

Detection of viral diseases affecting sweet pepper in Counties Iribarren, Jiménez and Torres of Lara State, Venezuela, using ELISA technique

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Abstract

Sweet pepper is an important crop in Lara State, where farmers harvest about 50% of the national production. This crop has been affected in previous years, by the increase of a complex of apparently viral symptoms, mainly dwarfing, severe mosaic, leaf curl, fern leaf, blistering and leaf deformation. In order to get current information about which viruses are present, 85 samples in Iribarren, Jiménez and Torres municipalities of Lara state were collected and analyzed by ELISA technique with commercial kits against eight different viruses, some of them have been previously reported in the country affecting sweet pepper and other important solanaceous species. Several samples were inoculated on indicator plants and their particles were observed in a transmission electron microscope. The ELISA technique enabled the detection of following viruses: Cucumber mosaic *Cucumovirus*, CMV; Tobacco rattle *tobravirus*, TRV; Potato Y *potyvirus*, PVY; Tobacco etch *potyvirus*, TEV; Tobacco mosaic *tobamovirus*, TMV; Pepper mild mottle *tobamovirus*, PMMOV; Tomato ringspot *nepovirus*, ToRSV; and Tobacco ringspot *nepovirus*, TRSV. TRV, ToRSV and TRSV are detected in sweet pepper by first time in the country.

Key words: Sweet pepper, *Capsicum annuum*, virus, ELISA, detection.

Introduction

In Lara state, Venezuela, a zone of main production of vegetables at low altitudinal soils, contributing near 52% of sweet pepper *Capsicum annuum* L. that is consumed in the country (19). Nevertheless, the dynamic system of culture (short

cycle, continuous sowing throughout the year and intensive handling of the plantation) makes it susceptible to the continuous attack of plagues, several of them transmitting diseases. Within these, the etiology viral, limited are considered like since quality causes

diminution of fruit, and when its incidence is high reduce the yield, that in some cases can be close to 28 % (6, 10), considering itself that the losses can be greater when multiple infections in the field appear. In the country, they have been indicated following the virus affecting sweet pepper: the virus of the tobacco mosaic (tobacco mosaic virus, TMV), *Tobamovirus* sort; the viruses Y of the potato (potato virus Y, PVY) and the engraving of the tobacco (tobacco etch virus, TEV), pertaining to *the Potyvirus* sort; the virus of the mosaic of the cucumber (cucumber mosaic virus, CMV), *Cucumovirus* sort; the mild mosaic virus of sweet pepper «MMVSP» (Pepper mild mosaic virus, PMMsV) (7, 9, 10, 13, 14, 27), this one last one considered like a possible member of *the Potyviridae* family (28), virus X of the potato (potato X virus, PXV), *Potexvirus* sort (20), and the mild mottle virus of pepper (Pepper mild mottle virus, MMVP), *Tobamovirus* sort (18). In the country have been indicated the following viruses in tomato: the virus of the yellow mosaic of the tomato (YMT or tomato yellow mosaic virus, TYMV),

Begomovirus sort (8), TMV, TEV and CMV, (6, 13, 15) with base in criteria combined of transmission by vectors, observation of the morphology of the particle in the electron microscope of transmission, evaluation of symptoms on guests differentials and serology. Also PVX, PVY, (20), the virus of the atrophy of the terminal bud of the tomato (tomato aspermy virus, TAV), *Cucumovirus* sort have been detected; the virus of bordered of the tobacco (tobacco streak virus, TSV) the sort *Ilarvirus*; virus of the yellowish mosaic of the marrow (zucchini yellow mosaic virus, ZYMV), *Potyvirus* sort; the virus of the mosaic of the tomato (tomato mosaic virus, ToMV), *Tobamovirus* sort; and the annular virus of the tomato (tomato ringspot virus, ToRSV), *Nepovirus* sort (21), using the ELISA technique for its detection. In 1999, a sampling was conducted with the purpose of updating information on some of possible the virus present in the culture of sweet pepper in the Iribarren, Jiménez and Torres counties of Lara state, and establishing strategies of handling integrated of these diseases.

Materials and methods

Collect of field samples. In Iribarren, Jiménez and Torres counties of Lara state, samples were collected of leaves of sweet pepper of 'Capistrano', 'Camelot', 'Jupiter NK', and 'Cacique' cultivars, that indifferently of cultivating presented viruses symptoms apparently of mosaic, decree of veins, stirred up

corollas, philiform leaves, stocky plants and small fruits and deformed. Also leaves of *Datura* were collected *inoxia* Miller within the sampled plantations that presented symptoms of winding and mosaic. Altogether, 85 samples were collected that were kept in plastic bags, labeled by county of origin and maintained in a digging

with ice until their prosecution in the laboratory.

Electronic microscopy. The observation of viruses particles became on a reduced number of field samples, and in plants inoculated in the laboratory, with an electron microscope of transmission Hitachi H-300 at 15.000 X, through preparations of rinsing and later negative tintion with acetate of uranyle to 2 % in plug phosphate to 0.1 Ms and pH 7,5.

Serology (ELISA). In order to determine the presence of virus through serology, commercial cases of diagnosis from Agdia, Inc. specific for 8 viruses: Sonajero virus of the tobacco (tobacco rattle virus, TRV), genre *Tobravirus*; virus of the annular spot of the tobacco, (tobacco Ring spot virus, TRSV), genre *Nepovirus*, PVY, TEV, PMMoV, ToRSV, CMV and TMV. All the used systems are based on the technique of direct double sandwich (DAS-ELISA), with polyclonal antibodies of capture.

For the cases of PMMoV and CMV, the secondary antibodies of detection are monoclonal, and for the virus remaining, polyclonal. The secondary antibodies are conjugated to phosphates alkaline. The protocols described by the manufacturer were followed for each system of detection, that essentially follow the same sequence and detailed theoretical foundation in specialized Literature (4, 12). Fragments of leaves (0.5 g) were macerated with cold and sterile

mallet and mortar in plug of extraction in proportion 1:10. The extract was filtered through gauze and cell was placed in the microplates of degree at the rate of 100 i/cell and two cells/sample were used, as the tissue controls provided by the manufacturer for each virus: positive (sick plants), negative (sane plants), in addition to the absolute control (extraction plug). The liophilized controls were hydrated previously in plug of extraction by 18 h at 4°C. The time of incubation, rinsing and volume of application of the other reagents became of uniform way according to the described in the protocol provided by the manufacturer. The plates were analyzed in a reader of plates of microdegree with a filter of 405 nm, making white in the absolute control. Due to the number of analyzed samples, 2 plates for each virus were used and an only control for each pair of plates was used. The plates provided by the manufacturer are of polystyrene (DYNEX, Immulon 2HB) of high capacity of fixation of protein and low coefficient of variation of absorbance (intra and between plates). They were considered as positive samples those that presented readings average of absorbance, greater or equal than the average plus the double of the standard deviation of the readings of absorbance of the negative control (Pe, si Prom. X_m , e» Prom. $X_{(sane)} + 2 \sigma_{(n-1)}$) (4, 31).

Results and discussion

Symptoms of field and occurrence. The predominant symptoms in the plants of sweet pepper, consisted of mottle chlorotic of variable intensity and mosaic, a pronunciation of veins, curly corollas, philiform leaves and stocky plants. Plants of *D. innoxia* presented symptoms of winding and severe mosaic. Also plants with mosaic symptoms were observed that presented small fruits and deformed from the first stage of growth. In the sowings visited in the three Counties, the occurrence of these symptoms oscillated between 30 and 70%.

Electronic Microscopy: Small particles in flexible filament form, in field samples and the indicating plants of sweet pepper were observed 'Yolo Wonder', Capistrano and *Datura innoxia* that was inoculated with extract of *D. innoxia*.

Serology: The averages of absorbance for the controls and the point of court are showed in table 1. This criterion is arbitrary and relatively strict, but the selection of other points of court commonly used, is also empirical and arbitrary (4, 31). The ELISA tests allowed to detect the virus: CMV, TRV, PMMoV, TMV, PVY, ToRSV, TRSV and TEV. According to these results the virus that were in simple infection was the TMV, TRSV and CMV, the others were found in double or multiple infection until in combinations of eight of them in a single plant. Table 2 shows the different associations of viruses found by county, detected

using ELISA.

In Jiménez county associations of 2 to 8 viruses were found where the presence of these was in the Iribarren Municipality detected the presence of TMV, PMMoV, TRSV and TEV. There, only TRSV happened like simple infection and the rest in double associations. In Torres municipality the presence of CMV, TMV, PMMoV, TRSV, ToRSV and TEV was detected, in simple infection or association of three virus/plant. Table 3, shows the incidence of different virus detected in sweet pepper in the counties sampled in Lara state. The main diversity and incidence of virus were registered in Jiménez County, where were detected all the considered viruses in this study. Thus, between those of more high incidence emphasize PMMoV and TEV with 100.00%, ToRSV with 58.82%, TRSV with 50%, and CMV with 35,29%; TMV, TRV and PVY presented low incidences of 30%. This turns to Jiménez County a source of dispersion of the virus detected with high risk and economic importance since it is a fact that it provides plants for seedtime, not only to the remaining counties of the state, but also to other states of the country (21). This situation is particularly important for the cases of PMMoV and TMV that are tobamovirus of very easy mechanical transmission (17, 32, 33). In the Iribarren County it emphasizes the TRSV, detected in 72.22% of the cases, followed of the TMV with 38.39%, PMMoV and TEV, both with

Table 1. Average of absorbance of positive controls (insane) and negatives (sane), and point of court for the virus detected according to the inequality: Ill P., if the Average of the Absorbance of the sample is greater or equal to the absorbance average of negative control + 2 times dev. Standard. [Pe: Si Abs Prom X_1 e» Abs Prom control neg + 2 $\sigma_{(n-1)}$]

Case to:	Control	Absorbance of controls a 405 nm		Average	$\sigma_{(n-1)}$	2 $\sigma_{(n-1)}$	Cut Point
		X_1	X_2				
CMV(Mab)	+	0.840	1.042	0.941	0.075	0.150	0.351
	(sane) -	0.148	0.254	0.201			
PVY(Mab)	+	1.012	0.922	0.967	0.007	0.014	0.219
	(sane) -	0.200	0.210	0.205			
TEV	+	1.725	1.667	1.696	0.072	0.144	0.629
	(sane) -	0.536	0.434	0.485			
TRV	+	1.101	1.275	1.188	0.068	0.136	0.579
	(sane) -	0.491	0.395	0.443			
PMMoV	+	1.432	1.674	1.553	0.030	0.061	0.473
	(sane) -	0.433	0.390	0.412			
TMV	+	1.655	1.853	1.754	0.103	0.205	0.555
	(sane) -	0.422	0.277	0.350			
ToRSV	+	1.389	1.231	1.310	0.022	0.044	0.620
	(sane) -	0.816	0.591	0.576			
TRSV	+	1.228	1.082	1.155	0.035	0.069	0.443
	(sane) -	0.398	0.349	0.374			

11,11%. The other virus was not detected. In Torres Municipality TRV nor PVY were not detected; the other virus was detected in proportions that fluctuated from 16.67 to 62,50%. This municipality also is, according to these results, an important potential source of inoculums if it got to produce plants for other localities. Call the attention the low incidence of the PVY, that was only detected in Jiménez County (17,65%) and not in the remaining municipalities. This virus transmits itself of nonpersistent

way and with facility by several species of aphids, between which *persicae* emphasizes *Myzus* (Sulzer) (1), that has been identified in the country (3) and for the moment of the sampling they were neighbor in the same plantations. The main incidence of CMV related to PVY could possibly explain due to the first has a greater range of hosts, which has more than 190 species in 40 host families, increasing the probability of transmission of weeds to cultivars (11, 17), which is of difficult occurrence for

Table 2. Associations of virus in sweet pepper detected in three counties of Lara state.

County			
Associations	Jiménez	Iribarren	Torres
Single Double	PMMoV + TEV	TRSV TMV + TRSV TRSV + TEV PMMoV + TRSV	CMV, TMV, TRSV CMV + TMV ToRSV + TEV TMV + TRSV CMV + TRSV PMMoV + TMV + TRSV CMV + TMV + TRSV
Triple	PMMoV + TEV + CMV, PMMoV + TEV + ToRSV PMMoV + TEV + PVY		
4 Virus	PMMoV + TEV + TRSV + TMV PMMoV + TEV + TRSV + ToRSV PMMoV + TEV + TRSV + CMV PMMoV + TEV + TRSV + PVY PMMoV + CMV + TRSV + TMV PMMoV + TEV + ToRSV + TMV PMMoV + TEV + ToRSV + CMV PMMoV + TEV + CMV + TMV PMMoV + TEV + TRSV + CMV + ToRSV + TRV		
6 Virus			
7 Virus	PPMoV + TEV + TRSV + CMV + TMV + ToRSV + TRV PMMoV + TEV + TRSV + CMV + PVY + ToRSV + TRV		
8 Virus	PMMoV + TEV + TRSV + CMV + TMV + ToRSV + PVY + TRV		

Table 3. Incidence of virus in sweet pepper in three counties of Lara state. 1999.

Virus	County		
	Jiménez	Iribarren	Torres
PMMoV	100.00	11.11	31.25
TEV	100.00	11.11	16.67
TRSV	50.00	72.22	62.50
TMV	26.47	38.89	40.63
CMV	35.29	0	21.88
ToRSV	58.82	0	16.67
PVY	17.65	0	0
TRV	14.72	0	0

PVY, since its natural scope of host is restricted to the solanaceae, although experimentally infects species of four botanical families (1). In an wider perspective, the three detected viruses with superior frequency to 50 % in the sampled counties were PMMoV, TRSV and TEV (table 4). The PMMoV does not have transmitting agents into nature, it is transmitted by seed in high proportion, (ca. 29 % in sweet pepper) and it is transmitted of mechanical way with facility through the manipulation in the transplant (ca. 41 %) and by the implements used in agronomical practices as mechanized cultivation and/or the earthing among others (32); all these factors could explain their high

incidence. In contrast, the other tobamovirus detected (TMV), presented a smaller incidence in spite of have been detected previously in the country, probably due to genetic resistance to TMV in some genotypes of *C. annuum* since while (10). As soon as the detection of virus TRV (tobravirus), and TRSV, ToRSV (nepovirus) in sweet pepper, its importance establish that are transmitted by seed in variable proportion (17, 26, 29, 30), with potential risk of dissemination by the use of seed put under control of phitosanitary quality and by its movement like plants not to export to other states.

The TRV is transmitted by nematodes pertaining to *the*

Table 4. Incidence of virus in sweet pepper, *Capsicum annuum* L. in Iribarren, Jiménez and Torres counties of Lara state in 1999.

