

Original Research Article

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Sample size and Pearson's correlation on the characteristics of crambe the Crambe and sunflowerSunflower Plants

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ABSTRACT

Aims: determine the sample size and the correlation of Pearson correlation between the characterscharacteristics of the crambe Crambe and sunflowerSunflower plants.

Study design: Samples were collected from 108 crambeCrambe and sunflowerSunflower plants.

Place and Duration of Study: The research was carried out at the Federal Rural University of Amazonia, in the period from November 2014 to February 2015.

Methodology: The data of for 108 plants was subjected to a descriptive analysis of each variable and, subsequently, the sample size were was estimated (n), with an average a mid-range of the confidence intervals of range of confidence of 1 %, 5 %, 10 %, 15 %, and 20 % of the average (m) and a 95%, with coefficient of confidence of 95%. The sample size was obtained through the expression. $t_{\alpha/2}$, in which it is the critical value of the distribution t of Student t distribution, whose area, on the right, is the same as $\alpha/2$, thus, the value of t , such that $P[t > t_{\alpha/2}] = \alpha/2$, with $(n - 1)$ degrees of freedom, with $(\alpha > 5\%)$ of margin of error, and s^2 is the variance estimate.

Results: The analysed analyzed follow-upsdata demonstrated displayed a relatively high variation coefficients of variation for some some relatively high parameters, where while the number of grains of the lower raceme and the number of grains of the higher raceme were the evaluated statistical continuations that presented developed variance, thus demonstratingdemonstrated a superior dispersal between data for thothe crambeCrambe. For thothe girassol Girassol, the variables number of seeds by section, and the mass of the section with and without seeds presented displayed high variability, and, consequently, higher sampling demand numbers. Supplementary relevant points were that there werethe strong correlations between the mass of the section without seeds in function ofas opposed to the mass of the section with seeds.

Conclusion: On Of the behalf of the characterscharacteristics of the crambeCrambe and sunflowerSunflower plants that were observed observed, the sample sizes required is are superior larger than theo the ones analyzed here in order to properly estimate the parameters and Pearson's linear correlation coefficient.

Keyword: Agronomic experimentation; *Crambe abyssinica*; *Helianthus annuus* L. (Girassol); oleaginous.

1. INTRODUCTION

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A significant amount of the energy used world widely is originated obtained from nonrenewablenon-renewable sources; however, the increasing pursuit for of renewable energy sources has been leading to the studying of plants that could be used for the production ofto produce biodiesel [1]. Among tThe cultures of crambeCrambe and the sunflowerSunflower plants there can be serve as excellent alternatives from for use as raw material for the production of energy which can generate less pollution, and increasing increase the value of these sorts of oilseeds in the national and international economic scenarios [2].

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Given this context, the studies regarding these cultures became relevant mainly on what refers to thedue to the measurement mensuration of several characterscharacteristics, which are common proceedings and of great importance, given that the time availability, labor, financial and human resources, quite often limit the evaluation of a great number of plants, predominantlyespecially, when a large amount of characterscharacteristics needs to be measured [3].

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In the this textstudy, the sample size has has been studied analyzed in order to estimate of the the characterscharacteristics ' rate for of several cultures, such as: soy [4]; corn [5-6]; beans [7]; castor beans [8], and crambeCrambe [9]. Therefore, the realization of this experiment is was conducneted to the generation of information concerning about these cultures for the local authority of Capitão Poço, given the economicaleconomic potential of these specimens, along with the fact that the current literature lacks works that addresses this subject in the region [add reference].

Therefore, the application determination of an appropriate number of experimental unities is of significant relevance for the lessening ofto reduce experimental error, consequently, increasing statistical precision to of the estimate of the characterscharacteristics of plant growth and production. Thus, the realization of tThe objective of this work had as its

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objectivewas to ascertain the sample size(s) and Pearson's correlation between for selected
characterscharacteristics of crambeCrambe and sunflowerSunflower plants.

2. MATERIAL AND METHODS

2.1 Area of Study

The experiment was undertaken performed in a greenhouse, on the campus of Capitão
Poço of the Federal RuralFederal Rural University of the Amazon, state of Pará (Brazil).
Below, in Figure 1, is presented the microclimate of the interior of the greenhouse
utilizedused is displayed.

