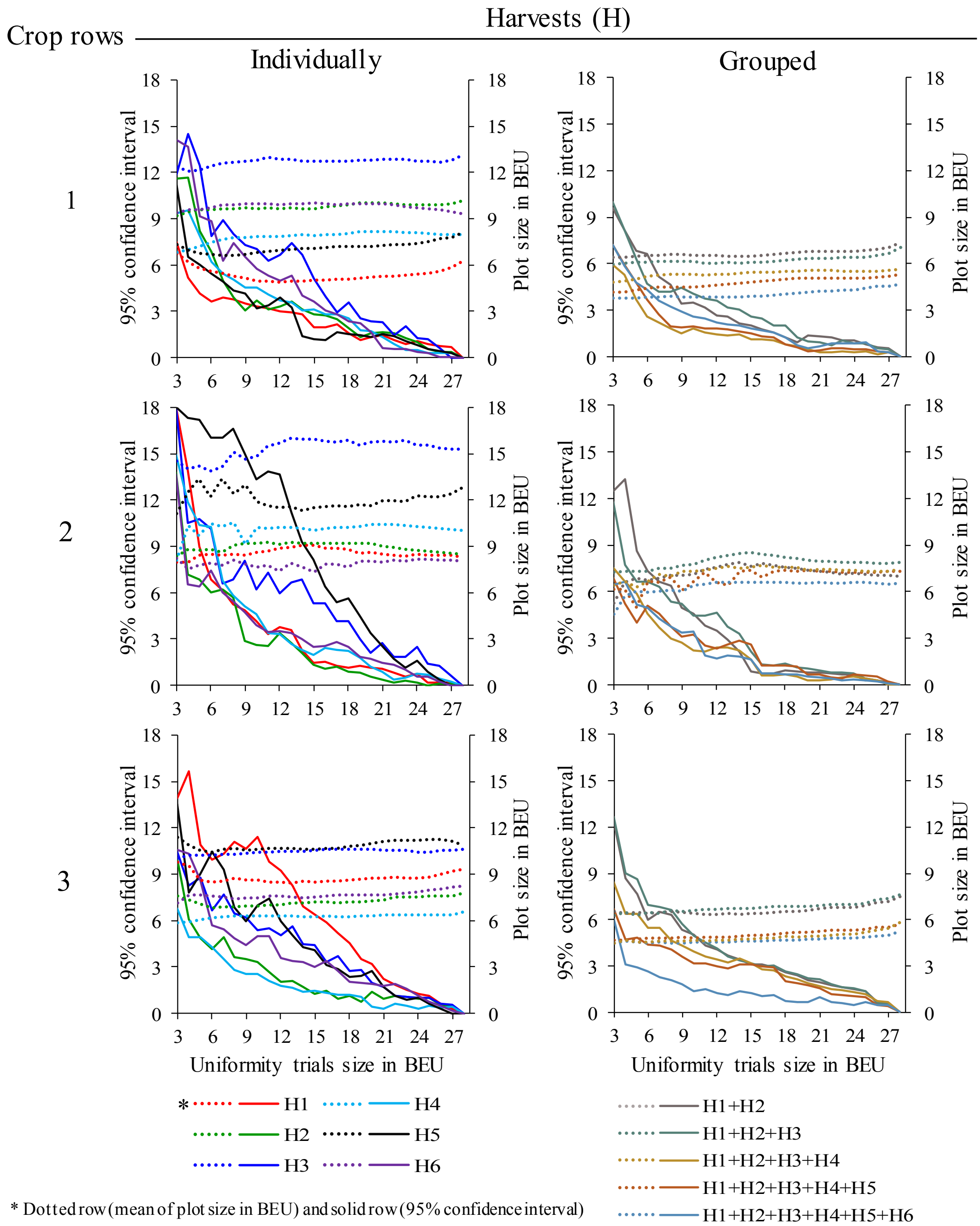

Figure 3. Amplitude of the 95% confidence interval and mean of the 3,000 plot size estimates, in basic experimental unit (BEU), to evaluate the number of fruits in the uniformity trial performed in the plastic tunnel 2