	TRV	CMV	PMMoV	TMV	PVY	ToRSV	TRSV	TEV
%	5.95	22.62	54.76	34.52	7.14	30.95	59.52	50.00

Trichodoridae family (17, 26); the TRSV and ToRSV are transmitted by species of nematodes in the family *Longidoridae* (29, 30), reason which the dissemination by these transmitting agents would be less efficient due to the low mobility of the nematodes by themselves to great distances within the plantations (17). Its importance establishes they could be disseminators of virus from inoculums primary, fundamentally to neighboring plants or short distance when irrigation by furrows is used, and possibly can be moved to great distances with rest of soil in mechanized implements. The two families of indicated nematodes have described representatives in the country (2, 5, 22, 23, 25). Thus, the TRV is transmitted by at least 7 species pertaining to the sorts *Trichodorus* and *Paratrichodorus* (16, 26); between these sorts, it has been only identified in Venezuela the *Paratrichodorus minor* (Colbran, 1956) Sidiqui, 1974 associated to ornamentals (23). The TRSV is transmitted by *Xiphinema americanum* Cobb 1913 (30) and it is present in the country, although associated to the guava cultivar (5). Due to the presence of these vectors in the country, and the importance of the damage caused by the viruses that transmit to sweet pepper, it is necessary a detailed study to explain its possible roll in the epidemiology of these diseases into cultivars. The

TEV, was detected by ELISA and the observed symptoms of philiform leaves in affected plants are characteristic for this virus, already indicated previously in the country (6, 13, 24). The results obtained in this research contribute to corroborating previous researches (7, 9, 10, 13, 18) related to the previous presence of CMV, the PVY, TMV, TEV and PMMoV infecting sweet pepper in the country. The detection of viruses established in this paper work was based fundamentally on ELISA evidence, which was sufficiently specific with the used systems, since it allowed to detect of mutually excluding way in several cases, samples infected with related virus, such as tobamovirus (PMMoV and TMV), potyvirus (TEV and PVY), and nepovirus (TRSV and ToRSV) (Table 2). In both nepovirus, is indicated that the serological evidence have been determining for their identification differential, establishing that several lineages of the ToRSV are serologically, but this relationship between the ToRSV with others nepovirus seems not to exist (29, 30). Finally, it was detected apparently for the first time, to the TRV, TRSV and ToRSV affecting sweet pepper in the country. From these, the ToRSV already had been detected in tomato previously in Venezuela (20), which is necessary to confirm the presence of three viruses mentioned before with specific studies for its identification.

Conclusions

It is known from previews research the presence of CMV, PVY, TMV, TEV and PMMoV infecting sweet pepper in the country.

It was detected TRV, TRSV and

ToRSV affecting sweet pepper in the country considering necessary to confirm the presence of the three viruses mentioned before with specific studies for their identification.

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Aspects of floral biology in papaya (*Carica papaya* L.) cv. «Cartagena roja» in Lara state, Venezuela

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Abstract

In order to contribute the knowledge about floral biology of papaya, anthesis, dehiscence of anthers, quantity, and viability of pollen grain on different flowers and fruit set moment were studied. Anthesis, dehiscence of anthers and fruit set were evaluated by observations in field, selected each of floral types at random. Quantity and viability were determined by hematocytometer methodological, using aniline blue in lactofenol at 1%. The results indicated differences between floral types. As anthesis as fruit set begin slower in a type I flower. Dehiscence of anthers occurred before anthesis. The floral IV+ the biggest quantity of pollen grain, compared with the types IV and V. Viability percentages were 86,2; 86,7 and 82,7% for IV, IV+ and V floral types, respectively.

Key words: *Carica papaya*, anthesis, dehiscence of anthers, fruit set, pollen, viability.

Introduction

The papaya (*Carica papaya* L.), is a perennial original specie of Tropical America and pertaining to the *Caricaceae* family (2). Although its exact origin has been very discussed due to the great dissemination by the man (9).

In this specie 6 types differentiated from flowers are recognized: one feminine one, three hermaphrodites and two masculine, designated commonly like types I, II, III, IV, IV+ and V, respectively (10).

The hermaphrodites flowers distinguish by the number and distribution of stamens, form of ovary and characteristics of the corolla; these flowers also denominate «pentandria» (type II), «irregular» (type III) and «elongate» (type IV); the flowers of type III and in smaller degree of type II present stamens carpeloidy. The masculine flowers can be «functional masculine» (type IV+) and «masculine typical» (type V); these flowers do not develop fruits (10,

20). According to the presence of these floral types the papaya plants can group in diverse sexual forms or genomes: androic form, which presents masculine flowers mainly (type V), ginoic form, with solely feminine flowers (type I) and the andromonoic sexual form, with hermaphrodites flowers of types II, III and IV, in addition to masculine flowers (IV+) (10). Researchers have demonstrated that the sex of the papaya is governed genetically but in spite of it has been reported that the floral development is under modifications by environmental factors, being the temperature, the light and the humidity, most influential. (12). The studies on the reproductive Biology of the papaya are fewer (17) and are located in Hawaii, India and South Africa. Parés (13) evaluating the reproductive behavior of the papaya Cartagena Amarilla cultivar in Venezuela, respectively found that the androic sexual form was precocious in initiating the flowering, taking 54 days after seedtime in field, whereas the sexual forms andromonoic and ginoic initiated their flowering to 59 and 61 days.

Mekako and Nakasones (11) indicated that the time from the emergency of the floral button to the anthesis of the flower, under the conditions in Hawaii, was of approximately 45 days in masculine flowers and 47 days in the feminine, whereas the hermaphrodites floral types delayed 49 days. On the other hand, Sippel *et al* (19) indicated a period of 10 weeks from the

emergency of the floral button to the anthesis in cultivating «Sunrise Solo» under the conditions of South Africa. Possibly these differences also must be due to the climatic conditions, as indicate the authors previously mentioned. Parés (13) reported that the floral types produced by the andromonoic sexual form (II, III, IV and IV+) presented similar performance as far as the number of days passed from the emergency of the floral button to the anthesis, taking 33 days in average, whereas the floral type I produced by the ginoic sexual form took 35 days and the floral type V produced by the androic plants, delayed 30 days. Sippel *et al* (19) mentioned that under conditions of South Africa, all the floral types show a tip of anthesis at the end of the afternoon or at the beginning at night, being for the staminate and pistil flowers between 6 and 8 p.m., and for the hermaphrodites between 8 and 10 p.m.. These results are similar to the reported ones in India by Parés in Venezuela (13). According to Rodriguez *et al* (16), the dehiscence of anthers takes place before it happens the anthesis; mentioning Parés *et al* (14) that the liberation of pollen grains happens two days before the opening of the floral button for the case of types IV+ and V, whereas for the floral types IV, III and II the day of the anthesis follows one another, previous to this one. Parés *et al* (15) mention that the greater amount of pollen grains by flower produce the floral types IV, IV+ and V, being the amount of pollen grains produced by flower of 107,200, 106,776, 238,680,

229,920 and 223,680 for the floral types II, III, IV, IV+ and V, respectively. The germination of pollen grains in papaya is presented in increasing form in the measurement in which the floral types approach the masculinity, presenting the viability *in vitro* of pollen grains the same isendency that the germination, which demonstrated by the high degree of existing correlation between the 2 variables, with $r^2 = 0,9956$ (15). Results allow to corroborate that the germination of pollen grains of papaya *in vitro* can be considered like a reliable test to determine their viability as indicates Cohen *et al* (3). The fixation of fruits varies between different the floral type floral from papaya; the floral type I produced by the ginoic plants is most delayed in fixing its fruits to comparison to the floral types produced by the andromonoic plants, delaying 10 days. From the floral types produced by the andromonoic plants, the II and III present a similar performance, taking 7 days in fixing their fruits, unlike flower IV which it turns out to be precocious, delaying 6

days from the floral opening (12). Possibly, this characteristic of the floral type it must to its unisexual constitution where the crossed pollination is obligatory, unlike the floral types produced by the andromonoic individuals, which release pollen before the floral opening (13). By previously exposed, and given the importance that has the study of reproductive Biology on the level of production and the handling of the plantations, it is considered to evaluate some aspects of the floral Biology of the papaya cv. Cartagena roja. For which the following objectives were formulated:

Determine the duration of the period from emergency of the floral button to the anthesis, for the floral types I, IV, IV+ and V.

Determine the moment of the dehiscence of anthers in the floral types IV, IV+ and V.

Consider the total amount and viability of pollen grains of the masculine flowers and hermaphrodite elongated.

Determine the time of fixation of the fruit for the floral types I and IV.

Materials and methods

The experiment was carried out in a block of 450 m², in the farm «La Esperanza», located in Bobare, Iribarren County of Lara state; the zone belongs to the thorny mount with precipitation annual average of 390 mm³; potential evapotranspiration of 250 mm³ monthly and temperature monthly average of 28°C.

Material vegetable flowers of cv.

Cartagena roja were used, this variety is characterized by being of high bearing, green stems and petioles of flowering to 4 months after the transplant and to present fruits of sure yellow crust reddish pulp and sweet flavor, when mature (4). Seedtime was made in polyethylene bags, the soil became disinfected previously with hot water. Plants was

protected initially of the sun placing them under shade, and 10 days before the transplant to field were put under total solar exhibition. The control of weeds during the phase of breeding soil was made manually. The subject population to study was conformed, once made to thinned, by 214 plants. At the three months of age the plants were taken to field where all the respective agronomical workings were made. The time average passed from the emergency of the floral button to the anthesis was determined marking visible a floral button, (4 mm approximately). 30 flowers of types I, IV IV+ and V were evaluated altogether. A flower by plant was evaluated selected at random with the exception of the androic sexual form of which evaluated three flowers by given plant its low proportion in the studied population (13). For the determination of the dehiscence of anthers 30 androic flowers (V and IV+) and 30 flowers of type IV were evaluated, selecting a flower by plant in the case of the flowers IV+ and IV and three of type V. The flowers were marked and it was open each one carefully; with the help of a magnifying glass, it was observed the moment at which it happened the dehiscence of anthers, and the number of days passed from the dehiscence of anthers was registered to the floral opening. (14). The amount and viability of pollen grains was determined at random selecting 5 flowers of types IV and IV+ and equal amount of flowers of same type V. The same had their mature anthers, nondehiscent, and were put to the

laboratory in paper bags. The estimation of the total amount of pollen grains (viable and nonviable) by flower was made under the microscope stereoscopic and with the help of two needles of dissection an anther was opened, of each verticil, by flower on a 0.1 touchstone and then 0,1 milliliter of blue aniline in lactofenol to 1% was added, considered like volume of dilution, which colored the viable pollen grains; it was verified that all the pollen grains were free of anthers and these were retired of the liquid. The mixture was shaken well with a needle and a drop of this one was transferred using a pipette Pasteur to each one of the cameras of hematocytometer repeating the procedure until obtaining a total of four measurements by each dilution. In each measurement the grains were counted of pollen viable and nonviable (not colored and deformed) (7).

The calculation of the total amount of pollen grains by anther, was made applying the following formula:

$$\text{Pollen Grains/anther} = \frac{N^{\circ}/\text{chamber} \times \text{Vol. of dilution} \times 10^4}{4}$$

The total number of pollen grains by flower was obtained multiplying the number of grains totals/anther by the total number of anthers of each flower. Whereas, the amount of pollen viable calculated applying the previous formula, using in the formula the number of viable pollen grains in place of the number of total grains. The complete procedure was repeated five times for

each type of flower.

In order to determine the moment of fixation of the fruits the number of days passed from the anthesis to the fall of the petals was registered; 30 flowers of the floral type IV of the andromonoic plants were marked and 30 feminine flowers (type I) of the ginoic plants, one by plant selected at random (14). These 2 floral types were evaluated by being those

that produced commercial fruits. Once verified the assumptions that rule the variance analysis, the data of each evaluated variable were put under the variance analysis and a Duncan test of averages, both at a significance level of 5% of probability. The Statistic Analysis System was applied 6,12 (18), like statistical applicative.

Results and discussion

It was detected that the type of flower affects the duration of period from the emergency performance in relation to this variable (table 1). The types of flowers IV and V, presented a similar behavior in relation to this variable. Also the Duncan test allowed to classify other two groups of floral types, in function to the time from the emergency of the button floral until its opening, being constituted by types I and IV+, respectively, which take longer in initiating its anthesis, comparing to types IV and V.

Parés (13) working under the conditions in the basin of Valencia Lake and with Cartagena amarilla

papaya, it obtained a similar tendency as far as the performance of the floral types in function to the anthesis. Although, the number of days passed for each case was higher, reporting 35 days for the feminine flower (type I), 33 days for all the floral types produced by the andromonoic plants and 30 days for the masculine flower (type V). On the other hand, Mekako and the Nakasones (11) found in the 26 line the group «Solo» a period of 45 days in masculine flowers and 47 days in feminine flowers, whereas the hermaphrodites delayed 49 days. Additionally, Arkle and Nakasone (1) and Sippel *et al* (19) reported a period of 9 to 10 weeks for the floral

Table 1. Days from button floral emergency of the (*Bfe*) to the anthesis.

Floral type	Sexual form	Days between <i>Bfe</i> and anthesis.
I	Ginoic	31.27 a
IV+	Andromonoic	30.42 a b
IV	Andromonoic	29.55 b
V	Androic	29.42 b

Averages with different letters represent significant differences according to the Duncan test with a 5% of probability

ontogeny. Some researchers have demonstrated that this period probably is affected nonsingle by characteristics genetics of the species but also by the climatic conditions prevailing in each region where the evaluations are made (1, 11, 19). In all the floral types evaluated the dehiscence of anthers it happened before the floral opening as indicated Rodriguez *et al* (16) and Parés *et al* (14). According to the made observations the dehiscence of anthers happened 2 days before opening the floral button for the case of types IV+ and V, whereas in floral type IV follow another a day before the anthesis (table 2). These results agree with the reported by Parés *et al* (14) who working with papaya Cartagena Amarilla indicate that the dehiscence of anthers of the floral types V and IV+ happen two days before the anthesis, whereas in types II, III and IV a day follows one another before the same. The total amount as the viability of pollen grains in the flowers of *Carica papaya* L. are affected by the floral type being type IV+ which produce the greater amount of pollen grains as well as presents greater percentage of viability (table 3). The results of this research agree with the report written by Lassoudiere (6) in the sense that mentions the amount of pollen produced by anther is among 10,000 to 14,000 grains. Nevertheless, Parés *et al* (15) mentioned that the amount of pollen grains produced by the floral types IV, IV+ and V are of 23,860, 22,992 and 22,368, respectively. Garret (5) indicated that the

production of pollen of the papaya plants is influenced by environmental factors in addition to the cultivated genetic material, diminishing the amount significantly of pollen produced at the cold season of the year.

On the base of statistical analyses to the viability tests, (Figure 3) the evaluated floral types can be classified in two groups; first constituted by the floral types IV+ and IV with 86.65 and 86.21 % of viability, respectively and the second conformed by the floral type V to 82.71 % of viability. Nevertheless, Parés *et al* (14) mentioned that the percentage of viable pollen grains by flower was significantly greater in the floral type V, followed by the types IV+ and IV which statistically present a similar performance. These differences can have not only by characteristics genetics of the species but also by the climatic conditions prevailing in each region where the evaluations are made (5, 8). In the observations, the fixation of fruits or period passed from the floral opening to the senescence of the petals, is affected by the floral type (table 4). When comparing the averages was the floral type I, of the ginoic sexual form was the plus delayed in fixing its fruits, delaying 8 days in average, compared with the floral type IV, which took in average 6 days from the floral opening. The same tendency was obtained by Parés *et al* (14) who indicate that the floral type I produced by the ginoic plants is most delayed in fixing its fruits to comparison with the floral types produced by the andromonoic plants.

Table 2. Period from dehiscence of anthers (*Da*) until the anthesis.

Floral Type	Days between <i>Da</i> and anthesis
IV	1.0952 b
IV +	2.0000 a
V	2.2381 a

Averages with different letters represent significant differences according to Duncan test with 5% of probability

Table 3. Total amount and viability of pollen grains

Floral Type	Pollen grains/flower	Viability (%)
IV+	148.400+6482.7 a	86.65 + 3.75 a
IV	104.400+4960.3 b	86.21 + 5.50 a
V	107.600+4085.7 b	82.71 + 4.05 b

Averages with different letters represent significant differences according to Duncan test with 5% of probability

Table 4. Days between anthesis until the fixation of fruits (*Ff*)

Floral Type	Sexual Form	Days between anthesis and <i>Ff</i>
I	Ginoic	7.8 a
IV	Andromonoic	6.4 b

Averages with different letters represent significant differences according to Duncan test with a 5 % of probability.

