3. NATURAL CONDITIONS AND AGRICULTURE

3.1 SOILS

3.1.1 Methodology and Processes

Systematic sampling. Once the lots were located, limited and parcelled, a systematic sampling was made to determine the fertility levels of the soil. The coordinates of the systematic sampling were given in UTM (Universal Transversal Mercator) with a distance between lines of 333. 33 m. The points of sampling were preset in office and located in their respective coordinates, using a GPS (Global Position System) of the Garmin brand and e map Model.

Of each sampling site a field form was made, which includes among other things, the IDUEG (Identificator of the Unit of Geographical Space) of the site, besides the field data.

Of each surface of 11.1 ha, 9 subsamples were taken; the first in the line intersection site and the following in parallel lines at 111 m in respect to the main coordinate. (See detail of the soil sampling chart).

Each subsample site represented a square area of 1.23 ha.

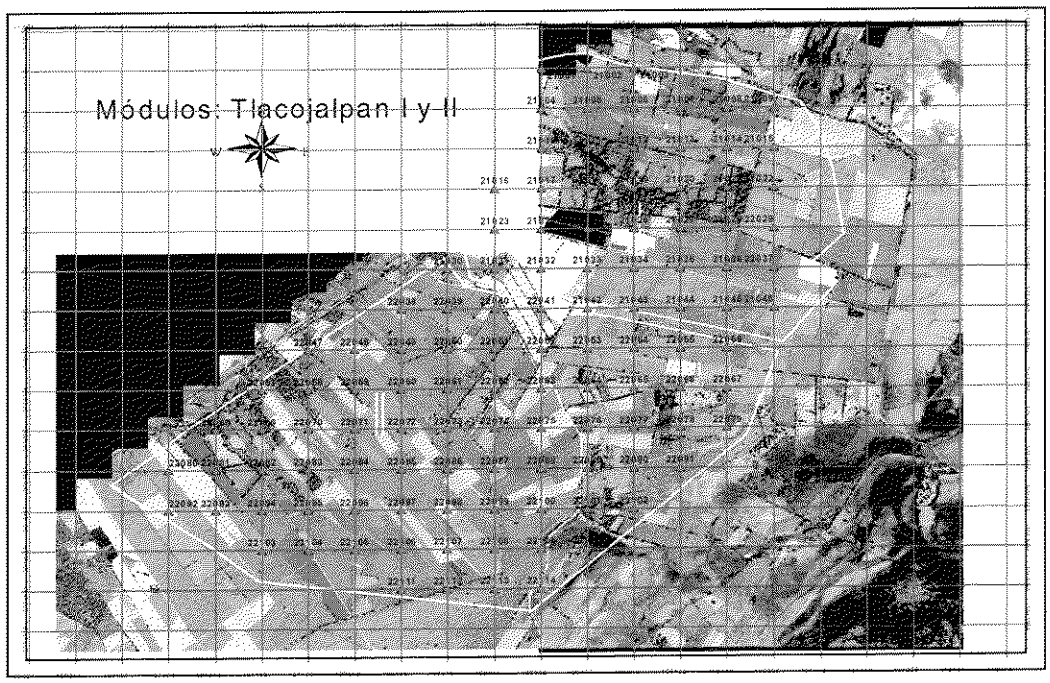
The 9 subsamples taken, with equivalent weights were mixed, homogeneized, a final sample of 2.5 to 3.0 kg, was obtained. The sampling was made at 2 depths: 0.30 and 30-60 cm.

In the annex of disc 3, the summary of the methodology to establish a systematic sampling and determin the fertility levels of a soil can be seen.

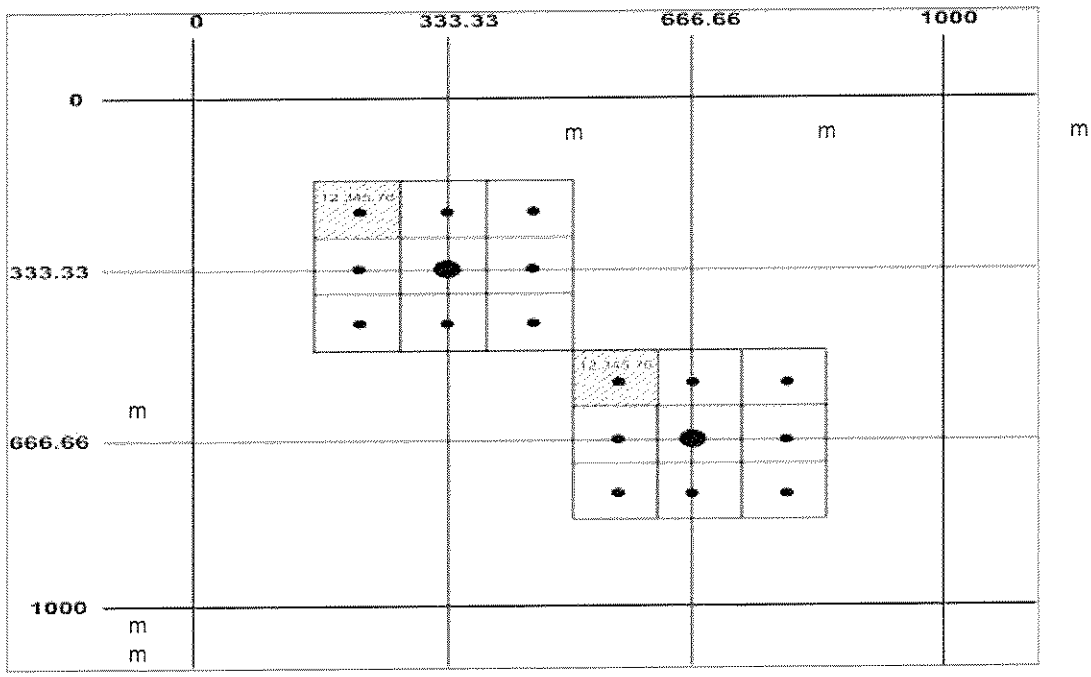
A) Laboratory Analysis. Each soil sample was placed in plastic bags which were properly labeled and closed, for their remission to the soil laboratory to determine each and every one of the parameters outlined in the terms of reference (pH, phosphorous, Ca/Mg relation, active carbonates, carbon reserve, available nitrogen, potassium and micronutrients. Also, depending on the pH of the soil, exchangeable aluminum and iron were determined, together with calcium carbonate and sodium content. The salinity was determined in reference to electrical conductivity (EC).

Of the 3,637 ha included in the study, 2,943 samples were taken at each level of depth, of which 327 compound samples were analyzed for each of the two levels.

For the determination of the fertility levels of the soil, as well as the salinity and soil classification, the NOM-021-RECNAT-2000 official norm was used.



GEOREFERENCED SAMPLING POINTS CHART FOR THE TLACOJALPAN MODULE



DETAIL OF THE SOIL SAMPLING CHART

SOIL SAMPLING WITH A DRILL

SOIL SAMPLES IN THE LABORATORY

B) Limitant Factors. To propose a strategy for the management of soil and water conservation it is necessary to undestand the circumstances of **present soil use** and the factors which restrict the use of it, according to its **productive aptitude and potential use.** To know the restricting factors in the use of soil, in this study the criteria established in the Soil and Water Conservation Manual of the Colegio de Postgraduados de Chapingo was used.