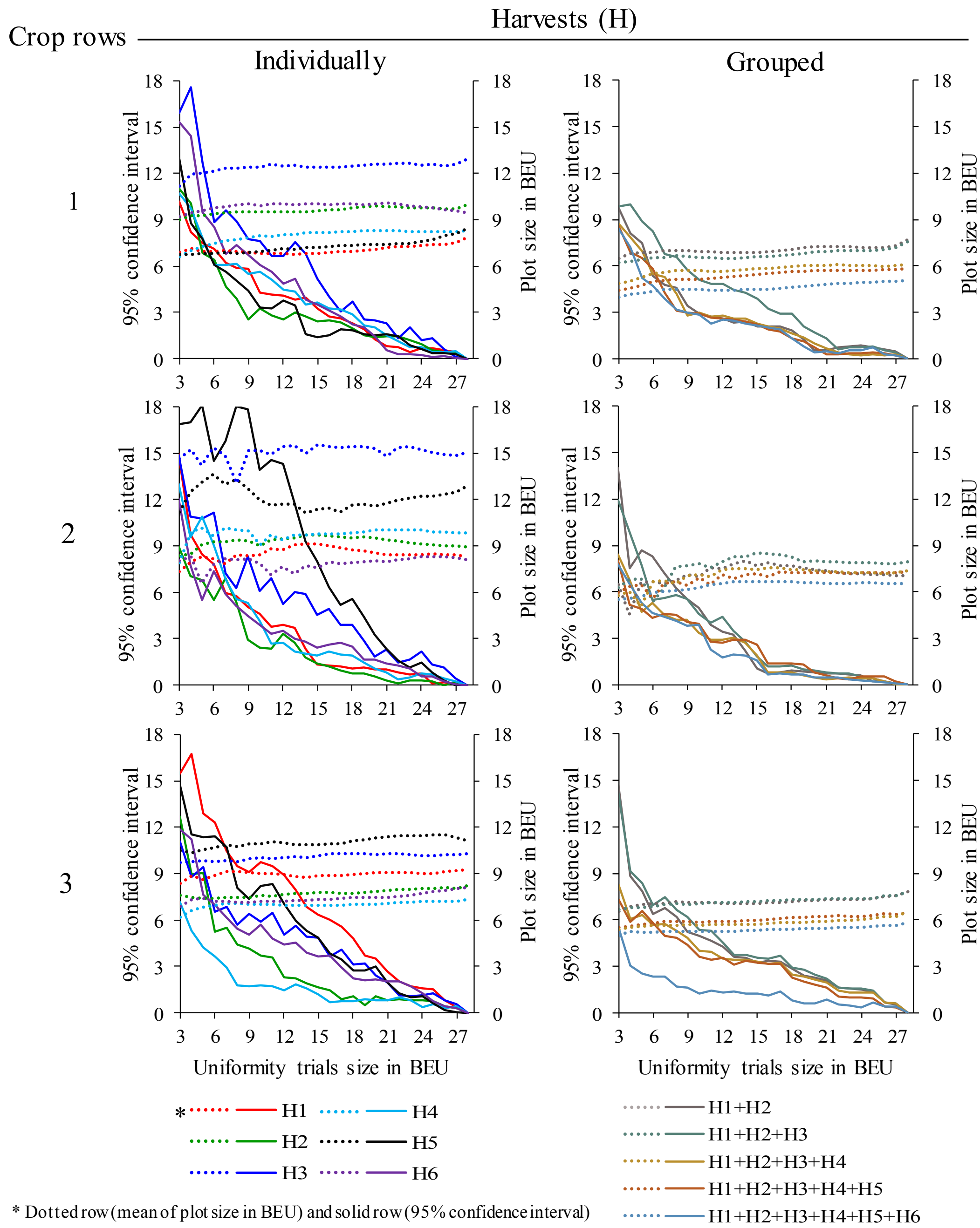

Figure 4. Amplitude of the 95% confidence interval and mean of the 3,000 plot size estimates, in basic experimental unit (BEU), to evaluate the fresh mass of fruit in the uniformity trial performed in the plastic tunnel 2

3.4 Size of the Uniformity Trial

The size of the uniformity trial required to estimate plot size with an AIC95% less than or equal to two BEUs of the mean presented a large variation between the variables, cultivation rows and tunnels (Table 3). However, when the harvests were grouped there is a trend to reduce the sizes of the uniformity trials.