They indicate that the feminine flower delay 9 days in fixing their fruits, flowers II and III showed a similar behavior taking in average 7 days unlike the elongate flower which delayed 6 days. Possibly these

differences must to that the floral type I obligatorily needs the crossed pollination, due to their unisexual constitution, unlike the andromonoic individuals which give off its pollen before the floral opening (Parés, 13).

Conclusions

The type of flower affects the duration of the period from the emergency of the floral button to the anthesis, happening itself of more

delayed way in the floral type I, which I take 31.27 days, whereas the floral types IV+, IV and V took 30,42; 29,55 and 29.42 days, respectively. The

dehiscence of anthers before appeared before the anthesis happening 2 days in the floral types IV+ and V, and a day before in type IV. The floral type IV+ produced the greater amount of pollen grains by flower in comparison to the floral types IV and V being produced amount 148,400, 104,440 and 107,600, respectively. The floral types IV+ and IV produced the greater

percentage of grains of pollen viable by flower in comparison to the floral type V; being the percentage of viability 86,65; 86,21 and 82.71 %, respectively. The fixation of fruits happens 8 days in the feminine flower, whereas in the floral type IV pass 6 days from the floral opening to the fixation of the fruits.

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Quality of soil organic matter under different management practices in a tropical acid soil

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Abstract

Dynamic of soil organic matter (SOM) in tropical savannahs is of growing interest because of the recent rapid increase of cultivation and the questions concerning their sustainability under intensive land use. As most of the soils of Venezuela are highly weathered and nutrient poor, the significance of SOM for soil fertility is even greater than temperate soils. A continuous sorghum study was initiated in 1999, located in Espino, Guárico state, Venezuela. It included fresh residues incorporation (grass, legumes, and native sod) with minimum tillage. No residue treatment and fallow were used as control. Organic C, mineralizable C, and C coming from microbial biomass were determined in soil samples collected at 10 cm depth during 2002. Subsamples also were separated into four aggregates size classes by wet sieving. Soil N mineralization was determined *in situ* in the field, during 2001. Soil organic C was divided into microbial, mineralizable, and resistant fractions. Cultivation decreased microbial biomass by 50%, and stable C by approximately 9%, but increased non-biomass C by 40% compared to fallow. Management practices did not affect significantly microaggregates proportion, but legumes and native sod residues increased macroaggregates amount. Net N mineralization was significantly increased by 40% by native sod residues compared to fallow. Incorporation of legumes residues increased carbon mineralization, and stimulated microbial activity. The ratio of microbial activity to soil microbial carbon was higher under legumes than under the other systems, indicating that microbes under legumes treatment have been most active. The results indicate that legumes residues with minimum tillage contribute to increase macroaggregates, and weaknesse fractions of C in highly weathered tropical soils.

Key words: organic matter fractions, aggregates, N and C mineralization.

Introduction

The interest in the study of the dynamics of soil organic matter (SOM) in tropical in Venezuelan savannas has increased in the last years due to the fast rise of the agricultural operation, in addition to the search of responses to questions related to the land sustainability under intensive agricultural use. (Hernández and López, 2002). The change of use of natural savannah land to culture greatly affects the structural ability and diminishes the organic land amount of C (van Veen and Paul, 1981), this loss of C reduces the proportion of macroaggregates of soil (Elliot, 1986; Gupta and Germida, 1988; Cambardella and Elliot, 1993; Freibauer *et al.*, 1999) since they are mostly affected by the handling practices. The tillage breaks the aggregates soil and releases the particulate organic matters (Six *et al.*, 1998) which increases the contact of residues with the microorganisms (Reicosky and Lindstrom, 1995). This is a consequence which brings an increase of oxidation of these residues that were protected within the aggregates (Beare *et al.*, 1994), reason why it is possible to conclude that the aggregation and content of SOM depend on the use of land and the cultivar systems. The conservationists handling systems, such as mini tillage and green fertilizer, have been proposed as alternative systems of handling to reduce lost of soil by erosion (Taylor *et al.*, 1964), improvement of the efficiency in the use of water (Smika

and Unger, 1986) and increase the concentration of C of the superficial soil (Karlen *et al.*, 1994). The conservationist soil handling has been suggested as a method to transform all the soil system of atmospheric source of C made a drain net of C (Kern and Johnson, 1993). The amount of SOM is a function of the amount of residues of plants that enter in the soil and the rates of decomposition of those residues. In addition to the climate, the type and quality of substrate (contained of N, relation C:N and lignin: N) are important factors that regulate the processes of decomposition of the SOM (Jastrow and Miller, 1997). The stabilization of the SOM can increase with the humification degree, by the association with the mineral phase and by the protection of the SOM within aggregates. This last stabilization is due to the SOM is kept in small pores of aggregates, so that the microorganisms cannot have access to the substrate (Elliot and Coleman, 1988). The paper of the protection of the SOM of the decomposition on the part of the soil structure has been demonstrated by the increase in the mineralization of the aggregate C disintegrated in relation to intact aggregates (Elliot, 1986; Gupta and Germida, 1988; Gregorich *et al.*; 1989; Beare *et al.*, 1994). The soil organic matter is a complex mixture of heterogeneous fractions with rates of different recharge parts. The characterization of the dynamics of the SOM has been

used in simulation models that include discreet fractions of C with different rates from rechange (van Veen and Paul, 1981; Parton *et al*, 1989). Many models divide the SOM in active, slow and passive fractions. The most active fraction, representing the microbial matter and soluble organic matter, constitutes 3-5 % of total the organic matter (Rice and Garcia, 1994). The slow fraction has time of residence of 10 to 50 years and represents of 20-40 % of the total C of the soil (Elliot, 1986). Both fractions

of active and slow C are considered through the measurement of microbial matter and kinetic analyses of mineralization in the laboratory (van Veen and Paul, 1981). The passive fraction with times of rechange on the order of 100 to 1000 years can be considered by difference. In this study, it was tried to determine the effect of application of vegetal wastes with mini tillage on the fractions of the organic matter, rates of mineralization of nitrogen and soil aggregation.

Materials and methods

Description of studied place

The experimental place was located in a savannah of the northeastern region of the Guárico state, near of Espino locality, Venezuela. The climate is characterized by an annual average temperature of 27 °C and a precipitation of 1136 mm. The soil has a sandy texture and has been classified like Typic Paleustults with 6, 9 and 85 % of clay, the slime and sand, respectively. With a content of total C and 1.2 N of 10 and Mg is⁻¹, respectively.

The natural vegetation this represented by ciperaceae, typical gramineae of the zone (*Trachypogon sp*, *Axonopus sp*) and the leguminous (*Indigosfera lespediade*). A field study was made to evaluate the effect of the application of green residues, gramineae (G) (sorghum), leguminous (L) (indigo) and wild vegetation (WV), in sowing of continuous sorghum. In 1999 a seedtime was conducted and

incorporation of the residues and in 2000 year was applied the basic fertilization of N, P and K and seeded the culture. The treatments controls were without residues (WR) and fallow (F). The parcels were of 2.025 m² with a distance between row of sowing of 0.45 m.s the mini tillage applied in the treatments where were applied the residues, it was a plough to the depth of 10 cm made with a rotocultor. The treatments were fixed in a design of blocks completely randomized with four replications using sorghum in dry land system. The sorghum [*Sorghum bicolor* (L.) Moench] used, Chaguarama VII, is a hybrid with abilities to adapt to acid soils.

Sampling Procedure

In 2001, before seedtime and from the application of fertilizers, ten soils random samples of 0-10 cm of depth, were obtained in each one of the parcels having used Oakfield large drills (2.26 cm of diameter). The

samples were placed in plastic of polypropylene and transported into bags to the laboratory to 4 10 approximate temperatures of 10 °C and then conserved to 4 °C until the accomplishment of the physical, chemical and microbiological analyses.

Determination of total C and N

The soil samples, taken before sowing, were dried airily through a mesh sieve of 0.15 cm, to determine the organic C by the method of humid oxidation with $K_2Cr_2O_7$ (Anderson and Ingram, 1993) and the total N following the method of Kjeldahl (Anderson and Ingram, 1993).

Analysis of microbial matter

The microbial matter of C (MMC) was determined by the fumigation-incubation technique (Jenkinson and Powlson, 1976). The soil used for the estimation of MMC was stored to 4 °C by a nongreater lapse of two weeks before the analysis. The samples were sifted through a 6-mm mesh. The soil (5 g) was added to serum bottles of 160 milliliter. When the water content was smaller of 0.28 g g⁻¹ (approx -150 kPa), water was added to it to reach that humidity content. All the samples were preincubated to 25 °C by 5 days, and then, half were fumigated with free ethanol chloroform by 18-24 h. Each fumigated soil sample received the conventional inoculate (0,5 g) of the corresponding not-fumigated soil. The fumigated and non fumigated samples were not sealed and incubated by 10 d 25 °C. At the end of the period of incubation, the concentration of CO²-C was moderate,

using a gas chromatograph Agilent 6890 (Agilent Technologies, Wilmington, DE) equipped with a column Porapak Q of 2 ms. The MMC were calculated with formulates $MMC = Fc / Kn$ where Fc = produced [CO² of fumigated soil-CO² produced of the non fumigated soil] and Kn = 0.45 (the produced microbial proportion of C like CO²).

Mineralization of carbon

Ten grams of soil was added into serum bottles of 160 milliliter. Before the analysis the samples were sifted through a 6-mm mesh. The water potential of the soil was taken to 30–J kg⁻¹ (0.30 kg water kg⁻¹ soil) with distilled water approximately. The soil was incubated to 30 °C by 65 days and the CO²-C determined as of the second day of incubation using a gas chromatograph. The potential of the mineralized C was considered of the rate of CO²- C production during 7 to 65 days of incubation, assuming that during this period the soil had reached a stable level, where most of the CO²-C flow came from the basal breathing occurred in this time. The mineralized potential C was calculated using the CO²-C produced, which is fixed to a model of kinetic of first order (Stanford and Smith, 1972) using a curve not to linear fixed to procedure PROC NLIN (SAS Institute Inc., 2000).

Physical division of soil

The fractions of aggregates were separated by soaking of the dry soil to the air, followed by sifting in humid (Elliott, 1986) through a series of four sieves (2000 :m (big macroaggregates), 250 :m (small macroaggregates), 53 :m

(great microaggregates), and 20 :m (small microaggregates). For each of the treatments, a subsample (equivalent to 100 g of dry soil to the air) was placed in the top of a sieve 2000 :m, then was submerged by 5 min in deionized water to room temperature. The separation was accompanied by a vertical movement by 3 cm, made the sieve. This manual movement, was made 50 times during a period of 2 min. The material surplus on the sieve was washed within a package of square aluminum dried to 50 °C all the night and then weighted. The soil suspension successively was sifted to the next size of sieve (Cambardella and Elliott, 1993).

Aggregate correction by sand

The dried fractions of soil in the furnace were cooled in a dryer and then dispersed in a solution of hexametaphosphate of sodium to 0.5%, by orbital agitation. The dispersed fraction was passed through sieves of 2000, 250, 53 and 20 :m, depending as large as evaluated fraction. The fraction surplus on the sieve was dried (60 °C) and heaved. The results are reported like the percentage of stability of aggregates.

Mineralization of N in the field

The mineralization of N was measured using polyvinyl chloride tubes (PCT) (diameter 10 cm, and depth 10 cm, with spiral covers, installed in the field after seedtime and placed during all the culture time 2002 year. The placing of tubes was made on the residues in the surface

of the soil. Throughout the tubes one was opened to them to holes of approximately 0.5 cm to a distance of 4 cm each. Then, approximately 2 cm over the surface were buried into the soil. Once installed the around was clean to eliminate the vegetation still on. Soil samples, using an Oakfield large drill (diameter 2.26-cm), were taken monthly during the time of growth of the culture of 2001 year. The samples were taken to 10 cm of depth within the mineralization tubes and immediately they were placed within polyethylene bags, transported to the laboratory and stored to 4 °C. Before the analysis, the samples was sifted using a size of 6-mm mesh. The water content was determined gravimetrically in sub-samples dried by 24 h 105 °C. The inorganic N was extracted to 3 g of a subsample to adding 30 milliliter of KCl 2M. The samples were shaken by 1 h with an orbital agitator to 300 RPM. The suspension was filtered through a paper Whatman filter #2 and $\text{NH}_4\text{-N}$ and $\text{NO}_3\text{-N}$ certain colorimetrically in an autoanalyzer Perkin Elmer, Fias 300, Ueberlingen, Germany.

Statistical Analysis

The data of every year were analyzed separately through of the SAS (SAS Institute, 2000). Proc Mixed was used like procedure for the variance analysis. For separation of difference between averages the test of minimum significant difference was used (MSD). All the results were considered significantly different from $P < 0,05$ unless the opposite is mentioned.

Results and discussion

Chemical parameters

The organic C to 0-10 cm of depth showed small differences between the treatments and was included between 9.3 and 10.1 Mg ha⁻¹ (table 1). The highest value was observed under fallow and lowest on leguminous residues. In opposition to the observed with the organic C, total nitrogen showed significant differences between fallow and the treatment without residues. Non significant difference was observed between the treatments where B was maintained and the G, L and BV were incorporated (table 1). The found values of C and N in this study were approximately 50% lower than reported by Hernandez and Lopez (2002), in savannahs of the same region in Venezuela, but under different cropping systems. Relation C:N of the different treatments was inversely proportional to the amount of N of the soil (table 1), the C:N was smaller in the soil under fallow and the treatment where L was used, perhaps and but high recharge of C due to the availability of necessary N for the microbial decomposition (Gregorich *et al.*, 1994.) suggests affects the leguminous residues.

Microbial matter of carbon

The microbial matter of carbon (MMC) followed the same pattern of the organic C. The MMC were affected significantly by the tillage and the application of residues. An average of the measures of the treatment where the tillage was applied indicates a diminution the carbon of the microbial

matter in 64% (table 2). Respect to the application of residues, the MMC reached significant ($P < 0,1$) high (> 60 kg ha⁻¹) compared with the treatments MR. and G (35 and 44 kg ha⁻¹). It was not observed significant differences between the MMC of the treatments where it was added L and the treatment where it was added NV. An increase of the organic C, due to the microbial matter, has been suggested as an indicator of the increase of the organic matter of the soil (Polwson *et al.*, 1987). The results indicate that the MMC were affected rapidly by the culture systems, this suggests that MMC can serve as an indicator of soil changes SOM highly degraded.

Mineralization of Carbon

It is shown in figure 1 the effect of the treatments on the potential mineralization of C. The values of mineralized C (potential microbial activity) were affected significantly as much by the tillage, as by the application of residues. In the treatment where it was not applied residues the value under microbial activity was mostly observed. The loosening of CO₂ during the incubation period was greater ($P > 0,05$) in the treatments where L and NV were applied; nevertheless, this difference just observed significant difference ($P < 0,05$) with the treatment WM., where 30% than C mineralized as of day 25 were observed less of incubation compared with the rest of the treatments. This difference increased in the measurement that increased the time of incubation. The

Table 1. Concentrations of carbon and nitrogen of soil at 10 cm of depth in different treatments.