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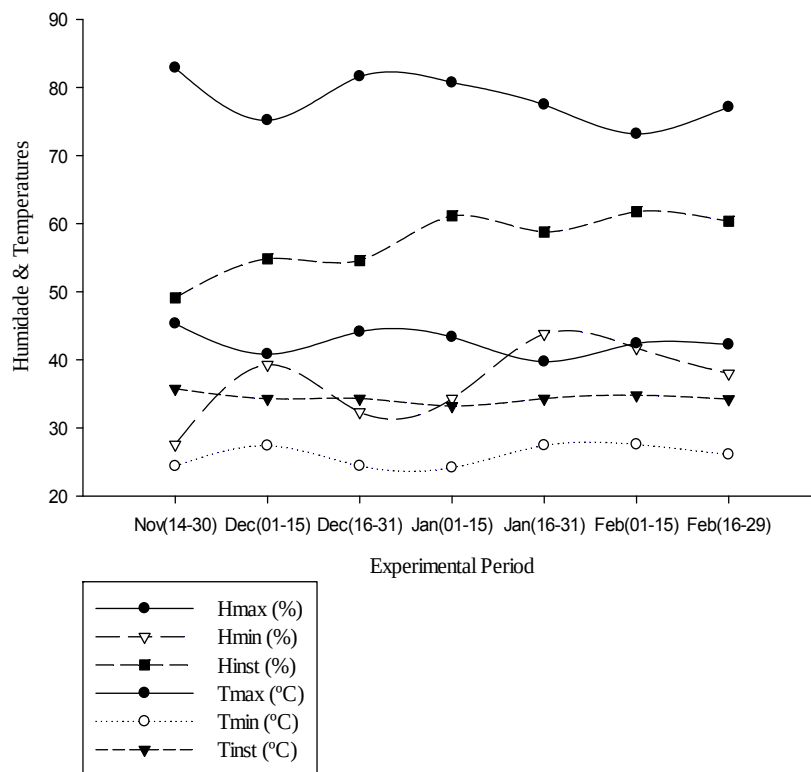


Figure 1. Monitoring of the microclimate of the greenhouse during the cycle of sunflower and crambe's cycle plants, with a biweekly average, from November 2014 to February 2015. Parameters are: Maximum temperatures (Tmax); minimum temperature (Tmin), instantaneous temperature (Tinst), maximum air humidity (Hmax), minimum humidity (Hmin), instantaneous humidity (Hinst).

2.2 Soil characteristics of for the experiment

The soil **utilised** **utilized** is classified as yellow latosol ('Latossolo Amarelo') [10]. The curve of soil moisture was determined, **and** expressing **inged** the **relationship** **among** **thebetween** **the** contents **in the water of water**, on a basis of mass or volume, and the matrix potential of water in the soil, i.e., the bond strength between the water molecules and the **latter's** **soil** particles. The physical and chemical characteristics **of the area** are **the as** following: pH **of Water water** = 4,5; electrical conductivity = 0.25 (1000 micro Siemens per centimeter) dS m⁻¹; Ca²⁺ = 0.70 centimoles per kilogram (cmolc.Kg⁻¹); Mg²⁺ = 0.60 cmolc.Kg⁻¹; In⁺ = 0,05 cmolc.Kg⁻¹; K⁺ = 0.09 cmolc.Kg⁻¹; H⁺ + Al³⁺ = 4,46 cmolc.Kg⁻¹; Al³⁺ = 0,0 cmolc.Kg⁻¹; S = 1,4 cmolc.Kg⁻¹; T = 5.9 cmolc.Kg⁻¹; C = 8,52 g.Kg⁻¹; N = 0,86 g.Kg⁻¹; C/N = 10; organic matter = 14.69 (gram per kilogram) g.Kg⁻¹; cation exchange capacity = 2.2 cmolc.Kg⁻¹; V = 24 %; m = 36 %; P-Assimilable = 8 (milligram per kilogram) mg.kg⁻¹; θ_{FC} (100 kPa) = 17,82 %; θ_{WP} (1500 kPa) = 7.13 %; ds = 1.93 (grams per cubic centimeter) g.cm⁻³; dp = 2.85 g.cm⁻³.



Figure 2. Illustration of the space of distribution in the experimental units for the **crambeCrambe** and **sunflowerSunflower** crop.