The factors evaluated were: erosion, salinity, compactness, rockiness, slope and drainage, effective depth, besides texture and humidity level. The factors were determined by the field and/or laboratory observation according to the case.

C) Soil Taxonomy. The taxonomic identification of the different units of soil in the area of study, was carried out based on NOM-RECNAT-2001.(See annex chart in disc 3).

The criteria for locating the agrological wells was the photointerpretation of satellite images and field trips; having as a general representation one agrological well per every 65 ha.

Each well located in the preselected site, was studied to describe its profiles and sample taking, it was also photographed and georeferenced, with the corresponding location in the field plan.

The wells were studied up to a depth of 1.5 m taking a field chart in each site, the probation and limitation of each of the soil types was used the systematic sampling chart.

The result of the study of each well is a digital chart which describes the characteristics of the profile and which, together with the laboratory results defines the taxonomic unit of the studied area.

3.1.2 Results

A) In this point a summary of the laboratory results which permitted the establishment of the general characteristics of the fertility levels in each irrigation module is presented.

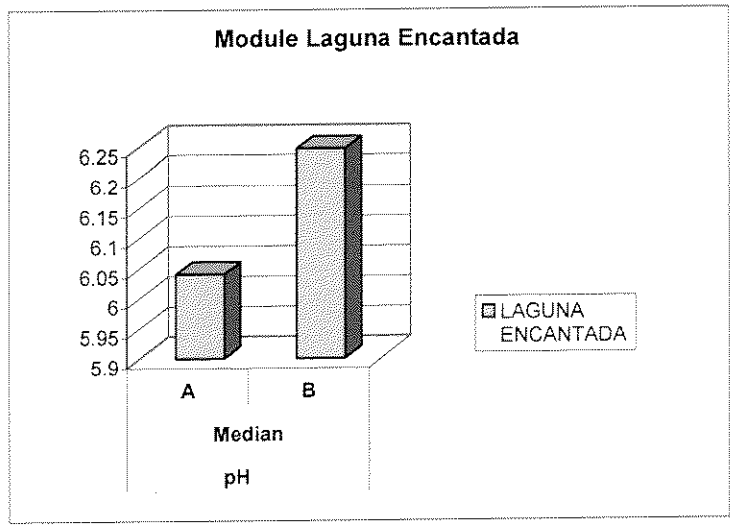
The information of the parameters analyzed refer to pH, contents of nitrogen, phosphorous, potassium and organic matter; also to the resulting textural class.

The tables and graphs are formed based on the average values and their respective variance. The order of presentation is by irrigation module: Laguna Encantada, Tlacojalpan, Tesechoacán-Curazao and Los Naranjos.

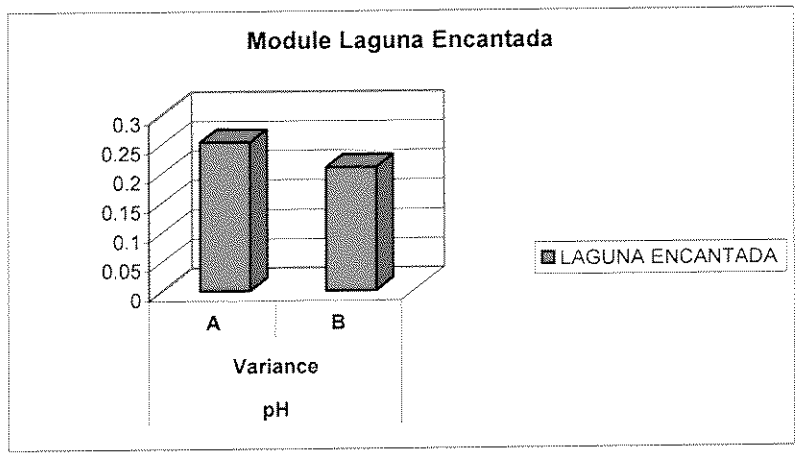
Derived from the analysis of all the laboratory parameters, in the index 3.1.3 their respective discussion is presented.

pH

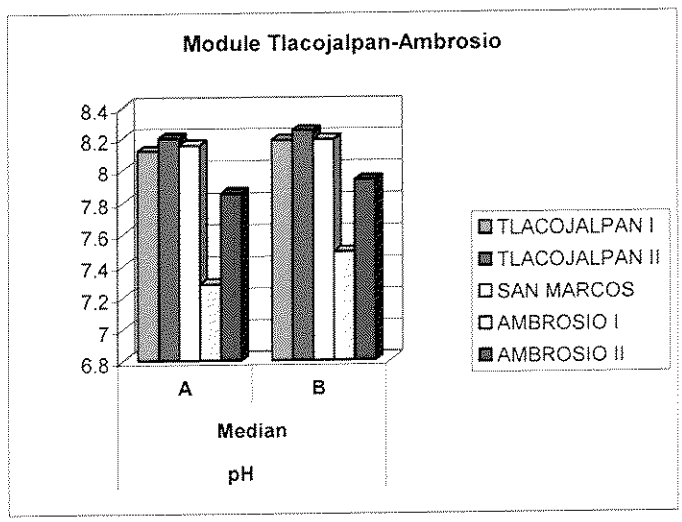
MODULE	SUBMODULE	pH Median A (0-30cm)	pH Median B (30-60 cm)
Laguna Encantada	LAGUNA ENCANTADA	6,040375	6,246625



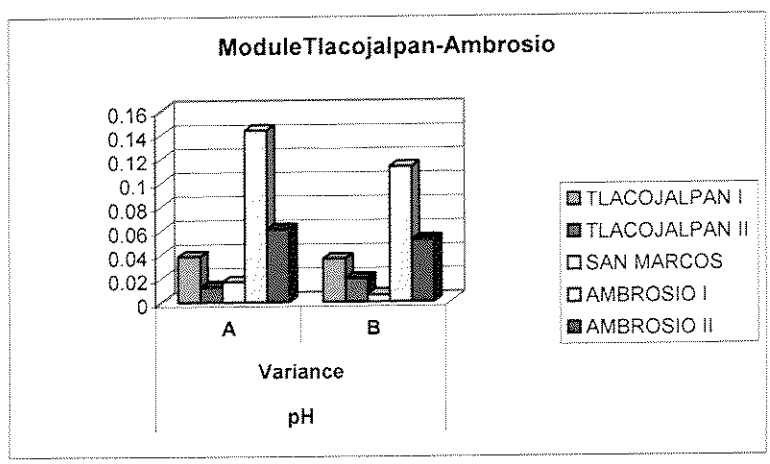
MODULE	SUBMODULE	pH Variance A (0-30 cm)	pH Variance B (30-60 cm)
Laguna Encantada	LAGUNA ENCANTADA	0,253031503	0,209845427