Treatments	Carbon	Nitrogen Mg ha ⁻¹	C:N
Fallow	10.1a	1.12a	9.02
Without residues	9.7a	0.82b	11.83
Gramineae residues	9.8a	0.99ab	9.89
Leguminous residues	9.1a	1.01ab	9.01
Wild residues	9.3a	0.98ab	9.49

Numbers followed with different letter within the same column denote significant differences at $P < 0.05$.

lost carbon like CO₂-C, during the 65 days of incubation represented 0.6 and 0.9 % of the total C, for the treatments without residues, respectively. Similar values were found by Hernandez and Lopez (2002). According to the results obtained in this study, the application of vegetal residues has maintained the quality of the organic matter when

comparing with the fallow treatment, as it is indicated by the amount of mineralizable C. In agreement with Gregorich *et al.* (1994), the weatherable fraction of the organic matter of the soil contributes to the cycle of nutrients and the interphase between the autotrophics organisms that synthesize complex compounds of inorganic components, and of

Table 2. Distribution of the different fractions from the organic matter of the soil of agreement to the application of residues and minimum tillage.

Treatment	*MCM	**NMLC	C estable
		kg ha ⁻¹	
Fallow	123a	76.9b***	10023.1
Without residues	36c	87.4b	9612.6
Gramineae residues	35c	125.6ab	9674.4
Leguminous residues	60b	158.2a	8941.8
Wild residues	44bc	134.2ab	9165.8

* MCM Microbial Carbon Matter

** NMLC (not-microbial weakness Carbon) was calculated by the difference of weatherable potential carbon and originating carbon of the microbial matter.

*** the letters within the same column denote significant differences ($P < 0.1$) between the treatments.

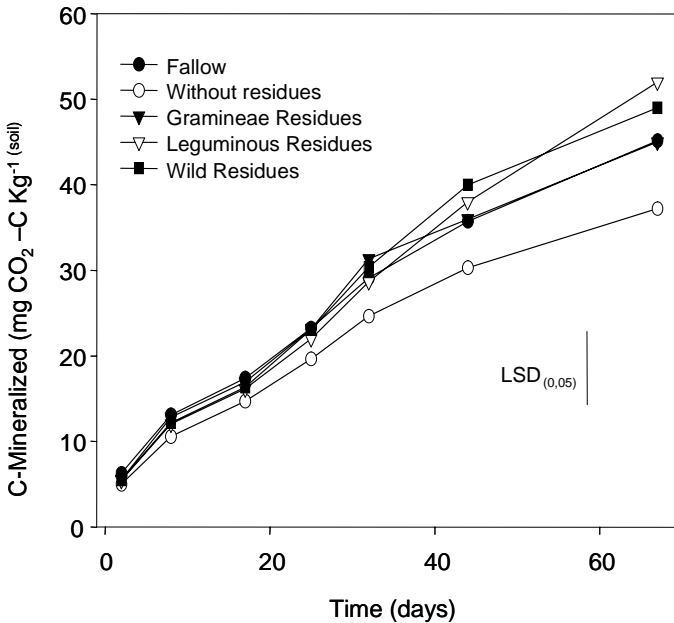


Figure 1. Mineralization of carbon of 0-10 cm depth from soil under fallow without residues and gramineae residues, leguminous and wild species.

heterotrophs organisms that disturb organic compounds and allow that the inorganic components again used. The organic C of the soil can be divided within active fractions (weakness) and resistant. Generally, the weakness fractions consist of sources of soluble C in water (sugar simple, organic acid and proteins), the microbial matter and its products, which are rapidly metabolized during the initial states of the incubation. The resistant fractions are composed containing lignin, humic acids, humate and fulvic acids of C physically protected. In table 2, the distribution of the different fractions from C in the different treatments is showed. The weatherable C [C-

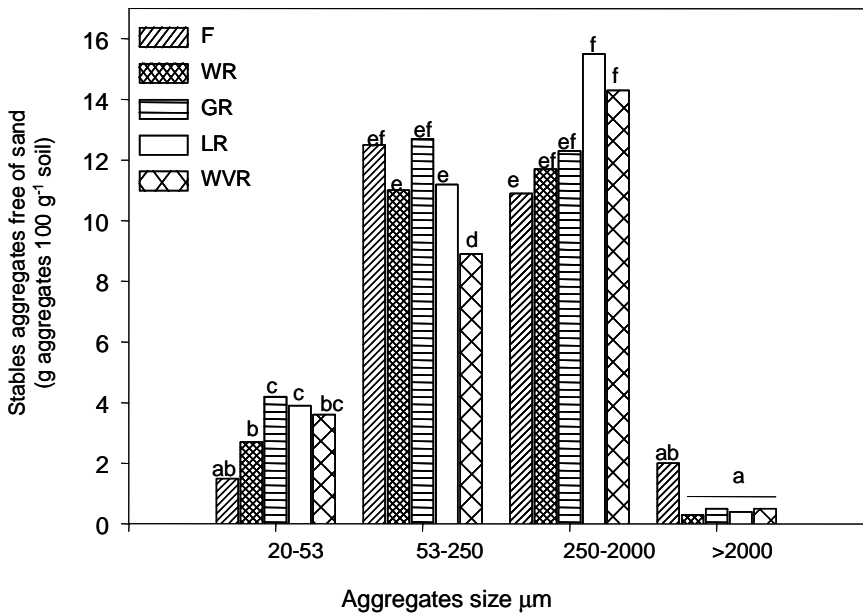
microbial] (MMC) and C- non microbial weakness (CLNM)] approximately represented 2% of total the organic C. The non microbial weakness C increased significantly with the tillage and the incorporation of L, which was greater 50% to comparing with the treatment of fallow. Nevertheless, this increase was similar to those where RN and G were applied. The stable C (total C-CLNM-MMC), was similar between the treatments, nevertheless, after three years to land cultivated the stable C diminished in 10% approximately.

Distribution of stable aggregates to the water

In general the effects of the soil

handling indicate, when comparing it with fallow, that all the treatments tend to lose macroaggregates > 2000 :macroadded m. This amount in approximately 60% as a result of the natural savannah change diminishes to agroecosystems (figure 2). The smallest macroaggregates (250-2000 :m) showed similar proportions in the treatments with the application of L, RN and G. The small macroaggregates seem to have increased due to the macroaggregates > 2000 :m. When correlating the macroaggregates (> 2000 :m) of the different treatments with the

biological division from the C, it was observed that the treatment with fallow, where exists a greater amount of macroaggregates, we found the smaller concentration of CLNM, and the greater one of stable C. The tillage diminished the amount of macroaggregates (> 2000 :m) (figure 2), consequently, the amount of stable C also diminished table 3). It is possible that this diminution of the concentration of the stable C has been product of the use of the CLNM that was stored in macroaggregates. According to Six *et al.*(1998), the tillage breaks macroaggregates and



Different letters means significant differences within the treatments and sizes of aggregates at P< 0.05

Figure 2. Distribution of soil aggregates into ultysol (0-10 cm) under different applied residues: fallow (F), without residues (WR), gramineae residues (GR), leguminous residues (LR), wild vegetative residues (WVR) and minimum tillage.

the organic matter that was within aggregates, and that is not incorporated and protected within smaller aggregates, which rapidly deteriorated. When is observed the treatments where residues was applied, it is possible to see that the CLNM greater is compared with treatments B and WW. Then the entrance of vegetal material to the soil seems to have increased the weakness fraction (CLNM), but this fraction was not within the aggregate, therefore, is quantified like CLNM and not like stable C. Even though the C in different aggregates from the soil was not determined, seems that great amount of weakness carbon present in the treatment under fallow is protected by aggregates of the soil and therefore it is quantified like stable C (table 3). In a study of the aggregate characteristics of vertisols in Venezuela (Espinoza, 2000), were great amounts of weatherable C in macroaggregates (> 250 :m) compared

with the microaggregates (< 250 :m). On the other hand, Hernandez and Lopez (2002) report a high production of $\text{Co}_2\text{-C}$ in macroaggregates comparing it with the microaggregates in ultisols of native savannahs in Venezuela. According to Elliott (1986), the macroaggregates tend to contain more organic matter and less sand, but is not clear if the organic matter in macroaggregates is weatherable than in the microaggregates. Freibauer *et al.* (1999) have demonstrated that in oxisols tropical the macroaggregates (> 2mm) are more sensitive to the land use, indicating a similar performance to those of soils in the tempered zones.

Mineralization of N into field

The observed rates of mineralization under optimal conditions in the laboratory are single potentials that rarely are obtained under conditions of field. In fact, under sub-optimal conditions of field the formation of weatherable fractions

Table 3. Distribution of different fractions of organic matter of the soil, according to the application and minimum farming.

Treatment	**MMC	*CLNM Kg ha ⁻¹	C stable
Fallow	12.3a	76.9b*	10023.1
Without residues	3.6c	87.4b	9612.6
Grass residues	3.5c	125.6ab	9674.4
Leguminous residues	6.0b	158.2a	8941.8
Native residues	5.4bc	134.2ab	9165.8

*CLNM (Carbon no-microbial) was calculated by the difference of potential carbon and the carbon coming from the microbial mass.

**MMC Microbial mass of carbon.

*** The letters inside the column show significant differences ($P < 0.1$) between the treatments

can be favored that can be deteriorated quickly under conditions of laboratory. In this study, the evaluation of the mineralization of N in the field was made using soil without vegetation and protected of rain. In the first 30 days of the experiment, the greater amount of mineralized N was observed where minimum tillage was not applied (fallow) (figure 3); nevertheless, at the end of the experiment (138 days) the N mineralized under this treatment increase only in 5% of the N mineralized to the 30 days. These results support the hypothesis of protection of the organic matter within macroaggregates $> 2000 \mu\text{m}$, as one considered in the results presented in figure 2.

The treatment where the greater amount of macroaggregates was observed ($> 2000 \mu\text{m}$), it is where

the period in evaluation is observed throughout a mineralization of approximately constant N. In the treatments where it was applied residues, a progressive increase of the N mineralized with the course of the time, compared with the treatment is observed significant control (MR.). The application of NV increased significantly ($P < 0,05$) in 50, 30 and 20% the N mineralized accumulated in 138 days, compared with the treatment MR., G and L, respectively (figure 3). The residues of wild and leguminous vegetation elevate the microbial activity (figure 1), and therefore, increase the mineralized nitrogen. Consequently, the microbial activity can be taken as an indicator of the mineralization of N into field. Mineralization of N without the application of wastes was not observed. This result indicates that

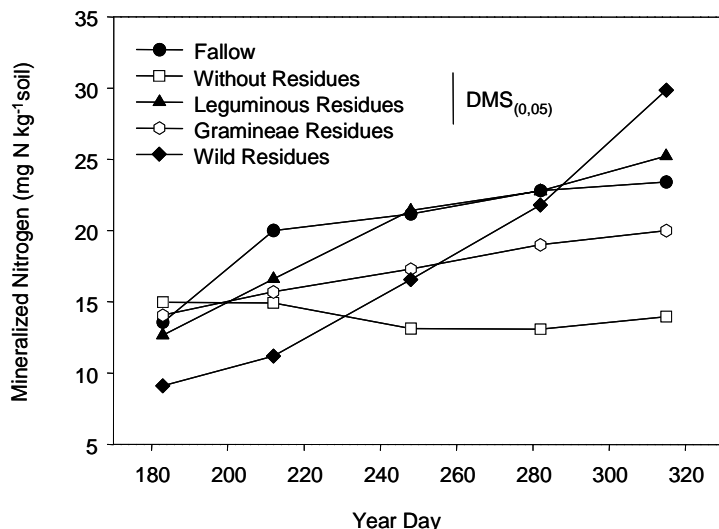


Figure 3. Mineralized nitrogen into field under applied different residues and minimum tillage, at 10 cm depth.

the dynamics of the incorporation of N within the organic fractions is governed by the quality of the

substrate. It seemed that the organic matter in the treatment without residues acts as N drain (figure 3).

Conclusions

The results of this research show that the traditional land use in these degraded savannahs drastically diminishes the originating C weakness of the microbial matter, as well as the activity of the microorganisms. A tendency exists to increase the microaggregation and soil. Nevertheless, the use of handling practices, such as the application of leguminous residues and wild vegetation increase macroaggregates (250-2000 :m), which suggests a conservation of the entrances of C into the soil. Apparently in these degraded

soils, the weakness fractions of the organic matter also contain considerable amounts of N weakness and the stable fractions of C and N it seems to contribute to pool weatherable of these elements by the liberation of the stored organic matter in macroaggregates. The results reveal that the microbial matter of C, the microbial activity and not-microbial weakness carbon can be used as indexes of quality of organic matter of the soils to compare the effect in short time of the change of use of the soil highly meteorized.

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Extraction of N, P, K, Ca and Mg by cantaloupe plants (*Cucumis melo* L.) Packstar hybrid under Tarabana conditions, Lara state.

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Abstract

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Lara State is one of the largest cantaloupe farmers in Venezuela, thus the importance of determining the crop nutrient removal in order to program rational fertilizer practices. Cantaloupe plants hybrid Packstar were grown in Tarabana, Lara State, Venezuela, and N by microkjeldahl method, P by colorimetric analysis using ammonium-vanadate, K by flame photometry, Ca and Mg using atomic absorption spectrophotometry removal were determined based on plant dry weight and nutrient concentrations. The experiment was conducted as a randomized complete design with seven replications and five-plant plots. During harvest time, highest level of K, Ca and Mg were found in petioles while the lowest was found in lamina, root and ripe fruits, respectively. Highest level of N and P were found in lamina and ripe fruits whereas the lowest was found in roots. Total extraction of macronutrients were 75 kg N, 7 kg P, 64 kg K, 62 kg Ca and 10 kg Mg per hectare when 28,440 kg of fruits were harvested.

Key words: *Cucumis melo* L., Nutrition concentration. Foliar diagnostic. Nutrition

Introduction

The cantaloupe cultivars *Cucumis melo*, L), a fruit vegetable, has experimented a great development, being in the past a product of minority consumption to another one of ample acceptance (37). Lara state is one of the main producers with 10.400hg/ha, whose

potential is originated of its great area with a semi-arid climate (22). In the country the studies made on nutritional on melon aspects are few, although it is known that the plant is more demanding to the availability of macronutrients that other cucurbitaceae (10; 6). Therefore, is

important to define the levels of extraction of macronutrients on the part of the plant with the purpose to establish investigation lines to define fertilizer doses. In this sense, the amounts of required macronutrients must be considered on the bases of the development of the plant (24) and studies of calibration of soil analysis (15). Stanley (31) indicates that cantaloupe cultivars removes considerable amounts of nutrients of soil. For example, Gorski (11) found that to produce 15,000 kg of fruits until maturity 56 kg of N were extracted, 17 kg of P_2O_5 , 100 kg of K_2O , 70 kg Ca and 15 kg of Mg; nevertheless for these levels of

extraction the author does not specify the conditions of fertility of the soil nor the used variety. Between the main factors that condition the extraction of nutrients are the cultural combination of the genetic aspect and practices (23), age of the plant and the tissue (20), environmental temperature (5), light (30) and conditions of the soil such as humidity (7), salinity (1), acidity (19), aerate (17) and presence of toxic substances (35). The purpose of this research was to study the levels of extraction of N, P, K, Ca and Mg by cantaloupe plants in the Tarabana region, Lara state, under traditional handling conditions.