2.3 Experimental procedures

The planting of crambeCrambe to cultivate 'Brilliant FMS' was carried out in November of 2014, where when 108 plants were cultivated, contrariwise,while the sunflowerSunflower sowing cultivation occuredoccurred on the 20th of _ October of, 2014, with 139 experimental units (Figure 2). The total space provision for s of the units for of both cultures was of 0,7 m X 0,5 m, between lines and plants respectively. The amount of fertilizer applied ing of for the planting for the crop was 35 kilograms per hectare (kg.ha⁻¹) of N; 140 kg.ha⁻¹ of P₂O₅ and 140 kg.ha⁻¹ of K₂O (for Crambe), and 80 kg.ha⁻¹ of P₂O₅; 80 kg.ha⁻¹ of K₂O and 60 kg.ha⁻¹ of N, (for to crambe and sunflowerSunflower) respectively [11]. The measured characterscharacteristics of the crambeCrambe and sunflowerSunflower plants can be found in Table 1.

Table 1. Abbreviation and unity units of for 13 evaluated characterscharacteristics on of 108 Crambe and 139 Sunflower plants of crambe and sunflower respectively.

CRAMBE		
<u>CharactersCharacteristics</u>	Abbreviation	Unit
Height of the <u>crambeCrambe</u>	HC	Cm
Length of the plants' main racemes	LPR	Cm
Number of racemes	NR	Un
Length of the racemes of the inferior third	LRI	Cm
Length of the racemes of the middle third	LRM	Cm
Length of the racemes of the superior third	LRS	Cm
Number of grains of the racemes of the inferior third	NGI	Un
Number of grains of the racemes of the middle third	NGM	Un
Number of grains of the racemes of the superior third	NGS	Un
Mass of the grains of the racemes of the inferior third	MGI	g plant ⁻¹
Mass of the grains of the racemes of the middle third	MGM	g plant ⁻¹

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Mass of the grains of the racemes of the superior third	MGS	g plant ⁻¹
Total mass of the racemes' grains	TM	g plant ⁻¹
SUNFLOWER		
CharactersCharacteristics	Abbreviation	Unit
Total seed mass	SM	g plant ⁻¹
Seed length	SL	Mm
Seed width	SW	Mm
Diameter of the gathering	D	Cm
Leaf area	LA	cm ²
Height of the sunflowerSunflower plant	HSP	Cm
Height of the flower bud	HF	Cm
Numbers of Leaves	NL	Un
Diameter of the Chapter	DC	Cm
Numbers of seeds by section	NSS	Un
Mass of the section with seeds	MSW	g plant ⁻¹
Mass of the section without seeds	MSWS	g plant ⁻¹
Sunflower Yield	SY	g plant ⁻¹

2.4 Statistical procedures

Initially, for each character, the measures of central tendency, variability, asymmetry, and kurtosis were calculated, and the normality was verified through the Kolmogorov-Smirnov test [12]. The data was subjected to the descriptive analysis of each variable, and subsequently, the sample size was estimated (n), with a mid-range of the confidence interval of 1 %, 5 %, 10 %, 15 % and 20 % of the average (m), and a 95% coefficient of confidence of 95 %.

The sample size was obtained through the following expression:

$$n = \frac{t_{\alpha/2}^2 s^2}{(\text{estimation of error})^2}$$

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[13-14], in which $t_{\alpha/2}$ is the critical value of distribution of Student t, whose area, on the right, equals $\alpha/2$, thus, the value of t, hence $P[t > t_{\alpha/2}] = \alpha/2$ degrees of freedom, with $\alpha = 5\%$ of error probability, and s^2 is the variance estimate. The analyses was were implemented performed using the Microsoft Office Excel® (2012) on the electronic spreadsheet the Microsoft Office Excel® (2012), and in the Software Sisvar software [15].

3. RESULTS AND DISCUSSION

3.1 Crambe Crop

Based on the characters assessed characteristics on of the crambeCrambe culture, it was possible to obtain, regarding descriptive statistics, the mediummean, maxim, minimum, median, variance, kurtosis, asymmetry, standard deviation, and interval between for the characterscharacteristics of the crambeCrambe plants (Table 2).

Table 2. Descriptive statistics: the medium mean (Med), maximum (Max), minimum (Min), median (Medi), variance (Var), kurtosis (Kur), asymmetry (Ass), standard deviation (SD), interval (Int), and coefficient of variation (CV %) of 108 crambeCrambe plants.