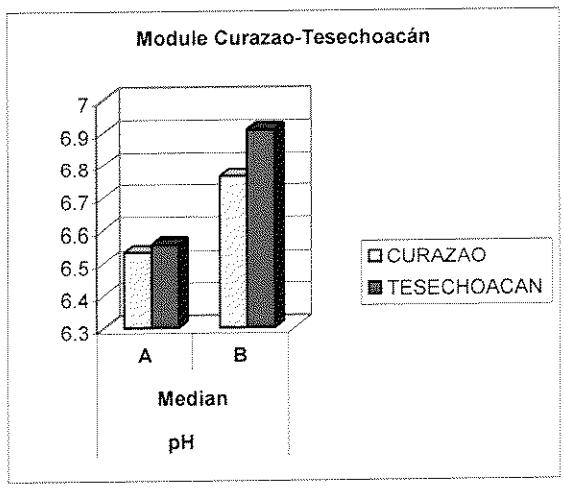
MODULE	SUBMODULE	pH Median A (0-30 cm)	pH Median B (30-60 cm)
Tlacojalpan-Ambrosio	TLACOJALPAN I	8,120357143	8,184285714
	TLACOJALPAN II	8,1975	8,246041667
	SAN MARCOS	8,154090909	8,188181818
	AMBROSIO I	7,2825	7,4875
	AMBROSIO II	7,852777778	7,935555556



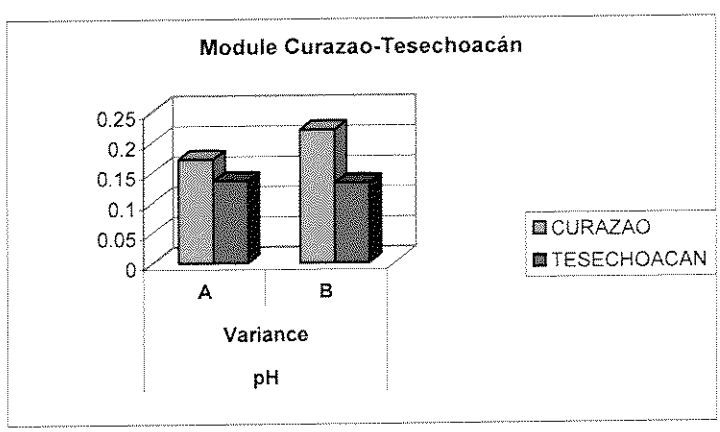
MODULE	SUBMODULE	pH Variance A (0-30 cm)	pH Variance B (30-60 cm)
Tlacojalpan-Ambrosio	TLACOJALPAN I	0,038025794	0,035884656
	TLACOJALPAN II	0,012623404	0,0194457
	SAN MARCOS	0,016549134	0,005939394
	AMBROSIO I	0,143535526	0,112946053
	AMBROSIO II	0,06069183	0,051684967



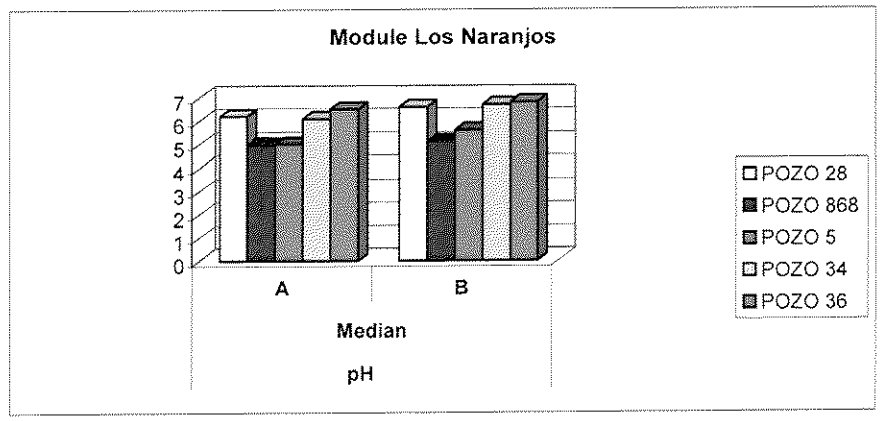
MODULE	SUBMODULE	pH Median A (0-30 cm)	pH Median B (30-60 cm)
Curazao-Tesechoacán	CURAZAO	6,53295455	6,76272727
	TESECHOACAN	6,558	6,9078



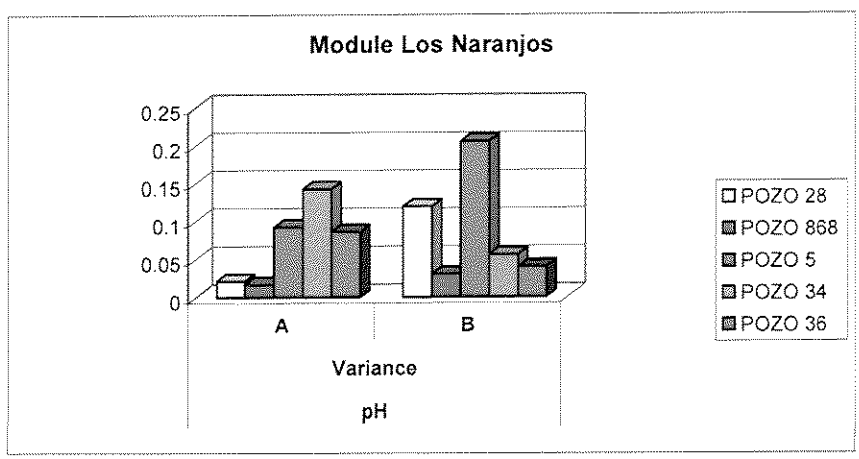
MODULE	SUBMODULE	pH Variance A (0-30 cm)	pH Variance B (30-60 cm)
Curazao-Tesechoacán	CURAZAO	0,171337579	0,21955518
	TESECHOACAN	0,135485714	0,131813429



MODULE	SUBMODULE	pH Median A (0-30 cm)	pH Median B (30-60 cm)
Los Naranjos	POZO 28	6,196363636	6,585454545
	POZO 868	4,971111111	5,106666667
	POZO 5	5,00125	5,61
	POZO 34	6,084	6,69
	POZO 36	6,502	6,81

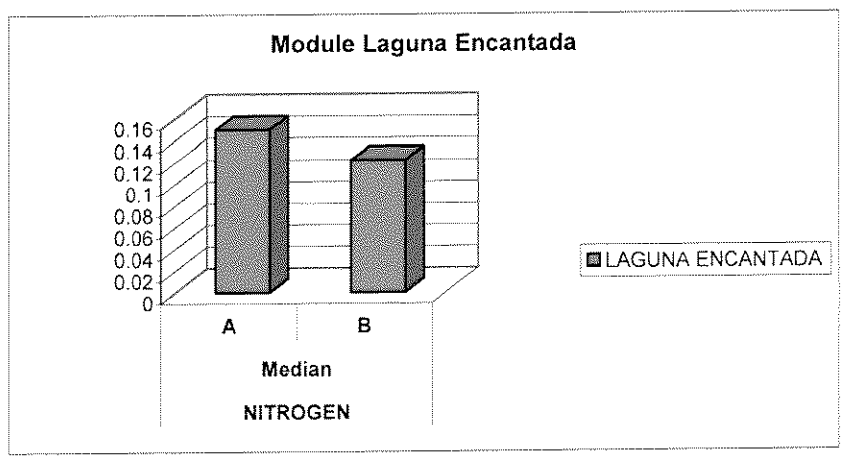


MODULE	SUBMODULE	pH Variance A (0-30 cm)	pH Variance B (30-60 cm)
Los Naranjos	POZO 28	0,021185455	0,119267273
	POZO 868	0,016861111	0,030425
	POZO 5	0,092555357	0,2054
	POZO 34	0,14228	0,0558
	POZO 36	0,086106667	0,039933333