Materials and methods

The test was conducted between the months of February and May of 1999 at the Decanato de Agronomía of UCLA zone, located in Tarabana, Palavecino county, Lara state, located to 10° N and 510 01' m.s.n.m. The soil is formed by lateral contributions of the rivers Turbio and Claro and presents frank texture, moderate natural fertility (table 1) and one slope to 1%. Almost all the area belongs on a mount foot. The zone corresponds to a dry tropical forest (bs-T) according to the classification of the zones of life of Holdridge (12). According to the registries of the climatologic station (29), located within the experimental field, the precipitation average for 1998 was of 927 mm, with a regime of bimodal distribution. The first peak of maximum precipitation occurred in April and the second in October. The

annual average temperature is 26°C with maximum of 35.6 °C in April and minimum of 17.0 °C in January. The relative humidity average is 69%. The average of evaporation is 2102 mm/year with 7.9 hours/day of insolation. Cantaloupe hybrid Cantaloupe Packstar was cultivated into field conditions, of fruit widely adapted to the environmental conditions of the zone. The plants were lead under traditional conditions of handling, seeded in ridges to 1.50 ms of separation and 30 cm between plants (equivalent to 22,222 plants/ha), in a surface of 10m X 10m. furrow irrigation was used, incorporating by point of 10 sowing g of urea + organic fertilizer («fertipollo») later to the emergence and weekly fertilizations with the formula g/plant completes 12-24-12 at the rate of 30 g/plant. The control of weeds, plagues and diseases

Table 1. Analysis of the soil in the place of the test on stratus 0 -20 cm.

Sand	Limo	Clay	MO	P	K	Ca	Mg	pH	CE
	(%)				(mg kg ⁻¹)			(1:2)	(CE x 10 ⁵)
58	24	18	2	9	102	>3000	175	7.5	38

was made according to its incidence having used technical and products usually used by the farmers.

The test was conducted completely at random with seven replications where the experimental unit was constituted by five consecutive plants in a same row within the plantation. During the course of the experience the following variables were quantified:

Dry accumulation of matter.

A sampling of 35 plants was made to determine the humidity content discriminating each organ according to root, stem, leaves and fruits. The difference to reach the 100% represented the percentage of dry matter (DM). This value served to calculate the total of dry matter of the organs of all the plants of the test from its fresh or humid matters. The dry matter of each organ was obtained after putting under drying in stove of air forced to a temperature of 75°C during 24 hours. After obtained the different percentage from humidity average, the matter or dry matter in the plants remaining calculated using the formula:

$$M = MF (100 - \%H)/100$$

DM: dry matter.

FM: fresh matter

%H: percentage of humidity

Nutritional Levels. At the

time of the harvest the concentration of foliar of elements N, P, K, Ca and Mg. or it, after extracted the plants for the determination of dry matter, the nutricionales levels in each organ were evaluated. When it happened abortion of green fruits after the mincemeat, these also were incorporated to the analysis.

The used method to determine the nitrogen concentration was the microkjeldahl. For the other elements a humid extraction through nitric acids and perchloric was made. Then, each element was determined in the following form (14):

a.- Phosphorus, by colorimetry using vanadate of ammonium.

b.- Potassium, by flame photometry.

c.- Calcium and magnesium, by spectroscopy of atomic absorption, using a Perkin-Elmer equipment, model 2280.

Extraction of nutrients. From the concentration of nutrients and the dry matter of each organ of the plant, the total matter of nutrients extracted by the plant was determined during harvest. For this, the total efficiency by hectare based on the fresh matter and number of fruits harvested by plant was considered. In order to evaluate the different variables related to the accumulation from dry

matter and extraction of the plant the statistical program computerized COHORT (7) was used, version 4.21. The central tendency of the results

expressed by the average of the values and the dispersion through the standard deviation of the average.

Results and discussion

Percentage of dry matter (DM)

Average of 12.1% was at harvest time the main percentage of DM corresponds to the foliar lamina, followed by the buds with 9.7% and petiol 6.2% (figure 1); the smaller percentage of DM were observed respectively in the green fruits as much as the mature with values of 5.3% and 4.9%. The diminution of the percentage of dry matter observed in the mature fruits apparently are related to a dilution effect (9).

The results agree with the values of approximately 5% of DM in the fruits reported by Mallick and Masui (18). The distribution pattern of the proportion of dry matter in leaves agreed with reported by Tyler and Lorenz (32) for varieties PMR450,

Crenshaw, Honey Dew and Persian, and by Rincón *et al.* (28) for Toledo cultivar.

Concentration of nutrients Foliar Lamina

The content of nutrients in the foliar lamina at harvest time, expressed percentage on the base of dry matter in table 2. The concentration of N, P and K are in the ranks like low by Jones *et al.*, (14). This indicates that the amount of fertilizer is not adequate for the zone conditions. The Mg is located in the sufficiency rank and the Ca over the average (table 3). Considering the results of other authors as Locascio (15) and Piggott (25) the levels of K are low, whereas Ca values are high in comparison with all the reported. In this sense, it to emphasize that in

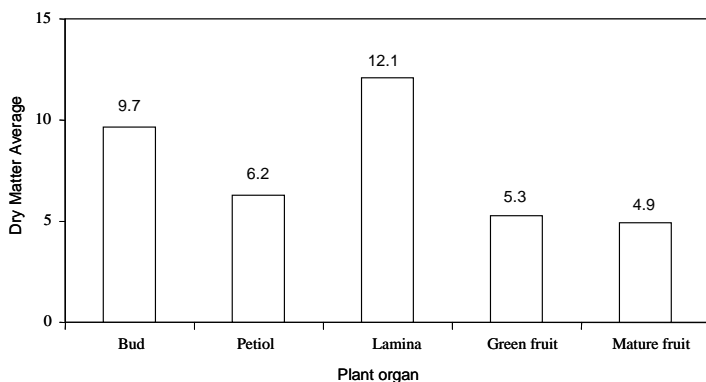


Figure 1. Average of dry matter into each plant organs of cantaloupe hybrid Packstar at harvest time

Table 2. Percentage of nitrogen, phosphorus, potassium, calcium and magnesium in the different organs from the hybrid melon plant Packstar at harvest time.

Organ	N	P	K	Ca	Mg
Lamina	3.8	0.21	1.5	5.3	0.63
Petiol	2.6	0.19	3.7	7.3	0.66
Buds	2.4	0.24	3.2	3.2	0.42
Mature fruits	3.3	0.43	3.5	1.0	0.35
Green fruits	3.2	0.37	3.0	2.2	0.33
Roots	2.1	0.1	1.6	1.8	0.23

another cucurbitacea, like the watermelon, it has been verified that the concentration of K in tissues can diminish and on the contrary by an increase in the concentration of Ca as a result of an antagonistic effect (16). Likewise, the Ca concentration has diminished due to the increased levels of N (4; 21). When comparing the concentration of nutrients of the plants under study with the values obtained in another zone of Lara state (table 3) in hybrid Araucano melon plants put under similar conditions of handling to the described for this study, it can be observed that the values of the studied plants are slightly below to the reported ones for that zone. These differences can be result of a varietal behavior or differences in the availability of nutrients for the plant. On the other hand and agreeing with the reported by Rincón *et al.*, (28) the greater concentration of N was in this organ, whereas the smaller concentration was in the roots, as it is observed in table 2.

Petiol

Table 2 shows the averages

values of the concentration of N, P, K, Ca and Mg in petiol during harvest. The N with 2.6 % is very below of the levels of sufficiency described by Gorski (11) for this organ of the plant (table 3). The P with a value of 0.2% and the K with 3.7% are in the level of sufficiency described by this author. On the other hand, for Ca and the Mg was not scientific investigation that it allowed to compare them at suitable nutricionales levels; nevertheless, Tyler and Lorenz (33) reported concentrations of Ca and Mg for melon plants of the varieties Cantaloupe, Crenshaw, Honey Dew and Persian that were between 2 and 4% and 0.5 and 0.8%, respectively, being able to observe that the concentration of Ca of this test is very over these results, whereas Mg this around them. The concentrations of these elements in peciolo fué superior to the concentration in the rest of the plant.

Buds

The concentration of N, observed Ca and Mg in the buds was smaller to the rest of the vegetative organs that include/understand the aerial part of the plant, whereas the P was

Table 3. Comparative values of tissue nutrients to cantaloupe foliar according to diverse authors

Nutrient (%)	Author				
	Piggott (1986) ¹	Jones (1991) ²	Locascio (1993) ³	Gorski (1989) ⁴	Data nonpublished by the author ⁵
N	2.0 - 3.0	4.09 - 5.00	2.5 - 5.0	0.4	4.0
P	0.25 - 0.40	0.25 - 0.6	0.2 - 0.6	0.2	0.3
K	1.8 - 2.50	3.59 - 4.5	2.0 - 6.0	4	2.0
Ca	5.00 - 7.00	2.59 - 3.2	1.0 - 2.0	-	8.9
Mg	1.00 - 1.50	0.35 - 0.8	0.3 - 0.6	-	0.8

¹In leaves of plants during harvest.

²In leaves of plants of *Reticulatus* groups and Honey dew at maturation time of the fruits.

³In completely active leaves and fruits in maturation.

⁴In petioles from 6th leaf at harvest time of the first fruits

⁵In leaves of plants hybrid Araucano at harvest time in Bobare region, Lara state.

greater with respect to those organs. Also, it is possible to be emphasized that the nutrients in greater proportion in this organ are K and Ca, followed of the N (table 2).

Green and maturity of fruits

The content of K and Mg was superior in the maturity of fruits with respect to the green ones, whereas the content of Ca was evidently in these last ones, as it is showed in table 2. The values obtained in this research are resembled to the reported by Tyler and Lorenz (32) in melon fruits PMR450 at 79 days posterior to seedtime; nevertheless, the reported values for Ca by these authors are very below of the obtained results with this research.

Roots

The content of N in the roots reported like of 2.1% was similar to the concentration presented by Tyler and Lorenz (32) as an average of four melon varieties. Also, it is observed that the content of this element in the roots was remarkably inferior with respect to the rest of the studied organs. The concentration of P, K and inferior Mg was inferior to the reported by the authors before mentioned, whereas C was superior. The high concentration of Ca in all the organs of the plants can be result that these were cultivated in soils with high content of this element, which promotes a luxury consumption, the plant continues absorbing Ca in amounts that exceed what requires for its optimal growth (34). This brings as a result an accumulation of the element in the plant without increase of any activity that involves

the Ca and therefore without increase of growth.

Extraction of nutrients

The nitrogen extraction by the different organs from the plants varied from 0.12 g/planta in petiole to 1.28 g/plant in the mature fruits (table 4). Also, well-known differences in the extraction for the different sampled organs were detected (figure 2). The main extraction was reached in mature fruit, in that order, by the foliar lamina, green fruit, root, petiole and sprout, which agrees with the results of Rincón *et al* (28) who found that the greater extraction of N made the fruits, followed by the foliar lamina and finally the stem. Nevertheless, the distribution pattern is different from the reported by Wilcox (36), Pire and Colmenárez (26), that observed greater extraction of nutrients in the stem that in the root in several olericols species. This can be attributed to the difficulty that there are in this type of study to accurately determine the dry matter of the roots because usually, into field conditions, it is not managed to extract the totality of the radical system. As it is shown in table 4 the extraction of phosphorus and potassium. In this sense it is possible to be observed that great differences as far as the extraction by the different organs exist (figures 3 and 4). In general, the extraction of both elements presents the same distribution pattern, which shows the greater amount of element extracted in the mature fruits and the minor for the pecíolos as far as P and the roots as far as K. The values showed in the

Table 4. Extraction of nitrogen, phosphorus, potassium, calcium and magnesium (g/plant) by the different organs from the hybrid cantaloupe plant Packstar at harvest time (average \pm standard deviation)

Organ	N*	P	K	Ca	Mg
Lamina	1.013 \pm 0.091	0.057 \pm 0.005	0.367 \pm 0.035	1.327 \pm 0.129	0.170 \pm 0.015
Petiol	0.115 \pm 0.014	0.008 \pm 0.001	0.169 \pm 0.020	0.321 \pm 0.028	0.030 \pm 0.003
Buds	0.219 \pm 0.019	0.021 \pm 0.002	0.281 \pm 0.024	0.290 \pm 0.032	0.036 \pm 0.003
Mature fruits	1.278 \pm 0.046	0.164 \pm 0.007	1.468 \pm 0.040	0.388 \pm 0.040	0.131 \pm 0.006
Green fruits	0.501 \pm 0.080	0.061 \pm 0.009	0.495 \pm 0.079	0.268 \pm 0.047	0.058 \pm 0.010
Roots	0.326 \pm 0.031	0.018 \pm 0.002	0.046 \pm 0.004	0.178 \pm 0.018	0.024 \pm 0.001
Total	3.452	0.329	2.826	2.772	0.249

*The data come from samples of 35 plants, with the exception of the green fruits that come from 33 plants

research and the greater extraction of these elements on the part of the fruits agrees with the reported thing by Rincón *et al.*(28) cantaloupe to cultivate Toledo under conservatory conditions. Of the total of P and K extracted by the complete leaf, the extraction of petiol represents 12.4% and 30.69% respectively. This factor could be important to consider when comparing these results with the obtained by other authors, who express their results on the base of the complete leaf. The behavior of the different organs from the plant as far as extraction of Ca and Mg is similar, since the greater extraction is observed in the lamina to foliar and the minor in the root (figures 5 and 6). In average the extraction of Ca made by the plant until the moment of the harvest was 61.33 kg/ha. Distributed in 6,5% in the roots, 9.8% in the green fruits, 10.5% in buds, 11.6% in the petiol, 14.1% in mature fruits and 47.5% in the lamina.

The extraction of Mg until the harvest was 10 kg/ha, distributed in 5,3% in the roots, 7.0% petiols, 8.0% in the buds, 12.9% in the green fruits, 28.9% in mature fruits and 37.8% in the foliar lamina. On the base of 22,222 plants/ha and an average production by plant of 1.28 approximately 28,440 kg to produce kg/ha of hybrid cantaloupe fruits Packstar until harvest, the plant extracted from soil a total of 75 kg of N, 7 kg of P, 64 kg of K, 62 kg of Ca and 10 kg of Mg. The total extraction of N is similar of (73 kg/ha) the reported by INPOFOS (12), but which was calculated for a production of 22,000 kg/ha. The high

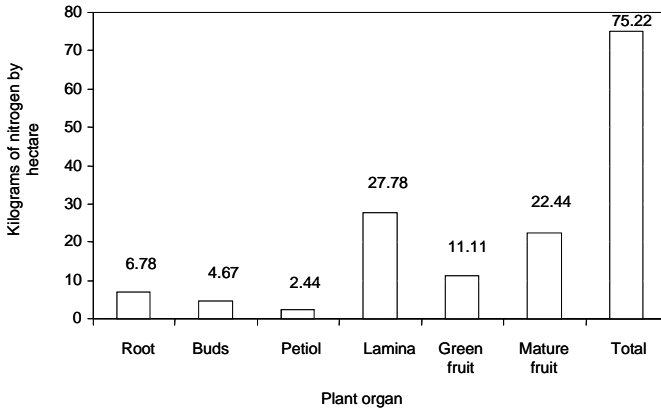


Figure 2. Extraction of nitrogen by different organs of cantaloupe plant hybrid Packstar at harvest time.

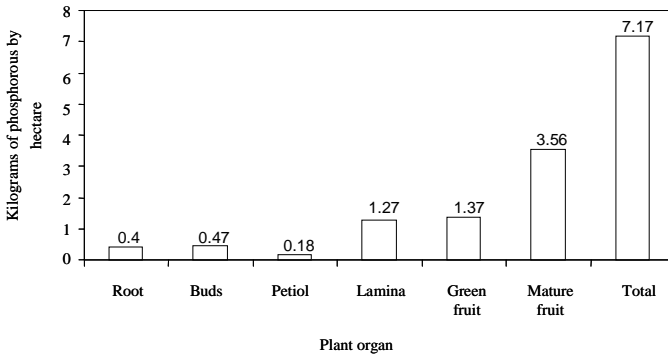


Figure 3. Extraction of phosphorous by the different organ plants of cantaloupe hybrid Packstar at harvest time.