<u>CharactersCharac</u> <u>teristics</u> ⁽¹⁾	Med	Max	Min	Medi	Var	Kur	Ass	SD	Int	CV %
HC	29.11	50.12	13.48	28.64	39.01	0.3	0.33	6.27	0.43	21.55
LPR	76.48	126.0	39.9	76.5	232.7	0.3	0.15	15.33	1.04	20.04
NR	37.57	99.0	12.5	34.00	245.41	2.00	1.21	15.74	1.07	41.89
LRI	27.5	57.9	17.3	25.7	49.42	3.16	1.55	7.06	0.48	25.68
LRM	22.97	38.0	15.2	21.9	22	0.86	1.02	4.71	0.32	20.51
LRS	19.35	36.0	10.6	19.1	19.18	1.79	0.9	4.4	0.3	22.74
NGI	28.18	59.0	18.0	26.4	50.59	3.27	1.56	7.15	0.49	25.36

NGM	23.68	39.0	4.0	23	25.9	2.18	0.36	5.11	0.35	21.59
NGS	20.12	37.0	1.0	20	22.1	3.24	0.18	4.72	0.32	23.47
MGI	0.9	3.0	0.14	0.7	0.41	1.78	1.56	0.65	0.04	71.53
MGM	0.58	2.21	0.01	0.4	0.17	5.00	2.25	0.42	0.03	72.13
MGS	0.36	2.0	0.00	0.36	0.08	12.47	2.73	0.29	0.02	80.0
TMG	1.84	6.82	0.15	1.44	1.47	4.26	1.95	1.22	0.08	66.2

⁽¹⁾Abbreviations are defined on in table Table 1.

According to the statistical evaluation, the analysed follow-ups characteristics of the Crambe plants demonstrated a high coefficients of variation coefficient for some relatively high parameters (Table 2), where while the number of grains of the lower raceme and the number of grains of the higher raceme were the evaluated statistical continuations that presented developed variance, thus demonstratatinged a superior dispersal between data for the respective crops.

For a number of the variables consideredstudied, the values of the coefficient of variation coefficient tended to be high rates, which can be connected linked to genetic and physiologicalal factors, promoting alterations amongaffecting the normality of the data presented [add reference]. Was observed in the crambeCrambe plants, the magnitude of the coefficient of variation coefficient (HPCV), generally oscillating oscillates around 19.54 % on plant height, and 62.29 % on the number of results per plant [16].

The coefficient of variation coefficient is a measurement of the analysed characteristics; consequently, it does not contemplate provide insight on the evaluated crop's peculiarities, the nature of the tests, and, mainly, the considered specific variables, which can bare relevant for the correct interpretation of the magnitudes of this measurement [17]. On the

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work developed performed with on the peach culture of the peach, not displayed a high variation in a few characterscharacteristics, such as the pulp firmness [18].

The set of characterscharacteristics presented here appropriate approximate rates of normality, characterized, mainly, by the positive asymmetry of the distribution of data (Table 2). The parameters of the middle third grains medium mass (MGM), mass of the higher third grains (MGS), and total mass (TM), in addition to the positive asymmetry, presented kurtosis differences at t from three ($P \leq 0,05$), which characterizes the degree of distribution flatter of this distribution likeassociated with leptokurtic kurtosis [19].

ConcerningWith respect to the crambeCrambe culture, the magnitudes oscillated between $[r] = -0.19$ to 0.92 , where 15 % of the pairs presented demonstrated negative correlation, whereas while 85 % of the analysed analyzed pairs obtained demonstrated positive linear regression, function with an magnitude average $[r] = 0.27$ (Table 3).

Table 3. Pearson Linear correlation matrix of Pearson amongfor 13 characterscharacteristics of crambeCrambe.

CharactersCharacteristic	s	HC	LPR	NR	LRIT	LRM	LRS	NGI	NGM	NGS	MGI	MGM	MGS	TM
HC			0,262	0,254	0,220	0,225	0,218	0,219	0,212	0,200	0,211	0,214	0,212	0,215
LPR		**		0,255	0,209	0,211	0,209	0,225	0,226	0,204	0,218	0,218	0,220	0,221
NR		**	**		-0,206	-0,209	-0,203	0,235	0,223	-0,204	0,220	0,218	0,218	0,224