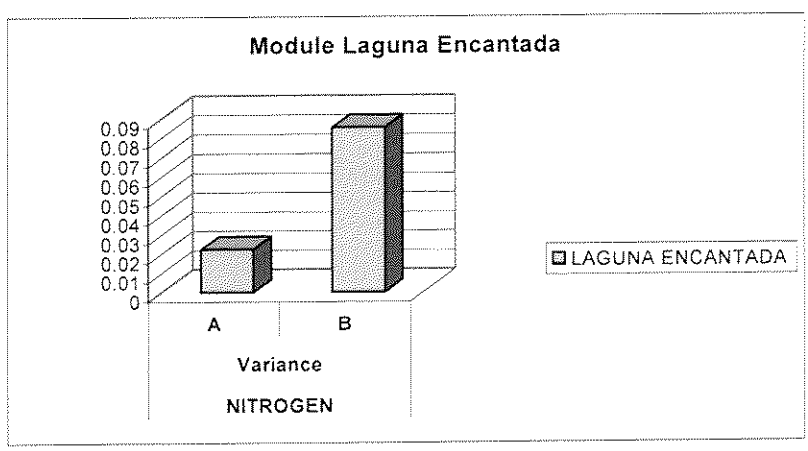


NITROGEN

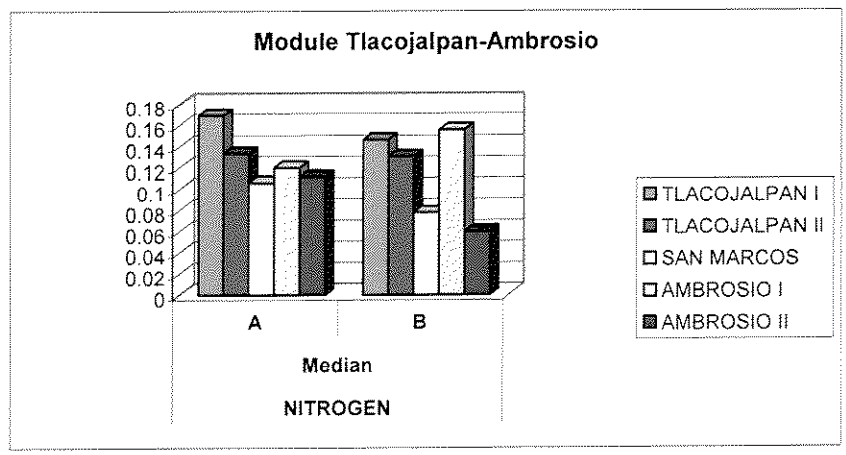
MODULE	SUBMODULE	NITROGEN (%) Median	
		A (0-30 cm)	B (30-60 cm)
Laguna Encantada	LAGUNA ENCANTADA	0,1501125	0,1222125



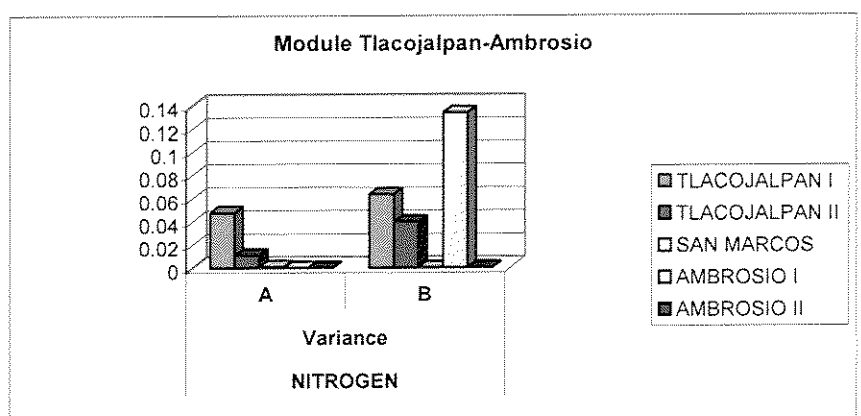
MODULE	SUBMODULE	NITROGEN (%) Variance	
		A (0-30 cm)	B (30-60 cm)
Laguna Encantada	LAGUNA ENCANTADA	0,022462456	0,085275613



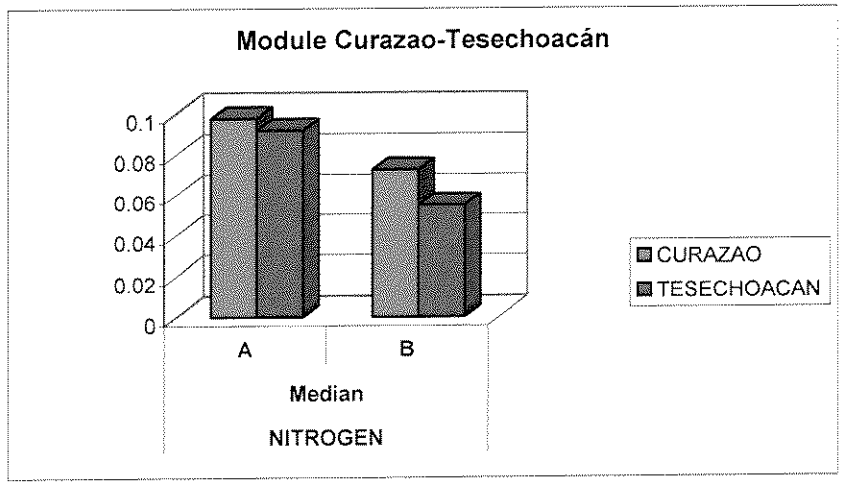
MODULE	SUBMODULE	NITROGEN (%) Median A (0-30 cm)	B (30-60 cm)
Tlacojalpan-Ambrosio	TLACOJALPAN I	0,16928571	0,14642857
	TLACOJALPAN II	0,13354167	0,13064583
	SAN MARCOS	0,10590909	0,07772727
	AMBROSIO I	0,11935	0,1555
	AMBROSIO II	0,11111111	0,06