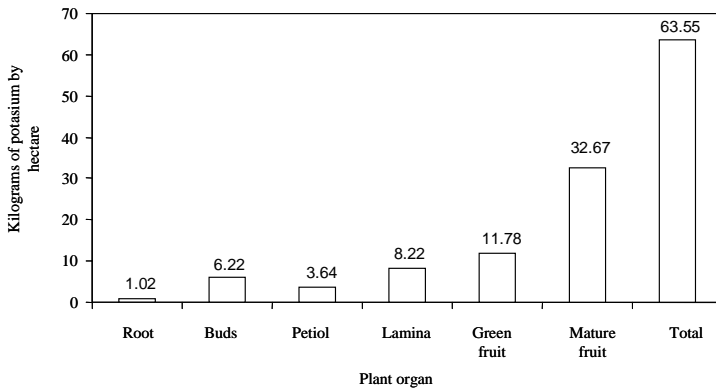


Figure 4. Extraction of potassium by the different plant organs of cantaloupe hybrid Packstar at harvest time

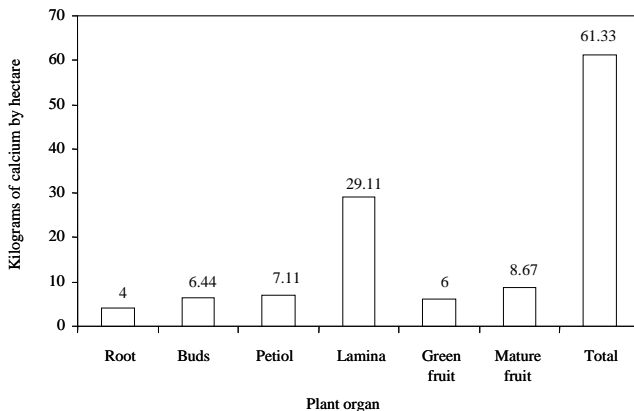


Figure 5. Extraction of calcium by the different plant organs of cantaloupe hybrid Packstar at harvest time

accumulation of N and K is associated with the effect that have these elements in promoting the development of the plants (27) and the growth and accumulation of sugars in the fruits (3, 28). Excepting the extracted amount of N, the values of

extraction of the P, K, Ca and Mg they are below the reported by 15,000 Gorski (11) to produce kg/ha of fruits, as well as of levels of extraction published by Bar-Yosef (2) for a 40,000 production of kg/ha.

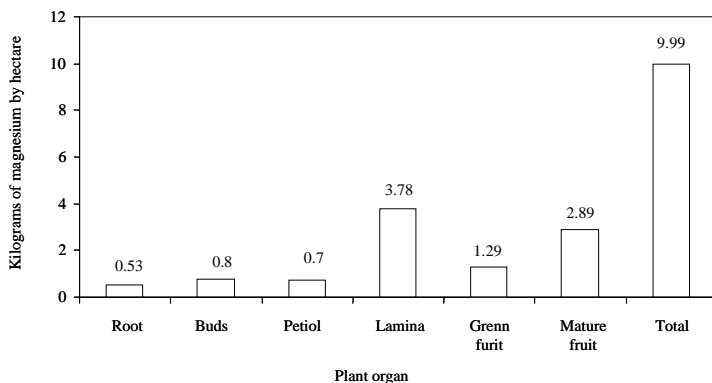


Figure 6. Extraction of magnesium by the different plant organs of cantaloupe hybrid Packstar at harvest time

Conclusions

At harvest time of the hybrid melon Packstar the main concentration of K, Ca and Mg was registered in petiol and the minors happened in the mature lamina, roots and fruits, respectively. The greater concentration of N registered in the lamina and P in the mature fruits, whereas the smaller concentration of

both elements was observed in the root. The N, K and Ca constituted the elements extracted in greater amount. Until the moment of the harvest, the plants with a production of 28,440 kg/ha of fruits managed to extract 75 kg of N, 64 kg of K, 62 kg of Ca, 10 kg of Mg and 7 kg of P.

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Technical note:

A new method for the isolation of betalaines by HPTLC.

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Abstract

Beta vulgaris L. roots were processed for to research the betalaines composition. Isolation and purification were carried out by means of high performance thin layer chromatography (HPTLC). They were eluted independently in one dimension with two solvent systems. Results showed red fraction and yellow fraction with maximum absorbance to 537 nm (betacyanin) and 465 nm (betaxantin) respectively. The HPTLC resolution was fine and route time was smaller fine that TLC, lowering oxidation hazard.

Key words: *Beta vulgaris*, betacyanin, betaxantin, HPTLC, purification.

Introduction

Betalaines are derived from betalamic acid. The biological importance of these compounds includes theirs antiviral and antibacterial activities and they are also taxonomic and phylogenetic markers. They play an important role in the attraction of dispensers of seed and pollinators. They have a high potential as natural pigments for food applications. Betalaines have been used as a substitute of synthetic coloring in processing of gelatin, strawberry yogurt, ice cream, fruits cocktails, candies and biscuits. The European Economic Community has

accepted (Cod. E162), dehydration and pulverization red beet from *Beta vulgaris* L. (3, 4, 5).

Several methods for isolation and purification of betalaines have been reported (1, 7, 8, 9) including ion exchange chromatography, electrophoresis, HPLC and TLC (2, 3, 6).

The Bilyk's method (2) using cellulose preparative TLC is the most used technique. It includes three one-dimensional developments in two different solvents systems (Mixture I: isopropanol 55: ethanol 20: water 20: acetic acid 5, Mixture II: isopropanol 30: ethanol 35: water 30: acetic acid

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5). The chambers to dry the plates are conditioned with nitrogen liquid. The total eluting time is higher for this method, the author did not report this data but our experiments using the conventional TLC method showed a total eluting time of 5h. These characteristics are disadvantages due

to increase the risk of oxidation and the cost.

The present work reports a rapid, simple and high resolution method for the isolation of betalaines which is an important compounds for food applications.

Materials and methods

Samples

The roots of *Beta vulgaris* L. cultivate in the Andes region (145.0 ± 0.1 g) were acquired from a local commercial expense of the municipio Bejuma, Canoabo, Carabobo state, Venezuela. The harvest season was November 2000.

The samples shown ripeness for consumption, homogeneous color and absence of apparent physical damage. Containers conditioned with dry ice were used for samples transportation (temperature 7.0 ± 1.0 °C). The roots were washed with water and dried in absorbent paper. After the skin was removed, 120.0 ± 0.1 g of roots were obtained and the samples were cut with stainless steel knife and extracted. The pH was evaluated.

Instrumentation

The extract was obtained using a juice extractor, Eastern electric® model JX5000. An Orion pHmeter was used for pH measurements. The HPTLC-Fertigschichten plates of cellulose, 10 x 10 cm, Merck, N° Cat. 5632 were used for isolation of the compounds. An Emerson, Model 5A55JXGTD-4144 electric pump was connecting to a vacuum stove witch was used to dry the plates. The

filtration process was done using a porcelain funnel Pyrex® USA, N° 36060, 15 ml, ASTM 10-15 M.

Isolation and purification

The extract was applied with capillaries as continuous lines until saturation on cellulose HPTLC plates, which were previously activated during 30 min at the temperature of 90.0 ± 1.0 °C.

Two one-dimensional developments were performed using two different solvents systems (table 1). The first development was in mixture II and the second one in the mixture I (2). The eluting time in the mixture II was 1.20 h. After this, the plates were dried into a conditioned vacuum stove connected an electric pump, inside it 400.0 ± 0.1 g of dry ice were placed. The conditions of the drying cooling were: temperature of 5.0 ± 1.0 °C, pressure of 5 inch Hg and the time 25 min. The same procedure was done using the mixture I, the eluting time with this solvents system was 1.0 h.

The development and drying process were done in dark conditions. The Rf values (table 2) for each detecting compound were determined. The mayor compounds were removed using a spatula and placed into a

Table 1. Composition and proportion of the two solvents systems used in HPTLC.

Solvents	System I	System II
Isopropanol	55	30
Ethanol	20	35
Water	20	30
Acetic acid	5	5

porcelain funnel. Distilled water was used to wash (10 mL) it. The filtrated was directly collected in a spectronic cell and its visible spectrum was taken. The pH of the collecting compounds was 6.1. Removing and washing process were done in dark. Four plates were needed

to get the visible spectrum. However, ten plates were use in order to study the reproducibility of this method.

In order to compare the method using HPTLC with the conventional TLC technique, all experiments were done using these two types of plates under the same conditions.

Results and discussion

The Rf values and the colors for the major compounds are shown in table 2. Visual detection allowed the observation of three delimited fractions (figure1), the fraction with the high Rf value was not identified. Rf values were 0.22 and 0.34 for the red compound and the yellow, respectively. Both compounds were identified by their visible spectra (figure 2). The red compound showed a maximum absorbance at 537 nm

and the yellow at 465 nm. These absorbances have been reported to betaxantin and betacyanin, respectively (1, 2, 3, 8).

Several advantages were observed in the HPTLC method described in this work. The reduction of the total eluting time from 5 h (TLC technique) to 2.20 h and the use of two developments diminished the risk of betalaines oxidation. The replacement of nitrogen liquid (2) by dry ice

Table 2. Rf values and color of the major compounds detected by HPTLC.

Compounds	Rf	Color
1	0.48	Yellow
2	0.34	Yellow ¹
3	0.22	Red ¹

¹major compounds detected

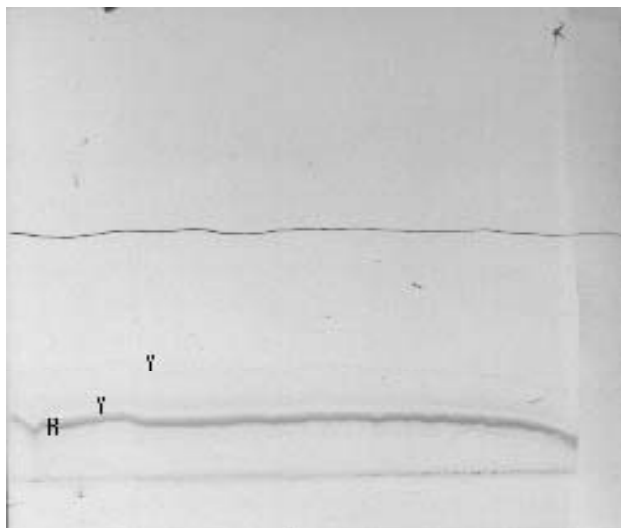


Figure 1. HPTLC chromatoplate of the aqueous extract of *B. vulgaris* L.

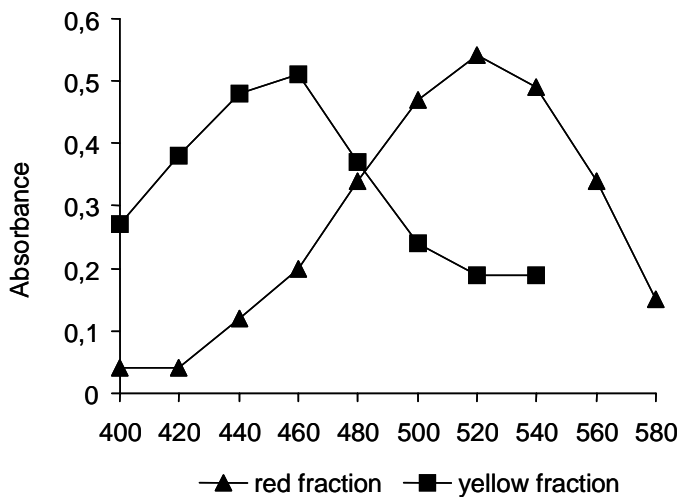


Figure 2. Visible spectra of the betalains of *B. vulgaris* L.

decreased the cost and it made the HPTLC method easy to handle.

Because of it a special chamber to dry the plates was not needed.

Conclusions

The HPTC method for the isolation and purification of betalaines showed high reproducibility, simplicity and celerity. The oxidation of betalaines

was reduced because the eluting times are short. The uses of dry ice for transportation and drying process make this method more versatile with a low cost.

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Evaluation functional and rheological of flours from Coroba (*Jessenia polycarpa* Karst)

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Abstract

In this research some functional properties (water absorption index and fat absorption index) and rheological behavior (pasting properties) of two flours obtained from Coroba (*Jessenia polycarpa* Karst) mesocarp with different fat content were evaluated. Mature fruits harvested in Caicara of the Orinoco (Cedeño County, Bolivar State, Venezuela), were washed, scalded (80° C during 5 minutes) and decorticated. The mesocarp was separated in thin knives, dried (70° C during 12 h) and grounded. The flour was divided in two lots (I and II). The lot I: whole flour (WF) with its original fat content. The lot II: defatted flour (DF). The proximate chemical composition (moisture, ash, crude fat, protein and starch), water absorption index (WAI), fat absorption index (FAI) and pasting properties were determined for both flours. Fat content in WF and DF were 31.90% and 2.00%, respectively. DF showed the highest starch content (57.33%) and the lowest fat content. Protein level was less than 3% for both lots of flour. Gels obtained from DF were more stable than those obtained from WF. The results showed that coroba flour is an alternative raw material for food industries.

Key words: coroba, palm, *Jessenia polycarpa*, flour, functional properties, indian food.

Introduction

The coroba (*Jessenia polycarpa* Karst) is a wild palm of the Alto Orinoco zone and environs (23), specifically the Cedeño County, Bolivar state, Venezuela. The mature fruit, also called coroba, harvests all the year with a maximum of

production in the months of May-July (19), has a matter average of 43 g which 22% correspond to mesocarp, that it is the used eatable fraction in typical food of artisan elaboration of the region (4). It is an agro-alimentary resource of possible industrial

advantage, but the scientific information on its attributes and adaptability to the processing is limited, situation that difficult the definition of its true industrial potential. The transformation of mesocarp of coroba into flour is an effective way to conserve it and an alternative to diversify its use (4). The process involves the operations of drying, milling and sifted. Drying increases life utility of product due to the water activity diminishes minimizing impaired reactions of chemical or microbial origin, whereas the milling and sifted distributes benefits that favor the manipulation, transports and storage of flours (3, 12, 18, 20). On the other hand, mesocarp of coroba has a high fat content that can be taken advantage of by the industry oils and fats, which would originate the obtaining of the residual flour of the extraction. In order to define the utility of flour it is necessary to know the properties that are influenced by the chemical composition and the interactions between the components, whose

affects its performance during the processing. Between these properties the capacity of fixation of water and fat, and the characteristics of filling are given by the rheologic performance, established through amylographic profiles, during the baking, which are related to the protein levels, carbohydrates (starch), lipids and fiber, mainly, as well as the of particle size (4,10,11,16). The objective of this research consisted on evaluating the relation between the chemical components of two types of flours of coroba with different greasy content and its functional properties (index of absorption of water and index of fat absorption) and rheologic, defined through the viscous-amylographic profile, in order to establish its possibility of use like raw material in the food industry. The results of this investigation constitute a base fundamental in the oriented studies to define the utility of coroba like a native nourishing resource, constituting the first information disclosed on their functional properties.

Materials and methods

Obtaining the coroba flour.

A random sample of 25 kg of mature fruits of coroba palm were collected in a natural plantation of 10 palms located in Caicara del Orinoco, Bolivar state, Venezuela, harvests corresponding to July 1999, was washed with potable water, scalded to 80°C during 5 minutes and bare manually with the help of a table knife. The mesocarp was separated by

into cuts in thin layers, drying in a stove Memmert U-30 model 70°C during 12 h, according to recommendations of Belén *et al.* (4), and then milled in an open circuit using an electrical mill VEM Tgl-8394 model.