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LRI	**	ns	ns		0.43	0.23	-0.18	-0.19	-0.05	-0.06	0.20	0.09	0.02
LRM	**	ns	ns	**		0.66	0.04	-0.06	0.18	0.07	0.15	-0.01	0.09
LRS	**	ns	ns	**	**		0.10	-0.06	0.00	0.06	0.11	-0.03	0.04
NGI	**	**	**	**	ns	ns		0.72	0.07	0.71	0.41	0.34	0.75
NGM	ns	**	**	**	ns	ns	**		0.10	0.63	0.58	0.55	0.74
NGS	ns	ns	ns	ns	**	ns	ns	ns		0.05	0.06	0.03	0.06
MGI	ns	*	**	ns	ns	ns	**	**	ns		0.46	0.42	0.92
MGM	*	**	**	**	*	ns	**	**	ns	**		0.52	0.63
MGS	ns	**	*	ns	ns	ns	**	**	ns	**	**		0.63
TM	*	**	**	ns	ns	ns	**	**	ns	**	**	**	

** Significant at the level of 1 % of probability ($P \leq 0.01$), * significant at the level of 5 % of probability ($P \leq 0.05$), 'ns' stands for 'not significant' ($P \leq 0.05$).⁽¹⁾ Abbreviations defined on in table Table 1.

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The Mid-range, once tending to the reduction of the experimental precision at the level of 20 % of error, displayed that the characterscharacteristics, length of the main raceme, middle length of the inferior raceme, and length of the middle raceme, were the characterscharacteristics that presented least demand of experimental unity, thuswhere only three plants are were sufficient to estimate the characterscharacteristics with precision (Table 4). Works Studies performedcarried out by in [9], similarly regarding the culture of the crambeCrambe, were comparable to the present study, where the error of 20 %, for the characterscharacteristic plant height and main raceme length, the data presentedrequired a minimum number from 3 to 5 plants to estimate it those characteristics with precision.

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Table 4. Sample size of the sample required to the estimation of the medium mean, with mid-range of the confidence interval of 95 % equal to 1 %, 5 %, 10 %, 15 %, and 20 % of the average (errors) of the characters characteristics of 108 crambe plants.

ERROR	LP			LR			MG						
(1)	HC	R	NR	LRI	M	S	NGI	NGM	NGS	MGI	M	MGS	TM
	175	137	793	135	187	531	5621	3994	57719	5301	4658	6325	3845
1%	2	6	4	5	3	2	0	6	2	9	9	2	9
5%	70	55	317	54	75	212	2248	1598	23088	2121	1864	2530	1538
10%	18	14	79	14	19	53	562	399	5772	530	466	633	385
15%	8	6	35	6	8	24	250	178	2565	236	207	281	171
20%	4	3	20	3	5	13	141	100	1443	133	116	158	96

⁽¹⁾ Abbreviations defined on in table Table 1.

The estimate of the size of the sample to relevant to determining the characters characteristics of the production of crambe, as well as the its mid-range, demonstrates a relation ship to the degree of impact on of the experiment, as the evidenced suggests o in Table 4. With an error estimation of 1 %, the following variables: number of grains of the inferior raceme, number of grains of the superior raceme, and mass of the grains of the superior raceme, demonstrated grander necessity of required more sample plants, in opposition as opposed to the latter stands the main raceme length, and the inferior middle raceme's length, since those were the statistical segments with less demand for requiring fewer experimental unities.

Studies developed by in [20], revealed that the sample size required to evaluate the height of plant, the diameter of the harvesting, and the height of plant / diameter relation ship of the to the harvesting of 'canjerana' seedlings, depends on the age of at evaluation [add reference].

Additionally, that, in accordance with this study [20], in assessing the the cores, substrates, and evaluation ages, and 18 plants by experimental unity were sufficient, to evaluate the

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mediummean of these characterscharacteristics, to an estimation error equal toof 10 %. In this case, to obtain a higher statistical precision, a higher number of samples would be necessary. It was observed that in order to improve the precision of the characterscharacteristics' evaluation in bean plants, it is necessary to use a higher number of repetitions, and at least 10 plants for experimental unity [7]. Concerning soy, the same author detected noted that using a higher number of repetitions and at least 12 plants for experimental unity is also sufficient to havefor a higher statistical precision of the evaluated characterscharacteristics [21].

3.2 Culture of Sunflower

From the characterscharacteristics evaluated for the on culture of sunflowerSunflower culture, it was possible to obtain the descriptive statistics mediummean, maximum, minimum, median, variance, kurtosis, asymmetry, standard deviation, and the interval between the sunflowerSunflower's characterscharacteristics are shown in (Table 5).