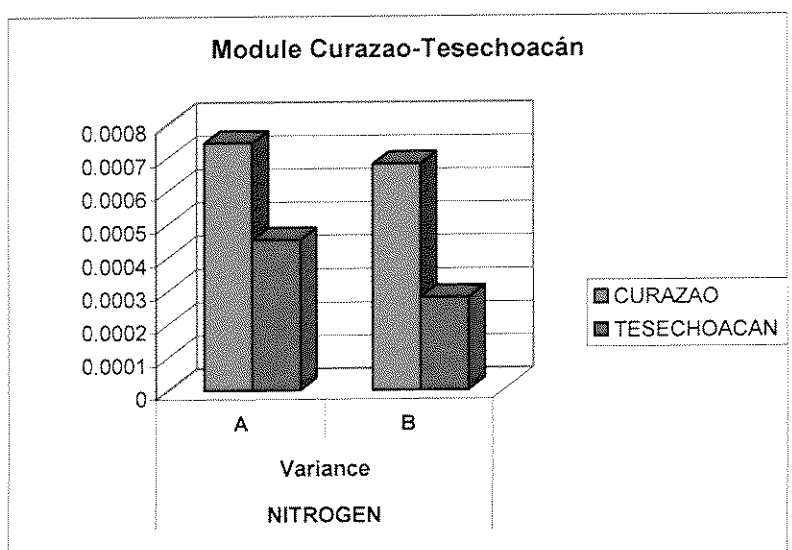
MODULE	SUBMODULE	NITROGEN (%) Variance A (0-30 cm)	B (30-60 cm)
Tlacojalpan-Ambrosio	TLACOJALPAN I	0,04771799	0,063453439
	TLACOJALPAN II	0,01096549	0,039870531
	SAN MARCOS	0,00096818	0,000456494
	AMBROSIO I	0,00025371	0,133899737
	AMBROSIO II	0,00022222	0,000388235



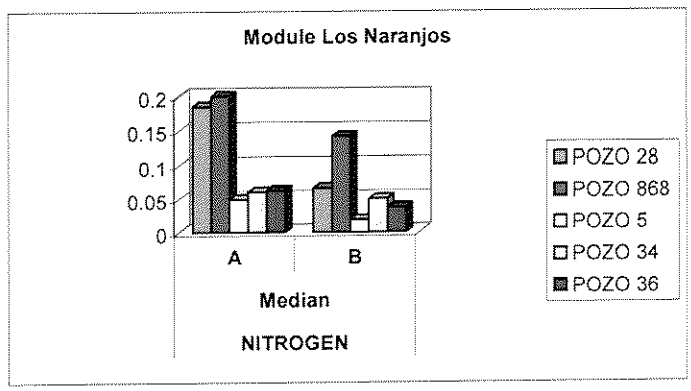
MODULE	SUBMODULE	NITROGEN (%) Median	
		A (0-30 cm)	B (30-60 cm)
Curazao-Tesechoacán	CURAZAO	0,09772727	0,0725
	TESECHOACAN	0,0918	0,0548



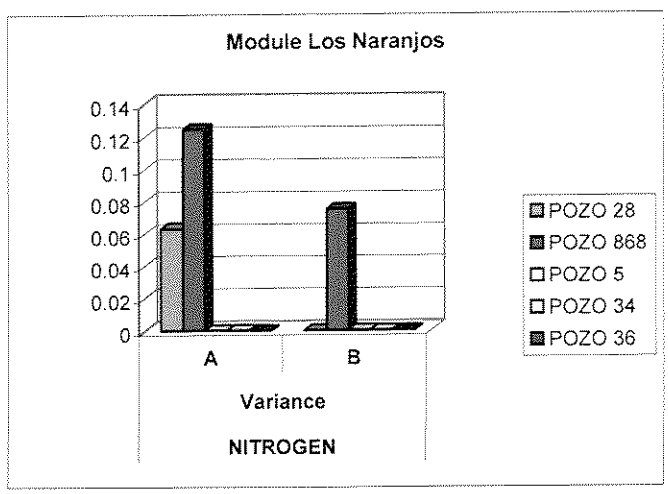
MODULE	SUBMODULE	NITROGEN (%) Variance	
		A(0-30 cm)	B (30-60 cm)
Curazao-Tesechoacán	CURAZAO	0,000743552	0,000679651
	TESECHOACAN	0,000451796	0,000278531



MODULE	SUBMODULE	NITROGEN (%) Median	
		A (0-30 cm)	B (30-60 cm)
Los Naranjos	POZO 28	0,18454546	0,06545455
	POZO 868	0,2	0,14111111
	POZO 5	0,04875	0,01875
	POZO 34	0,06	0,05
	POZO 36	0,062	0,037

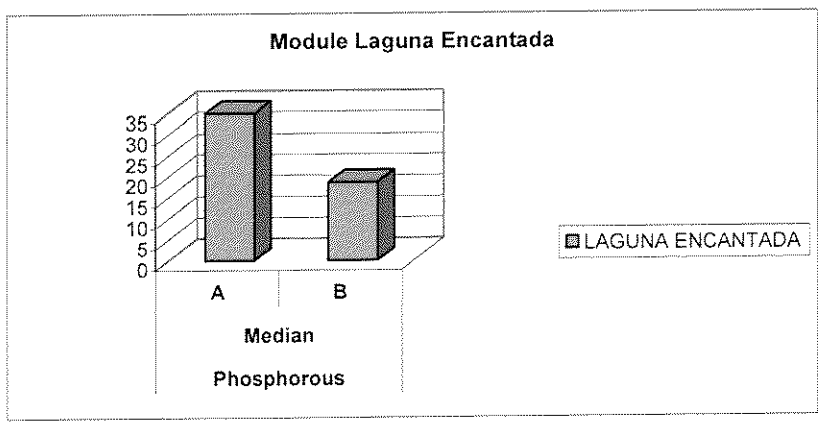


MODULE	SUBMODULE	NITROGEN (%) Variance	
		A (0-30 cm)	B (30-60 cm)
Los Naranjos	POZO 28	0,06326727	0,000147273
	POZO 868	0,124575	0,075161111
	POZO 5	0,00018393	0,00006964
	POZO 34	0,0001	0,0001
	POZO 36	0,00006222	0,000245556