At the individual harvests the size of the uniformity trial ranged from 13 BEU to 25 BEU (for FMF) and 12 BEU to 23 BEU (for NF), independently on the tunnel and cultivation row. For the grouped harvests (H1 + H2 + H3 + H4 + H5 + H6), a lower size of uniformity trial size was observed, ranging from 8 BEU to 16 BEU (for FMF) and 7 BEU to 14 BEU (for NF), independently on tunnel and cultivation row.

Table 3. Size of the uniformity trial (in BEUs) to estimate the plot size in the variables fresh mass of fruit (FMF) and number of fruits (NF)

Harvests	Tunnel 1						Tunnel 2					
	FMF			NF			FMF			NF		
	R1*	R2	R3	R1	R2	R3	R1	R2	R3	R1	R2	R3
H1	19	16	17	14	12	19	19	15	22	15	16	22
H2	14	15	18	19	15	18	18	14	14	18	14	14
H3	17	20	21	17	16	21	23	25	21	23	23	20
H4	14	22	18	17	18	18	21	18	13	19	19	12
H5	13	17	18	18	21	18	17	22	21	17	22	21
H6	20	16	16	18	17	16	19	19	23	20	19	19
H1+H2	19	13	14	18	14	9	18	15	22	16	15	21
H1+H2+H3	18	11	13	18	15	9	20	15	22	18	18	22
H1+H2+H3+H4	17	10	10	16	15	10	17	15	21	8	15	20
H1+H2+H3+H4+H5	10	10	11	10	15	10	16	16	20	8	17	19
H1+H2+H3+H4+H5+H6	16	9	9	7	12	10	16	13	8	14	13	9

Note. *R = Crop row.

4. Discussion

The reliability of plot size estimates for each simulated uniformity trial for each variable, tunnel, row, and harvests (individual and grouped) is indicated by AIC95% (Figures 1-4). When uniformity trial is performed with few BEUs, plot size estimates have low accuracy (higher AIC95%). As the size of the uniformity trial increases, the AIC95% decreases, increasing the accuracy of the plot size estimate (lower AIC95%).

An important point that should be emphasized in this work is that from a given simulation uniformity size, the AIC95% has a stabilizing of tendency, that is, as the size of the uniformity trial increases, the AIC95% varies very little with the size increase of the uniformity trial (Figures 1-4). The results found in this study are consistent with Cargnelutti Filho et al. (2011), Schwertner et al. (2015a), Schwertner et al. (2015b), and Sari and Lucio (2018) who concluded that small uniformity trial provide plot size estimates with low accuracy.

The AIC95% and the mean plot size estimate are closely related with the experimental variability. Note that the highest AIC95% and plot size averages occur in individual crops (Figures 1-4), especially in crops with a high percentage of zeros (Tables 1 and 2). However, if we analyze the grouped harvests, the AIC95% values and the mean plot size estimates are much lower than the individual harvests (Figures 1, 2, 3 and 4).

To obtain an accurate estimate of plot size for eggplant trials, researchers may use some techniques to circumvent the sources of experimental variability. The eggplant is a multiple-harvest horticultural crop that presents several harvests throughout its production phase. When working with this characteristic (of multiple harvests), the researchers may find the absence of fruits suitable to be harvested in a certain harvest. The absence of fruits is statistically poor because it generates an excess of zeros in the database, thus increasing the experimental variability. To minimize the excess of zeros values in the database, it is recommended to use grouping harvests. According to the results of this study, harvests grouping reduces variability among plants in the same growing row, due to reduced observations with null values in the database. Lucio and Benz (2017) and Krysczun et al. (2018) reached the same conclusion, corroborating with the results of this study.