Table 5. Descriptive statistics: the medium mean (Med), maxim (Max), minimum (Min), median (Medi), variance (Var), kurtosis (Kur), asymmetry (Ass), standard deviation (SD), interval (Int), and coefficient of variation (CV %) of for 139 sunflowerSunflower plants.

<u>CharactersCharacteristics</u> ¹⁾	Med	Max	Min	Medi	Var	Kur	Ass	SD	Int	CV %
D	7.78	10.45	5.45	7.71	0.68	0.76	0.28	0.83	0.05	10.63
NL	14.4	18.6	9.91	14.6	1.85	1.44	-0.29	1.36	0.08	9.44
LA	725.53	1739.3	296.13	705.94	39378.3	5.07	1.26	199.16	11.39	27.45
HSP	60.32	161.1	44.63	59.83	104.8	67.33	6.9	10.28	0.59	17.03

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HFB	79.5	99.9	62.2	79.1	53.6	0.01	0.3	7.35	0.42	9.23
DC	85.2	155.4	32	85.12	291.2	2.66	0.58	17.13	0.98	20.1
MSW	51.44	265.1	6.5	39.06	1565.4	7.27	2.13	39.71	2.27	77.19
MSWS	39.14	237.5	3.51	28.95	1229.8	9.97	2.53	35.2	2.01	89.93
TMS	6.47	34.2	1.12	5.71	16.9	15.5	3.04	4.14	0.24	63.9
NSS	369.22	810	100	378	24345.7	0.1	0.46	156.6	8.96	42.41
SY	0.02	0.06	0.01	0.02	0	3.21	1.91	0.01	0	67.4
CL	10.2	30.3	7	10	3.99	73.4	7.34	2.01	0.11	19.5
SW	5.29	6.92	3.4	5.24	0.63	-0.45	0.05	0.79	0.05	15

⁽¹⁾ Abbreviations defined on in table Table 1.

The following variables: , number of seeds by section, and mass of the section with and without seeds, displayed presented high coefficients of variability, and, consequently, higher sampling demand numbers, for the latter influences directly in the sampling directly, on what concerns with respect to the experimental precision (Table 5). It was observed that the sample size required to evaluate MF, MC, MA, DL, and DT of the fruit of pecan tree fruits depends on the cultivation, and will be higher for cultivations with greater variability and vice-versa [22].

The sunflowerSunflower characterscharacteristics had correlations that oscillated around ($r = -0.45$ to 0.98), where 55 % of the pairs exhibited positive values, and the remaining associations (45%) displaypresented 45 % negative intensities values (Table 6).

Table 6. Pearson Linear correlation matrix of Pearson amongfor 13 sunflowerSunflower characterscharacteristics.

Characteristics

¹⁾

D NL LA HSP HFB DC SY NSS MSW MSWS TMS SL SW

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D													
	0,247	0,280	0,214	0,221	-0,226	0,206	-0,202	-0,222	-0,220	0,200	-0,207	-0,217	
NL	**												
		0,246	0,217	0,234	-0,214	-0,209	0,205	-0,211	-0,214	0,204	-0,227	-0,224	
LA	**	**											
			0,210	0,209	-0,225	-0,201	-0,207	-0,222	-0,221	-0,205	-0,209	-0,211	
HSP	ns	*	ns										
				0,252	0,200	-0,203	0,207	0,201	0,200	0,204	-0,209	-0,207	
HFB	**	**	ns	**									
					-0,219	0,210	0,213	-0,219	-0,221	0,208	-0,213	-0,226	
DC	**	ns	**	ns	*								
						-0,211	0,217	0,286	0,283	0,234	0,226	0,244	
SY	ns	ns	ns	ns	ns	ns							
							0,210	-0,208	-0,208	0,204	0,261	-0,245	
NSS	ns	ns	ns	ns	ns	*	ns						
								0,206	0,205	0,232	-0,208	-0,222	
MSW	**	ns	**	ns	*	**	ns	ns					
									0,298	0,226	0,228	0,242	
MSWS	**	ns	**	ns	**	**	ns	ns	**				
										0,220	0,228	0,242	
TMS	ns	ns	ns	ns	ns	**	ns	**	**	**			
											0,207	0,203	
SL	ns	**	ns	ns	ns	**	**	ns	**	**	<u>Nsns</u>		0,241
SW	*	**	ns	ns	**	**	**	**	**	**	<u>Nsns</u>	**	

** Significant at the level of 1 % of probability ($P \leq 0,201$), * significant at the level of 5 % of probability ($P \leq 0,205$), 'ns' stands for 'not significant' ($P \leq 0,205$). ⁽¹⁾ Abbreviations defined [on in table Table 1](#).