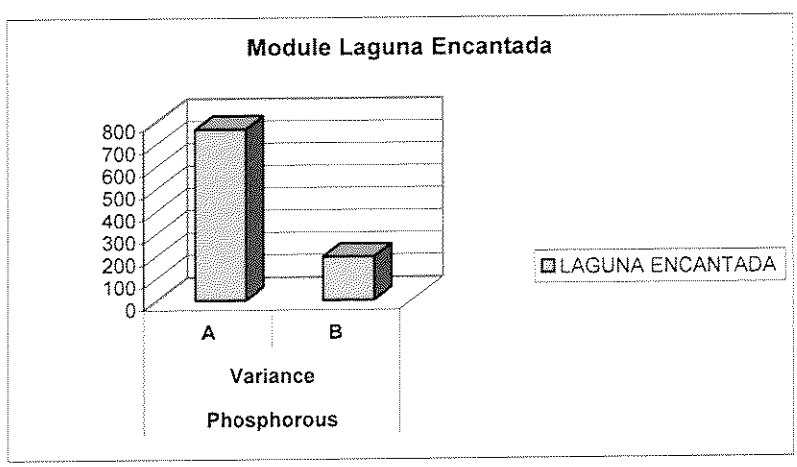


PHOSPHOROUS

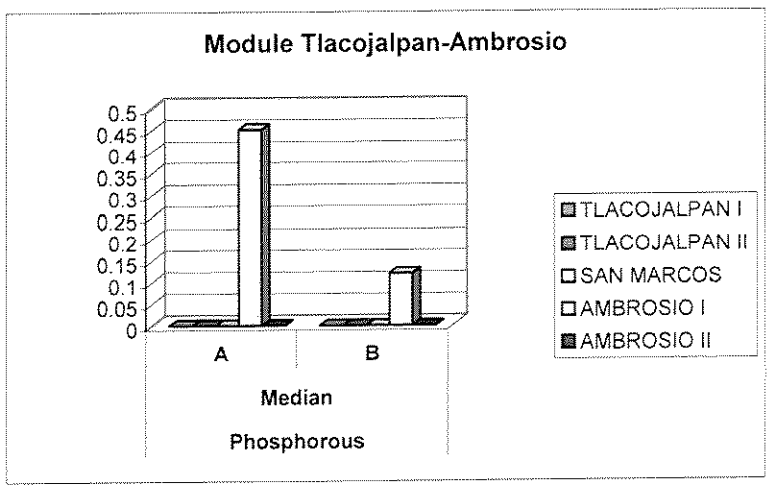
MODULE	SUBMODULE	PHOSPHOROUS (ppm) Median	
		A (0-30 cm)	B (30-60 cm)
Laguna Encantada	LAGUNA ENCANTADA	34,8925	18,59113



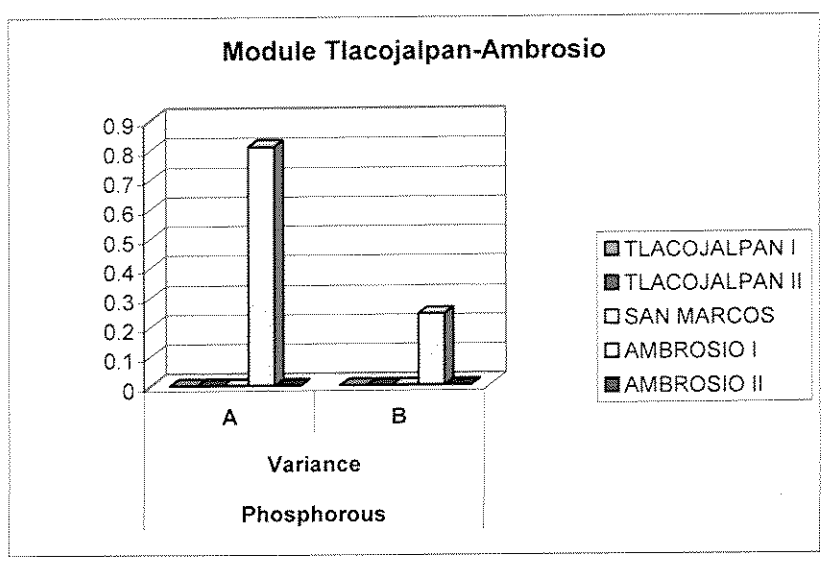
MODULE	SUBMODULE	PHOSPHOROUS (ppm) Variance	
		A (0-30 cm)	B (30-60 cm)
Laguna Encantada	LAGUNA ENCANTADA	765,635	193,2801



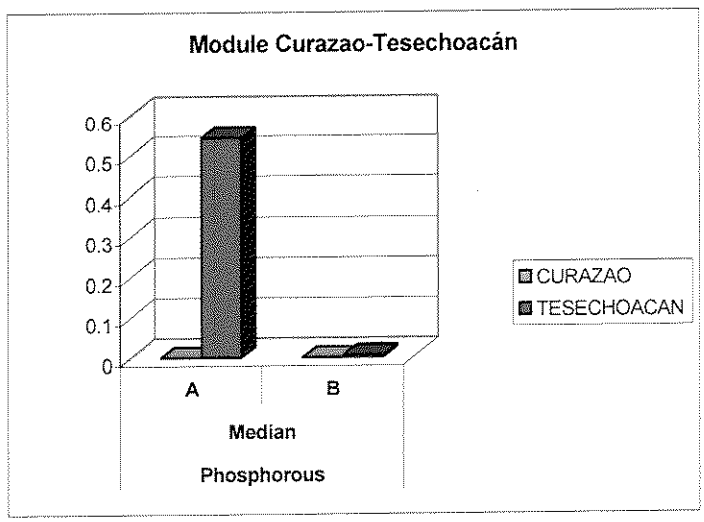
MODULE	SUBMODULE	PHOSPHOROUS (ppm) Median	
		A (0-30 cm)	B (30-60 cm)
Tlacojalpan-Ambrosio	TLACOJALPAN I	0	0
	TLACOJALPAN II	0	0
	SAN MARCOS	0	0
	AMBROSIO I	0,4515	0,1205
	AMBROSIO II	0	0



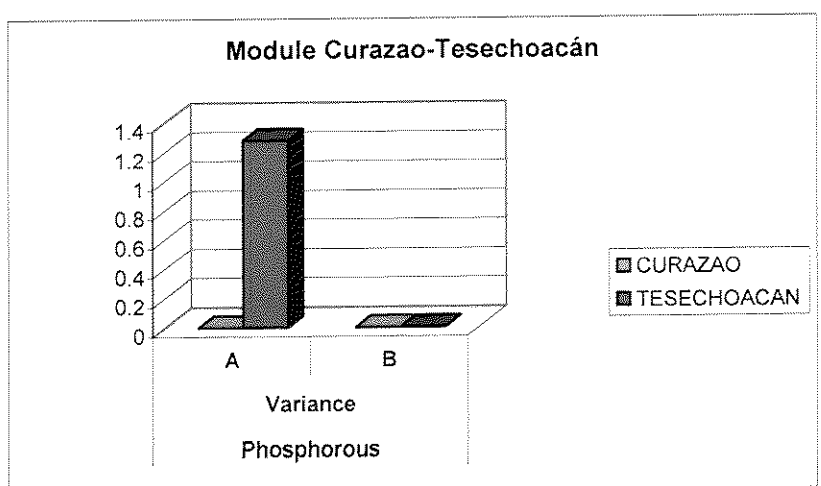
MODULE	SUBMODULE	PHOSPHOROUS (ppm) Variance	
		A (0-30 cm)	B (30-60 cm)
Tlacojalpan-Ambrosio	TLACOJALPAN I	0	0
	TLACOJALPAN II	0	0
	SAN MARCOS	0	0
	AMBROSIO I	0,80926	0,241773
	AMBROSIO II	0	0