The variability between crop rows in protected environments has been reported for crops such as pepper (Lorentz et al., 2005), Italian zucchini (Lúcio et al., 2008) and eggplant (Krysczun et al., 2018). The heterogeneity between the crop rows can be related to the proximity to the sides of the structure of the protected environment (Feijó et al., 2008) and the conditions of limitation of climatic factors, such as air temperature and hours of sunshine (Lúcio et al. 2008).

The results found in this study reveal that uniformity trials of smaller size may be used to estimate plot size in eggplant culture, however, researchers need to examine these results with good judgment. To estimate the plot size, it is recommended to use the pooled harvests (H1 + H2 + H3 + H4 + H5 + H6) and that the size of the uniformity trial should consist of at least 16 BEUs for FMF variable and 14 BEUs for the NF variable with an AIC95% less than or equal to two BEUs of the plot size average.

Other benefits of these results are the reduction of human, financial and material resources, as well as the experimental area required to perform the uniformity test, maximizing the use of space (which is limited in the protected environment). In this way, in the same experimental area, the researcher can carry out more than one uniformity test, being able to use different times of cultivation, cultivars, horticultural crops, cultural management and ensure that the plot size estimate is accurate.

5. Conclusions

For eggplant crop the size of the uniformity trial affects accuracy the plot size estimation. Grouping the harvests is a simple and effective procedure to reduce the variability in the dataset. To estimate the plot size for trials with eggplant, it is suggested that the uniformity trials be composed of at least 16 basic experimental units for the variable fresh mass of fruit and 14 basic experimental units for the variable number of fruits.

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Appendix A

Evapotranspiration of eggplant (mm day^{-1}) irrigated by dripper irrigation system according to the crop stage and daily historical of air average temperature (24 hours) and air relative humidity (ARU)

ARU (%)	Air temperature (°C)								
	14	16	18	20	22	24	26	28	30
Initial[a] and final[b] stages									
40	3.8	4.2	4.7	5.1	5.6	6.1	6.6	7.1	7.6
50	3.2	3.5	3.9	4.3	4.6	5.0	5.5	5.9	6.4
60	2.6	2.8	3.1	3.4	3.7	4.0	4.4	4.7	5.1
70	1.9	2.1	2.3	2.6	2.8	3.0	3.3	3.5	3.8
80	1.3	1.4	1.6	1.7	1.9	2.0	2.2	2.4	2.5
90	0.6	0.7	0.8	0.9	0.9	1.0	1.1	1.2	1.3
Vegetative stage[c]									
40	5.5	6.1	6.7	7.3	8.0	8.6	9.4	10.1	10.9
50	4.6	5.0	5.5	6.1	6.6	7.2	7.8	8.4	9.1
60	3.7	4.0	4.4	4.9	5.3	5.8	6.2	6.7	7.3
70	2.7	3.0	3.3	3.6	4.0	4.3	4.7	5.1	5.4
80	1.8	2.0	2.2	2.4	2.7	2.9	3.1	3.4	3.6
90	0.9	1.0	1.1	1.2	1.3	1.4	1.6	1.7	1.8
Productive stage[d]									
40	4.5	5.0	5.5	6.0	6.6	7.1	7.7	8.3	0.0
50	3.8	4.2	4.6	5.0	5.5	5.9	6.4	7.0	7.5
60	3.0	3.3	3.7	4.0	4.4	4.8	5.1	5.6	6.0
70	2.3	2.5	2.7	3.0	3.3	3.6	3.9	4.2	4.5
80	1.5	1.7	1.8	2.0	2.2	2.4	2.6	2.8	3.0
90	0.8	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5

Note. [a]Initial stage: Transplanting up to the seedling establishment (7-10 days); [b]Final stage: last harvest; [c]Vegetative stage: Seedling establishment up to the flowering stage; [d]Productive stage: Flowering up to the last harvest. Values not shown can be estimated by using a simple linear interpolation.