Weak linear correlations are notorious among [sunflowerSunflower](#) variables, corroborating [with the descriptions of the](#) descriptive analyses [in this study \[add reference\]](#). Supplementary relevant points were [that there were](#) strong correlations between the mass of the section without seeds, [in function of and](#) the mass of the section with seeds ($r = 0.98$), [and the](#) diameter of the section [in function of in](#) the mass of the chapter with and without seed, the [approximation factors between both](#) being ($r = 0.86$ and 0.83). The remaining variables presented correlations from very weak to moderate (Table 6). Theoretically, the value of p is a continuous measure [of proofs](#), though in practice, it is normally [trichotomized divided as into](#) highly significant, marginally significantly, and not statistically

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significantly, in with the conventional levels, as in the 'cut points' being $p \leq 0.01$, $p \leq 0.05$ and
e $p > 0.10$ respectively.

In the sunflowerSunflower culture, with a in precision to of 1 % of the average, the
characterscharacteristics: mass of the section with and without seeds, number of seeds by
section, production of grains by plant, and total mass of the seed, presented required high
demand numbers of sample unities sto determine with precision the statistical analyses,
and when the precision values were moved on to reduced levels (e.g., of mid-range), the
demands for unitiesrequired number of samples was reduced (Table 7).

ConcerningWith respect to the work with pecan tree crops, observed an elevated number
s of sampling samples were required to estimate, with a precision of 1 %, the
characterscharacteristics MF, MC, MA, DL, and DT in six cultivations, and concluded
thatthis is is difficult to practiceachieve, due to the elevated increased number of fruits to
that must be measured [22]. In With black oats, to find the average estimate of the
morphological and productive characterscharacteristics, to an estimate error of 20 % of the
average, with a degree of confidence of 95 %, 47 plants are sufficient [22]. Reported that
dDissimilar sample sizes are expected, due to the intrinsic variability between the variables
parameters and between the cultures, with the investigator having the responsibility to
assessestimate, on histhe time availability, financial, and human resources, which is the
error prone limit tolerated and, consequently, which complicates the sizing of samples is
which are adequate to the results offor their work [18].

Table 7. Sample size for estimationg of the averagemean, with mid-range of the 95%
confidence interval of confidence of 95 % equal to 1 %, 5 %, 10 %, 15 %, and 20 % of
the average (ERROR) of the characterscharacteristics of for 139 sunflowerSunflower
plants.

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ERROR ⁽¹⁾	D	NL	LA	HSP	HFB	DC	MSW	MSWS	TMS	NSS	SY	SL	SW
1%	431	341	2874	1107	166	1542	22725	30847	15616	6861	17237	1462	862
5%	17	14	115	44	7	62	909	1234	625	274	689	58	34
10%	4	3	29	11	2	15	227	308	156	69	172	15	9
15%	2	2	13	5	1	7	101	137	69	30	77	6	4
20%	1	1	7	3	0	4	57	77	39	17	43	4	2

⁽¹⁾ Abbreviations defined [on in table Table 1](#).

There **exists is** variability between some **characterscharacteristics analysed analyzed** to estimate the size of samples **required to estimate characteristics with precision, for since** there is a demand for a higher number of experimental units **in order to raise increase** the experimental reliability. It was observed that to estimate the average of **productive production** and morphological **characterscharacteristics** of white lupin, with **amplitude of the interval of a** confidence **interval** of 95 % **equal to 25 %** of the estimate of the average, 81 plants are necessary [23]. Additionally, to estimate the median with the same precision, 129 plants are sufficient **[add reference]**. In corn plants, the sample size may vary between hybrids, harvests and **characterscharacteristic** pairs, **larger Larger** sample sizes are necessary **for theto estimation estimate of** the coefficient of correlation **between for** weakly correlated **characterscharacteristics**, a **minor small** sample size is required to estimate the coefficient of correlation between highly correlated **characterscharacteristics** [24].

4. CONCLUSION

For the **characterscharacteristics** of **the_crambeCrambe** and **the_sunflowerSunflower** **observed**, a **superior larger** sample size is necessary **that what was used in this study, over the one analysed**, in order to estimate the parameters **and the Pearson correlation** coefficient **of linear correlation of Person**, with finer statistical precision.

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