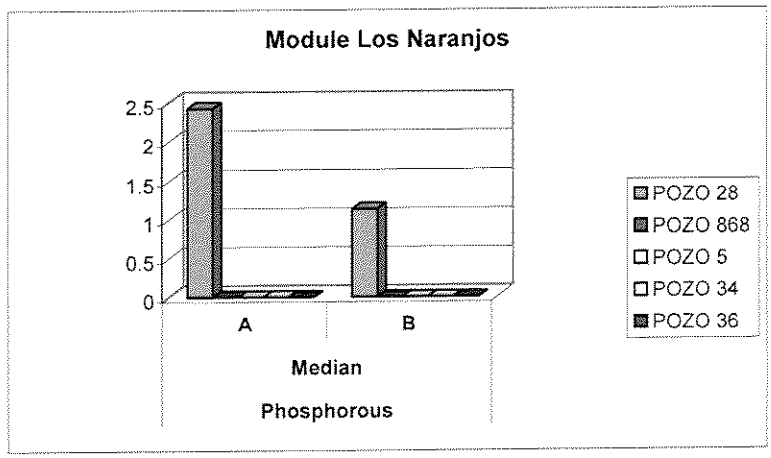
MODULE	SUBMODULE	PHOSPHOROUS (ppm) Median	
		A (0-30 cm)	B (30-60 cm)
Curazao-Tesechoacán	CURAZAO	0	0
	TESECHOACAN	0,5432	0,0056



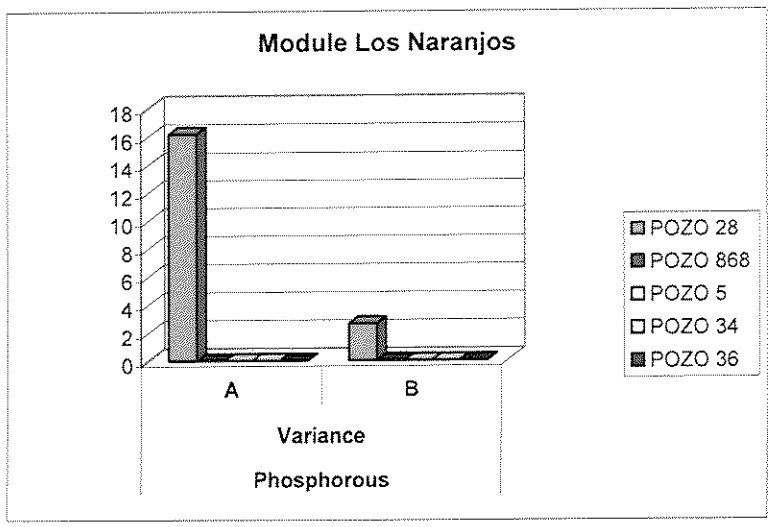
MODULE	SUBMODULE	PHOSPHOROUS (ppm) Variance	
		A (0-30 cm)	B (30-60 cm)
Curazao-Tesechoacán	CURAZAO	0	0
	TESECHOACAN	1,28037	0,001568



MODULE	SUBMODULE	PHOSPHOROUS (ppm) Median	
		A (0-30 cm)	B (30-60 cm)
Los Naranjos	POZO 28	2,42364	1,133636
	POZO 868	0	0
	POZO 5	0	0
	POZO 34	0	0
	POZO 36	0	0

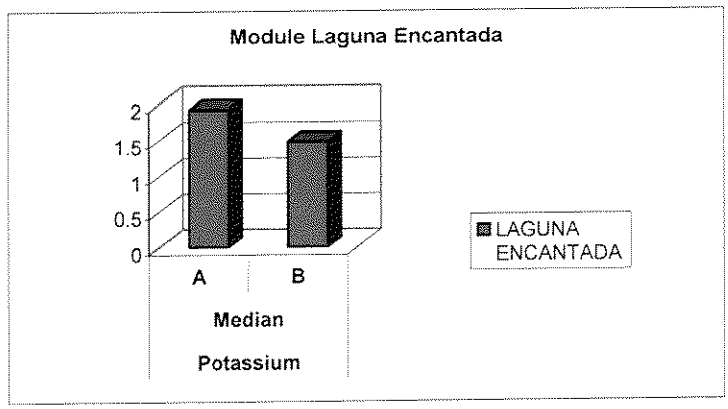


MODULE	SUBMODULE	PHOSPHOROUS (ppm) Variance	
		A (0-30 cm)	B (30-60 cm)
Los Naranjos	POZO 28	16,181833	2,631145
	POZO 868	0	0
	POZO 5	0	0
	POZO 34	0	0
	POZO 36	0	0

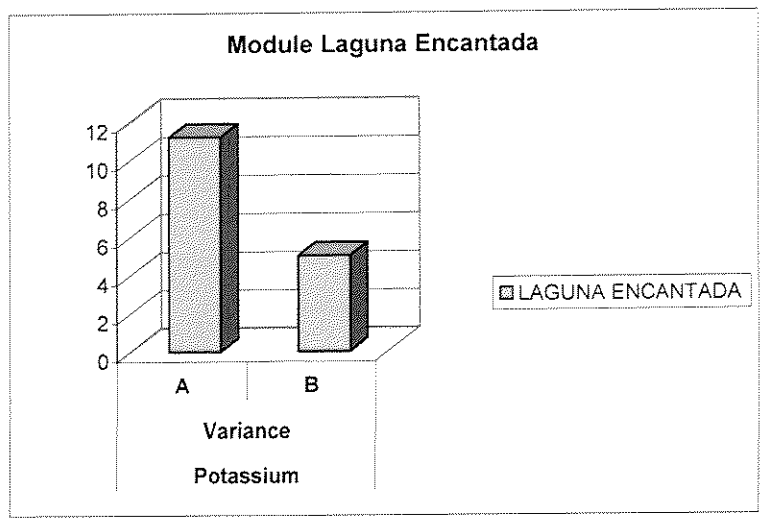


POTASSIUM

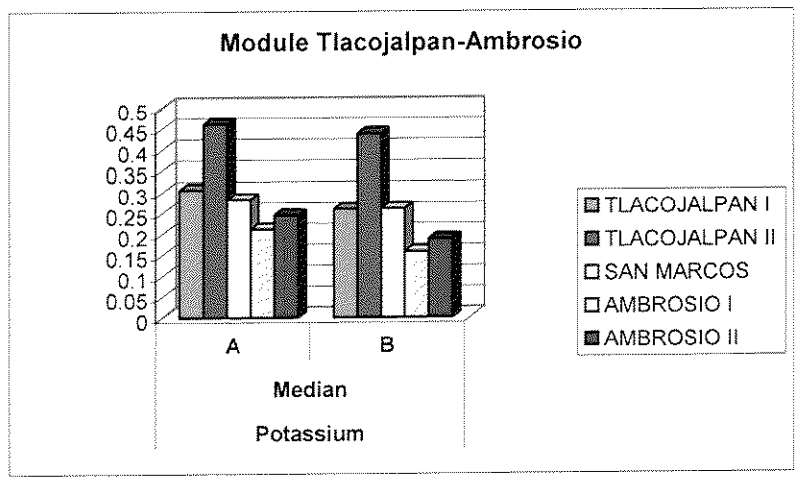
MODULE	SUBMODULE	POTASSIUM (meq/L) Median	
		A (0-30 cm)	B (30-60 cm)
Laguna Encantada	LAGUNA ENCANTADA	1,9227625	1,4796375