The obtained flour was divided in two lots of 1.250 kg each one and identified like: lot I, constituted the integral whole flour (WF), lot II was

put under defatted by means of extraction with n-hexane (analytical degree, Riedel – of Haën A.G., Germany) in a pilot multifunctional equipment Didacta (Italy) IC47D-04 model, to 65°C and solvent flux of 145 mL/min until obtaining one miscela of constant refractive index (measured to 25°C with a refractometer Bausch & Lomb model Abbe II and the defatted flour (DF) was treated in the stove Memmert U-30 model at 70°C during 12 h to eliminate rests of the solvent.

Proximal chemical composition.

Representative samples of each flour were processed to determine the contents of: humidity, ash, fat, protein (N x 6.25) and crude fiber, according to the methodologies indicated in the AOAC (2); starch applying the nonhydrolytic method described by Schimieder and Keeney (22) and 600 spectrophotometric measurement to 600 nm of the complex Iodine-starch with spectrophotometer Bausch & Lomb model Spectronic 20. All the analyses were made by triplicate and the results reported like values averages \pm the standard deviation.

Functional properties of obtained flours.

It was determined the water adsorption index (WAI) and the fat adsorption index (FAI) using the methodology described by Akobundu *et al.* (1).

Rheological performance.

The properties of pasting of the WF and DF were evaluated by

triplicate, using a fast viscous-amylographic (Rapid Viscous Analyzer, RVA) Newport Scientific model 3D. Sample of 4 g. of each flour were mixed with 25 milliliter of distilled water and introduced in carry-it samples of the equipment, warmed up to 50°C during 2 minutes with constant agitation; the temperature rose up to 95 °C at the rate of 11.65 °C/min, maintaining that temperature during 2 minutes soon to diminish it to 50°C at the same speed, remaining to this temperature during 2 minutes (10). The considered parameters were: temperature of gelatinization, maximum viscosity, fragility and retrogradation. Viscosity was expressed in arbitrary units RVU (Rapid Viscosity United).

Size of particle.

It was determined through sifted of samples of 50 g. of each flour in an equipment MLW TIR-2 model, vertical of constant vibration movement, provided with five sieves with openings: 3.000, 2.500, 600, 425 and 106 mm; the sifted time was of 30 minutes.

Statistical analysis.

The experimental design was totally randomized, linear model additive. The determinations were made by triplicate and the results expressed like values averages \pm the standard deviation. The data were evaluated using the statistical package SAS (21). In order to determine significant differences it was used the Tukey test ($P < 0.05$) (21).

Results and discussion

Proximal composition.

Table 1 shows certain proximal composition to each flour. Significant differences ($P < 0.05$) in all the parameters studied except for the humidity. These variations are due to the proportional increase of the insoluble substances in the n-hexane used to separate the fat of the WF to obtain DF. The greater components of the WF were greasy (31.90%) and starch (39.20%), whereas in DF the majority component was the starch (57.33%). The fat level in the WF is in the rank indicated by some authors for the African palm and other oily like sunflower and cotton, but it surpasses the values reported for soy (5,6), which allows to consider to coroba like a potential raw material for the oil industry. The proportions of starch are important because they can provide favorable properties for the food preparation, like

improvement of the texture (3, 8, 25); the starch level in the DF was similar to values indicated for flours of granular wheat and durum (14). The percentage of protein were low in comparison with flours of conventional use like the wheat, rice and maize (13). In the defatted process significant differences were determined on this parameter ($P < 0.05$); when diminishing the greasy content by effect of this operation is increased the proportion of protein in the DF. The crude fiber levels were superior to the contents in flours before mentioned, favoring to the flour of coroba by their favorable effects in the prevention and control of cardiovascular diseases, diabetes and cancer (9) and by the influential properties in the physiological functions of foods (16).

Distribution of particle size.

In figure 1 is shown the

Table 1. Proximal composition of coroba flour

Parameters	Composition (%)	
	HI	HD
Humidity	7.50 ± 0.02^a	7.80 ± 0.04^a
Ash	2.20 ± 0.03^b	3.15 ± 0.04^a
Crude fat	31.90 ± 0.07^a	2.00 ± 0.02^b
Protein (N x 6.25)	2.15 ± 0.06^a	2.85 ± 0.08^b
Crude fiber	3.35 ± 0.20^b	4.10 ± 0.20^a
Starch	39.20 ± 0.60^b	57.33 ± 0.55^a

Values averages ($n=3$) \pm standard deviation. Averages with different letters in the superscript (a,b), within a same row, present significant differences (Tukey, $P < 0.05$). Distribution of particle size.

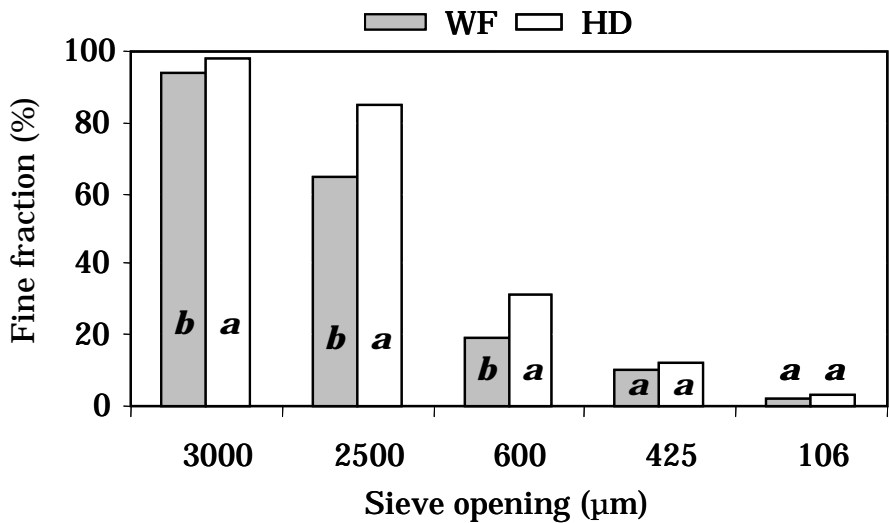


Figure 1. Distribution of particles size of coroba flour.

distribution of particle size of the WF and DF. Significant differences was found among the fractions of fine of the sieves with opening 3,000, 2,500 and 600 \pm mm respectively ($P < 0.05$). Both flours present particles superior to 106 mm in greater proportion; the DF showed the fraction of inferior particles 106 mm higher (34%). The observed differences are related to the greasy content of each flour. The particle presence of size superior to 106 mm must to the agglomeration and fine minors to that size it must to the attraction (3); in the first case, the high greasy content in the WF at random favored the union between particles originating others of greater size, reason why the WF presented the smaller fractions of fine in each sieve; in the second case, the applied process of extraction to obtain the DF possibly caused particle disintegration due to the action of the

solvent, originating attraction and a greater fraction of fine particles in each sieve for the DF. The results allow to classify to the WF and the DF of coroba like dusty non-cohesive systems, characteristic that would favor its inclusion in random mixtures (4), like for example instantaneous food formulation.

Water and Fat Adsorption Index.

Table 2 contains the values of the WAI and of the FAI for the WF and the DF of coroba being significant differences ($P < 0.05$). The greater FAI presented the DF (2.52 water g/flour g). The capacity to adsorb water is related to the protein presence in foods (24) and other factors like the size of particle, the starch content (10) and fiber presence (16). The differences experienced by the WF and the DF in the WAI demonstrate that the proportion of fat also is

Table 2. Water absorption index(wai) and fat (fai) of coroba flour

Flour	WAI(g of water/g of flour)	FAI(oil g/flour g)
HI	0.75 ± 0.02 ^b	0.66 ± 0.01 ^b
HD	2.52 ± 0.02 ^a	1.09 ± 0.01 ^b

Values averages (n=3) ± standard deviation. Averages with different letters in the superscript (a,b), within a same column, presented significant differences (Tukey, P<0.05).

influential in the water adsorption. The obtained value of the WAI of the DF was similar to values reported for the defatted sesame flour (17) and surpasses to some products of rice, oats and soy (16). The DF presented the greater value of WAI (1.09 oil g/ flour g) in comparison with the WF. The capacity to adsorb fat, as well as the one to adsorb water, experienced by flours of coroba allows to suggest his inclusion in the product formulation of bakery and pastry shop.

Properties of pasting flours of coroba

Table 3 shows the deduced properties of pasting from the viscous-amylographic tests of WF and DF; the evaluated parameters presented significant differences (P<0.05). In DF the increase of viscosity was not observed at 60°C, whereas WF showed viscosity at that temperature; the development of viscosity at the beginning of the heating during the viscous-amylographic test is related to the presence of one lowers

Table 3. Properties of pasting of coroba flour

Parameters	WF	DF
Viscosity at 60°C	2.20 ^a	0.00 ^b
Initial temperature gelatinization °C	85.00 ^a	78.05 ^b
Maximum viscosity (a)	100.00 ^b	220.00 ^a
Final temperature of gelatinization °C	95.00 ^a	95.00 ^a
Initial viscosity to 95°C	98.00 ^b	219.00 ^a
Final viscosity to 95°C (B)	98.00 ^b	185.00 ^a
Initial viscosity to 50°C	128.00 ^b	253.00 ^a
Final viscosity to 50°C (C)	144.00 ^b	287.00 ^a
Fragility (A-B)	2.00 ^b	35.00 ^a
Retrogradation (C-A)	44.00 ^b	67.00 ^a

WF: Whole flour

DF: Defatted flour

Values averages (n=3) ± standard deviation. Averages with different letters in the superscript (a, b), within a same column, presented significant differences (Tukey, P<0.05).

proportion of starch fragmented in the flour (14). The DF present the value of temperature of gelatinization (78.05 °C) lower in comparison with WF (85.00°C); these parameters allow to infer that WF presents a high degree of compaction. DF showed the maximum value of reached viscosity (220 RVU); the WF showed an inflexion at 100 RVU instead of the tip of maximum viscosity observed in DF. The viscous-amylographic performance of a flour is associate to the characteristics of gelatinization of the present starch (7). From the result is deduced that the starch contained in DF presented greater to be able of swelling than the one WF, bears relation to the greater capacity to adsorb water indicated by the WAI previously analyzed. The WF experimented slower gelatinization than DF, which allows to infer that the starch in the WF has a degree of compaction and crystalline greater than in the DF. None of flours showed changes in the respective values of viscosity the beginning of the heating to 95°C, which is due to the crystalline of the starch that did not allow to the weakening of the intermicelares forces (26). The DF showed a reduction in viscosity, with respect to the value the maximum viscosity, at the end of the heating to 95°C, whereas the WF did not show significant changes ($P < 0.05$). The diminution of viscosity at the end of this period is related to the degradation of the starch grain during the baking and to the sharp effort that debilitates the internal links (14). In this sense, the HI was more stable to

the baking because it presented the smaller difference between maximum viscosity reached and viscosity at the end of the heating to 95°C (2 RVU).

With respect to the retrogradation, that established by the difference between maximum viscosity and viscosity at the end of the cycle to 50°C, the DF experienced the greater retrogradation (44 RVU) and is able to form firmer gels. Factors like the lipid content, conditions of processing, size of particles, amylosa/ amylopectine relation and others, have been indicated like influential in the profiles of viscosity of flours and starches (7, 10, 15). In the case of lipids, interactions with the amylose present in the starch that origin complexes are located in the surfaces of starch grains having caused an increase in the temperature of gelatinization and diminution of the viscosity of the starch paste (11). It is possible that as a result of this situation, WF showed a slower gelatinization and smaller values of viscosity in comparison with DF. The viscous-amylographic profiles exhibited by the analyzed flours suggest the possibility of including them in the food formulation that conventionally are prepared with cereals like wheat, for example custard, dishes, cornflour drinks and sauces, among others. For products that include DF, it is recommended to control the agitation and conditions of transport because they can experience variations in viscosity that will influence in the texture and appearance of those products.

Conclusions and recommendations

The flours of coroba, classified with base to the greasy content, present functional properties (water absorption index, WAI, and fat, FAI) and viscous-amylographic that suggest their use in the product formulation of bakery and pastry shop. The differences found in the functional and viscous-amylographic properties are influenced mainly by the fat contents and starch, which is the majority components in flours of

coroba evaluated. It is recommended to analyze the extracted greasy content of the flour of mesocarp of coroba with the purpose of establishing his possible utility. Also it is important to evaluate the use of the flour of coroba, with his original greasy content and defatted, like partial substitute of wheat in the product formulation of bakery and pastry shop.

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The small farmers and its participation in the process of agricultural commercialization.

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Abstract

With the purpose of characterize a study was conducted in San Jose parish, Jesus Enrique Lossada county, Zulia state to small farmers and to evaluate its participation in the marketing of agricultural products, The research was descriptive – participative. It were made several observations of field, census, region sketch and workshops to obtain collective information about technical, organization and marketing requirements. It was applied a structural interview to 83,3% of population. Data were analyzed with Statistical Analysis System (SAS), It was applied the independence of variables of classification test X^2 , through the use statistic proposed by Fred David in order to generate strategically solution. The results show that 76% of producers have plots between 1 and 6 hectares and the 84% only the culture of 3 hectares. The 86% sell to the intermediary and there is no a direct action on marketing, which determine a low level of participation in the process, though its relation with experience, training and hectares quantity was no significant (X^2 ; $P < 0.01$). Producers recognize its little organization and participation, but they do not visualize it as a opportunity to take part in the process.

Key words: Venezuelan small farmers, agricultural commercialization, participation, organization.

Introduction

The agriculturists dedicate themselves to the production, because there are people in disposition to consume what they harvest. The production by itself would not have sense, without the disposition of the

medium that allow the positioning of products in the market and a demand to satisfy. It is a justice act, after all its effort, to guarantee to the producers an easy and safe access to the markets to sale their products.

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The agricultural commercialization is a process that allows to products arrive at the consumers located in distant urban zones of the agricultural areas of operation, so what the number of operations and functions that are carried out, determine the degree of complexity of the process. In this form, it is possible to establish the commercialization is a set of processes or stages that must surpass products in the transfer flow from the producer to the final consumer. (11).

The participation of the small farmers in the commercialization of their products, is perhaps, one of the delayed, dispersed and disorganized aspects, not only of the national economy but also of Latin America. (5). The commercialization food system in Venezuela is affected, among other due to: the season of the production, the volumes of negotiation, the dispersion of the production units, the distance of the markets and the ignorance of the options to place products in hand of the consumers. On the other hand, the complexity of the distribution channels grows according to fresh products consumption or material for the industry (15). This process is important to regulate the nourishing security of any country. In Venezuela, where certain deterioration of the interchange relations is observed, instability in the capital flows; as well as a mixture of disturbances of political order that contribute to generate general and maintained rises in the prices of products (2). In order to try to impel the

improvement of all the activities that the farmer makes in their unit of production, in special in the commercialization precinct of harvested products, it is precise the adoption of alternatives related to the social, economic and managerial aspect; the farmer, their families, taking in consideration all the surroundings (7 and 9). If it an accomplish to develop actions that allow to improve, fundamentally, the participation of the small farmers in the commercialization process, would take place very important increases in their income, having diminished the rural poverty. So that, it is necessary to eliminate the unfavorable conditions; like the weak power of negotiation, the lack of control on commercialization channels, and the lack of qualification and support. (15). When it is desired to design a proposal that tends to improve the relations of interchange in the commercialization process, it is also necessary to make strategic decisions (6); where different processes from analysis are involved such as: the personal and organizational and marketing aspect of goods, in addition to the surroundings where the agricultural activities and the commercialization in San José parish are developed. It is not necessary to develop a very deep study to know that the farmers need some technological strategies that help to solve them the problems that affects when commercializing their products (5). Additionally if it considered an approach of system to promote a sustainable development

and nourishing security, since these producers supply of perishable agricultural products for the satisfaction of the nutritional requirements of the consumers in Maracaibo County. «San José « parish of the Jesus Enrique Lossada County, has a population of 3,404 of habitants and a 132 surface of Km², populated by little and medium farmers that dedicate themselves to the vegetal production, like fruit trees (guava, medlar-tree, handle, soursop, papaya among others), vegetables (green onion, coriander), and tubercles (cassava), in addition to animal production (bovine, ovine and goat).