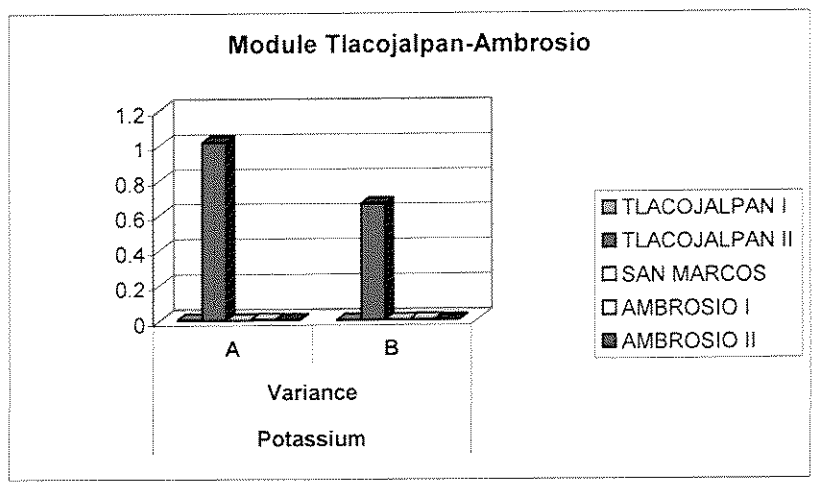
MODULE	SUBMODULE	POTASSIUM (meq/L) Variance	
		A (0-30 cm)	B (30-60 cm)
Laguna Encantada	LAGUNA ENCANTADA	11,20440279	5,006090259



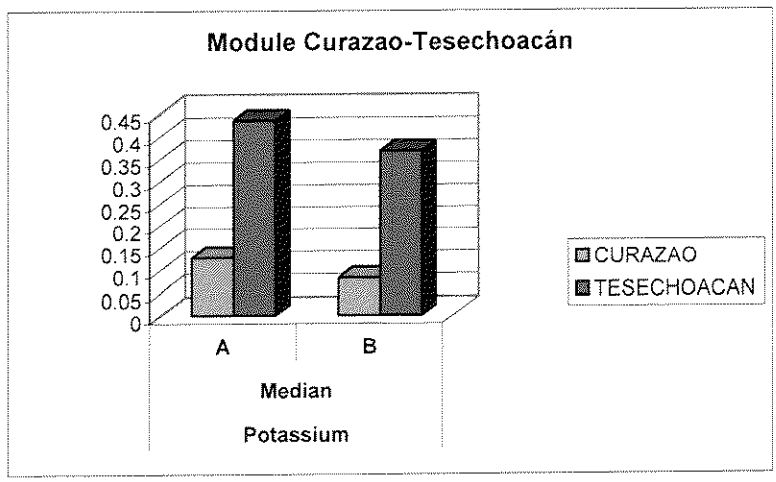
MODULE	SUBMODULE	POTASSIUM (meq/L) Median	
		A (0-30 cm)	B (30-60 cm)
Tlacojalpan-Ambrosio	TLACOJALPAN I	0,305714286	0,259642857
	TLACOJALPAN II	0,461041667	0,437916667
	SAN MARCOS	0,281818182	0,260454545
	AMBROSIO I	0,2115	0,158
	AMBROSIO II	0,245	0,187777778



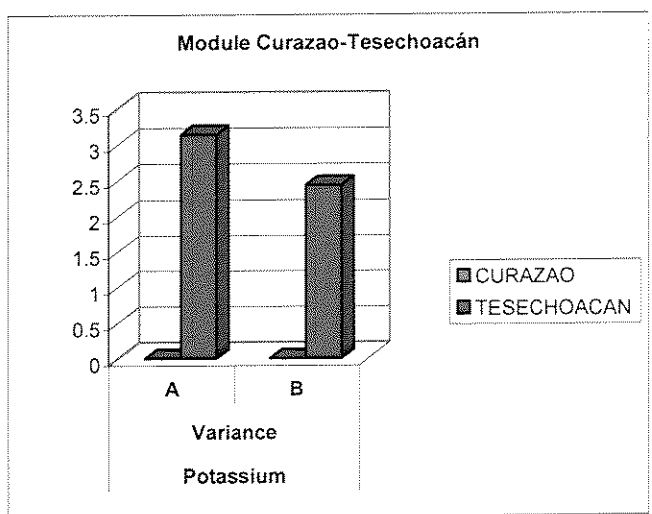
MODULE	SUBMODULE	POTASSIUM (meq/L) Variance	
		A (0-30 cm)	B (30-60 cm)
Tlacojalpan-Ambrosio	TLACOJALPAN I	0,004499471	0,001173942
	TLACOJALPAN II	1,017988254	0,663233865
	SAN MARCOS	0,000777489	0,001480736
	AMBROSIO I	0,004466053	0,004164211
	AMBROSIO II	0,002167647	0,001512418



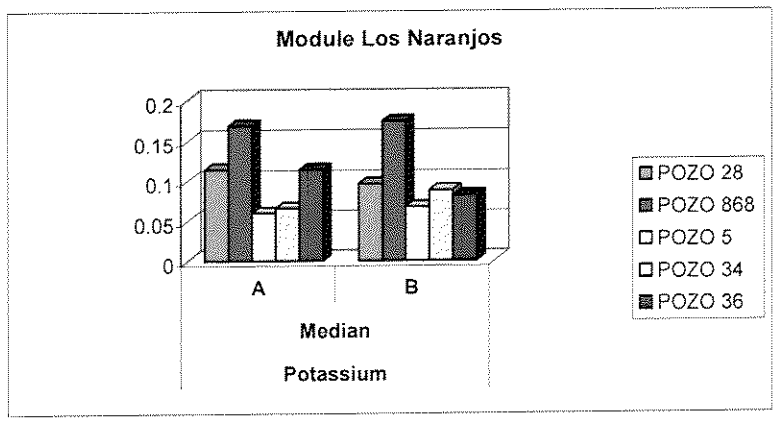
MODULE	SUBMODULE	POTASSIUM (meq/L) Median	
		A (0-30 cm)	B (30-60 cm)
Curazao-Tesechoacán	CURAZAO	0,12704546	0,08272727
	TESECHOACAN	0,4352	0,3672



MODULE	SUBMODULE	POTASSIUM (meq/L) Variance	
		A (0-30 cm)	B (30-60 cm)
Curazao-Tesechoacán	CURAZAO	0,002565486	0,000545877
	TESECHOACAN	3,137882612	2,434008327



MODULE	SUBMODULE	POTASSIUM (meq/L) Median A (0-30cm)	B (30-60 cm)
Los Naranjos	POZO 28	0,114545455	0,096363636
	POZO 868	0,167777778	0,173333333
	POZO 5	0,06	0,0675
	POZO 34	0,066	0,088
	POZO 36	0,114	0,082



MODULE	SUBMODULE	POTASSIUM (meq/L) Variance A (0-30 cm)	B (30-60 cm)
Los Naranjos	POZO 28	0,000887273	0,000825455
	POZO 868	0,000119444	0,000175
	POZO 5	0,000028571	0,000021429
	POZO 34	0,00003	0,00002
	POZO 36	0,001137778	0,000128889