(13 and 17). Considering that this parish is not exempt of the factors that affect the agricultural process of agricultural marketing, it is necessary to do an investigation to characterize the process of commercialization of agricultural products and to evaluate the intervention of the small farmers in the same, moreover to generate proposals with the objective to improve the life conditions of the farmer and their families, through a greater participation in the process of marketing or commercialization of the harvested product, as much in individual form as communitarian.

Materials and methods

Type and design research

Methods pertaining to the participative research like the direct observation, fast diagnosis, workshops, graphical visualization and the triangulation were applied. According to Geilfus (8) these tools as much provide qualitative information as quantitative in reliable and proved form; at the same time that the triangulation allows the verification of methods and results. Also it is defined as descriptive, since the aspects were identified and described that characterize the process of agricultural products commercialization. The factors of this system that determine the characteristics were interpreted and analyzed, for explaining the existing situations in the different activities from the small farmers in their units of production, as well as their participation in the

marketing process (18). The design was the cross-sectional or transectional descriptive, which has as a purpose to find out the incidence and the values in which it is pronounced one or more variables, measures in an opportunity (10).

Description of the zone of study

The study area includes the San José parish, Jesus Enrique Lossada County of Zulia state, whose limits are the following: to the East Maracaibo County, to the West Jose Ramon Yépez Parish, to the North with the Mara County and to the South with La Concepción Parish (17). From the four parishes that conform this County, San José is the greater vegetal agricultural vocation and by its location, it constitutes a food source for the supplying of Maracaibo County. The study area presents soils

with sandy textures in the superficial layers, classifying itself like Haplargids (4), with average texture, moderately drained, with low concentrations of organic matter and pH around 4,5 – 5,5. It have a relief from 0 to 200 msnm, and a vegetation classified like very dry tropical forest, Holdridge (4). The natural vegetation in the zone very has been taken part, since it has replaced by fruit orchards under irrigation and horticulture farms, in associations of grass established for the grazing. Precipitations from 500 mm to 1500 annual mm, distributed in bimodal form, with two maximums tips (April–July and September–November), and two minimums (January– February and August –July). The evaporation is 1800 to 2500 mm annual, these high evaporations must be due to the high temperatures (28 °C to 30 °C).

Population and Sample

In order to determine the population and due to the absence reliable and effective official registries, it was necessary to raise a census with the totality of the farmers of the Parish. For this a series of consecutive visits was made, which in addition allowed to delimit the study area. This information was drained and shaped in a sketch, thus obtaining, to locate each one of the production units and to know its in charge owners and/or people in charge. In this first step it was managed to obtain the total population of active farmers within the parish in study. The total was of 114 units of agricultural production. For the selection of the sample the

following criteria settled down:

- Main activity: Vegetal agriculturist.
- Established time of: more than a year.
- Surface: between 1 and 20 hectares.

Being a sample conformed by 95 units of production (83.33 % of the total), distributed in 7 sectors, identified like: Santa Rosa, San Benito, Marimonda 2, Los Lirios, El Cuchuchero, Chivato and 4 Vías.

Techniques and instruments of data collection

In order to collect the field information a questionnaire structured with closed and opened questions was designed, being based on the characteristics observed in the first made visits the field (inspection visits). 7 variables and 143 items were structured. A questionnaire was applied using the technique of the direct interview. Once tabulated and codified the information the Statistical Analysis System was used for the analysis (16), obtaining the frequencies and their distribution in quartiles (Q1 and Q3) for the values of top, average and backward. In order to evaluate the existing relation between the level of participation in the process of commercialization and the other variables considered in this research such as: years of experience, level of training, size of the parcel, seeded surface, type of goods and modality of sale, among others, the test of hypothesis of independence of variables of classification by means of the use of the X^2 was made (20).

Strategic Situational Analysis

FOWT

The strategic situation was made following the procedure proposed by David (6), analyzing the internal average where the forces or strengths were determined, considering the restrictions or weaknesses; and an analysis of the key factors of the surroundings to establish the opportunities and threats. Then to generate the proposal

strategic it designed the FOWT matrix. The characteristics of the internal and the surroundings environment were listed, and they were confronted in the superior part placing the internal capacity to commercialize, it means the fortress (F) and weaknesses (W), and in vertical form the opportunities were listed (O), and also the threats (T).

Results and discussion

1. - Characterization:

The farmer: The results of the interviews are summarized in the table 1, showing that 81% of the farmers are of masculine sex. The age of the majority (52%) oscillates between 32 and 53 years, showing a force of young work and 74% have more than five years of experience in the agricultural activity. The educative level was low, since 55% reached primary studies and the rate of illiteracy was of 13%, rising the values of the regional rates and national, according to the OCEI (12) in 2000 year, were located in 6,7 and 7,4%, respectively. Although, inferior to the reported by Perez *et al.*(14), for an agricultural community of a neighboring county. 77% of the farmers live in the production unit, with a high familiar load, where 78% have the responsibility to maintain to more than 5 people in their home, which generates economic a demand constant that it requires to be satisfied. 66% of the producers show desires to keep in the agricultural activities, whereas to the rest (34%),

it would like to make other workings such as: commerce, oil workers, mechanics, among others. This demonstrates that in spite of the influence in the county of the oil company, the agricultural vocation even stays. 78% do not take any registry of the activities and negotiations that develop.

There are low level of participation in the organizations, only 15% of them belong to some type of association and 73% do not know their existence. As far as mass media to stay informed, were that although only 51% of the farmers declared to read the press of the region, 80% listens to radio programs (musical and news), being the transmitters more tuned Mara Ritmo 900 and Zuliana 106.

b. Unity of production: As it is shown in table 1, 76% of the zone of the production units or blocks have among 1 and 6 hectares. Nevertheless, it is well known the small surface available for the agricultural production, maintains a great part of an idle surface, since 84%

Table1. Aspects that identify to small farmers and their production units.

Characteristics	Percentage
a. – Farmers:	
Sex: Masculine	81
Age between 32 to 53	52
Experience between 5 and 20 years	74
Educative level: primary	55
Level of illiteracy	13
Place of residence: the production unit	77
Desire to keep in the agricultural activity	66
They do not have land registries	78
Association: Agricultural Syndicate, Council	15
Communication media	
Radio	80
Press	51
b. – Production Unities:	
Size (Surface in Has)	
1 to 6	76
> 6	24
Cultivated surface (Has)	
< 1 – 3	84
> 3	16
Limitation to seed all the surface	
Lack of water and money	53
Surface cultivated with irrigation (Has)	
< 1 - 2.45	75
2,5 - 8	25
Cultivated goods	
Fruit trees	46
Tubercles	32
Vegetables	22

cultivate 3 hectares at the most. These results agree with others found in other counties of Zulia state (1.14 and 19); in spite of disposing with farmers with vocation, and soils with excellent physical-chemistries characteristics, making a bad use the main part of the surface for

production. There are multiple reasons, but 53% of the farmers of San José, argues that the main problem to seed all the block is the limited availability of resources and financial support, combined to the water problem; even when they have it, due to the Tulé aqueduct that spurts of

water to Maracaibo county, they present many difficulties because of the illegal taps and constantly they are put under cuts of the service, which generates a great uncertainty. In spite of this reason, all the farmers (100%) use the originating water of this aqueduct to irrigate their cultures and 75% of them irrigate annually between 1 and 2.5 has.

2. The commercialization process:

As it is observed in table 2, 57% of the producers limit their participation in the process of commercialization the product to interchange with the intermediary (truck driver), whereas 15% have greater participation in the distribution, commercializing themselves its products with no need of intermediaries to the wholesale market. In addition 42% to the farmers declared to receive the payment immediately, at the time of giving their merchandise (on cash), whereas 38% do one or two weeks after the delivery (on credit), 20% rest leave it to consignment.

When comparing the variable level of participation, a statistically significant relation with other variables does not exist such as: years of experience as a farmer, level of instruction, size of the parcel, cultivated surface, nor with the type of good in production. Nevertheless, it was significant for other variables such as: lack of financial liquidity, the problematic situation of the water supply; the price information, like with the mode of payment when selling their products. This explains

because the farmers that less participate in the commercialization process, are indeed that explain to have problems of financing and water, those that do not handle information of prices and those that sell their products on credit and/or to consignment. Putting them under the propose exigencies by the intermediaries, as much in the price as in the other factors related to the market, taking them to disadvantageous situations at the time of making the negotiation.

These results also demonstrate that disposing on: experience, a great amount of land, opportunity to cultivate, are not enough elements to decide to take part in the commercialization process. It seemed then, that the problems that the farmer presents turn into true limitations to obtain their effective participation in the process of rural development. This agrees with the results obtained by Borges *et al.* (1) and by Urdaneta *et al.* (19) where they indicate that the little farmers do not reach the development and stay in the poverty; not by an economic problem, but by a problem of vision that unmotivated and limits to look for them endogenous solutions, realistic and less dependent. An aspect to indicate is that a 57% of the farmers attribute the responsibility of their problems to the low prices that receive by their products and just a 16% consider that is due to the speculation on the part of the intermediaries. On the other hand, a 58% visualize as a solution that someone or something, eliminates the intermediaries,

Table 2. Level of participation of the small farmers in the process of commercialization and its characteristics.

Characteristics	Percentage
Commercialization:	
Level of participation (according to they sell)	
Directly to the markets	15
Truck drivers	57
Truck drivers and some times to the market	28
Type of sales	
Cash	42
Credit	38
Consignment	20
Relationship: Level of Participation &.....	(X ²)
Years of Experience	N. S.
Level of instruction	N. S.
Problem Type	S.
Surface of the parcel	N. S.
Cultivated surface	N. S.
Type of goods	N. S.
Information of prices	S.
Type of sale	S.
Information of prices	
Look for in the market	26
Problems	
Low prices	57
Intermediaries	16
None	17
Propose solutions	
To eliminate intermediary	58
To create market where to sell its products	28
To increase prices	14

because in individual form they are not able to create or to visualize alternatives different from the promoted by the paternalism. Borges *et al.*(1), exposes that this conduct type reflects the low level of confidence and the little communitarian participation. Others (28%) see as an alternative to make

the creation of a market in the zone to be able to sell their products. As far as the prices information, a 26% manifest that they obtain it investigating by themselves in the market or asking between their neighbors before making the negotiation. The farmers recognize that they are not organized nor

participate in the associations placed in the parish, but in no case they visualize it like as an opportunity that allows them to find solutions to the problems to manage to improve the income, obtaining a greater remuneration by products. This evidence a clear individualistic conduct that nothing has to do with the financial resources, nor with the amount of land that they have. Before this situation it is recommended that between the proposals to improve the participation of the farmers in the commercialization process, to manage to the incomes of the sales and to place directly commerce volumes until the wholesalers; the organization or association, who would allow them, in spite of the cultivated surface, to face the problems by them identified.

3. The situational analysis for the elaboration of strategic proposals.

In table 3 the different types of strategies are observed that were from the matrix of the situational analysis. These proposals are based on two basic aspects: qualification for the organization and the production and necessity of an information market system.

a. Program of qualification: directed to grant knowledge on the rational use of the resource water; service of commercialization; elevation of the technological level; administrative control of its units of production. To equip them with knowledge of rural communication by which the small farmers stay informed into the present prices to place them favorable position at the

moment of commercializing the agricultural goods.

b. Promote the organization of producers: with the purpose of obtaining a greater participation in the commercialization process is due to fortify the associations that exist in the zone, promoting them and/or motivating the constitution of new organizations for the commercialization and so the farmers are more efficient when they take part in the marketing process. The organization modality could be based on the type of good to harvest, because each farmer maintains his autonomy in the time and the price that receive by his goods, taking in consideration that 86% of the surveyed farmers expressed to be arranged to comprise of associations to improve the technical level, and that as well allows them to benefit in the purchases from goods and sales from harvests. Therefore the creation of an organization sets out who has a good administrative platform and that based on values and communitarian principles. With these strategic proposals of organization it is tried to obtain that the small farmers are able to: acquire the goods at wholesale way, saving in the purchase and the costs of transport, that influence in the operational expenses. Reduction of the marketing chain of its products, selling not to the first link or truck driver, but directly to the Wholesale Market, to obtain a greater margin of gain to the farmer, which can diminish the sale price to the consumer.

Table 3. Matrix FOWM to obtain the strategic proposals

<p style="text-align: center;">Internal Analysis</p> <p style="text-align: center;">External Analysis</p>	<p>Fortress (F)</p> <ul style="list-style-type: none"> ✓ Young farmers. ✓ Agricultural experience. ✓ Permanence. ✓ High agricultural vocation. ✓ Good routes of access. ✓ Desire to be associated. ✓ Self-knowledge of its little organization and participation. 	<p>Weaknesses (W)</p> <ul style="list-style-type: none"> ✓ Educative level. ✓ Degree of association. ✓ Capital of work. ✓ Little own vehicle. ✓ Informative level. ✓ They do not take countable registries. ✓ Control of price. ✓ Little technology.
<p>Opportunities (O)</p> <ul style="list-style-type: none"> ✓ Proximity of Maracaibo. ✓ Wholesale market. ✓ Agricultural Institute ✓ Financing. ✓ Program of extension on the part of the Mayorship ✓ L.U.Z (technology). 	<p>Strategies (S)</p> <ul style="list-style-type: none"> ✓ To foment the organization of farmers. ✓ To motivate the creation of committees for promotion of associations the commercialization of products. 	<p>Strategies (S)</p> <ul style="list-style-type: none"> ✓ To create an information system of market readily accessible, that it allows to plan the production.
<p>Threats (T)</p> <ul style="list-style-type: none"> ✓ Irregularity of the service of water. ✓ Inflation. ✓ Low availability of credit. ✓ Demographic pressure. ✓ Lost of rural identity 	<p>Strategies (FA).</p> <ul style="list-style-type: none"> ✓ To create a program of qualification for the rational use of the water. 	<p>Strategies (DA).</p> <ul style="list-style-type: none"> ✓ To create qualification program so that the farmers improve their managerial capacity.

Conclusions and recommendations

It was determined that the small farmers established in the San José parish, Jesus Enrique Lossada county,

present great limitations to participate in the process of commercialization of agricultural products, represented by

horticulture crops, highly perishable and that need a great efficiency in the handling of their system to diminish the losses and maintaining the income. Among the aspects that characterize to farmers it can indicate that 81% are of masculine sex, they are relatively young, active and tend to changes; a 52% into ages between 32 and 53 years old. Traditional in the activity; from 5 to 20 years of experience 74%. A low level of scholarship that does not exceed the primary or basic education (55%) and a level of 13% of illiteracy, which is greater 4% to the national value (13). These values represent certain limitations in the development of human capacities of the farmers and for the total and exact advantage of the opportunities of the surroundings.

78% of the farmers do not take land registries of their activity and 85% of them are not organized nor are affiliated with some type of association reflecting a clear individualistic conduct, which is not related to the availability of financial resources nor to the amount of cultivated land. It was demonstrated that 76% of the studied units of production in the zone have a surface between 1 to 6 hectares, where 85% of them only cultivate 3 hectares. Attributing the low index of use of land to the difficulty that presents the water and the lack of financial resources. A low diversity exists in spite of having on an excellent access to roads and being quite near to popular markets such as Las Pulgas, La Limpia and also Mercamara, which is the main agricultural food distributors for Maracaibo county. 58% of the farmers identified the low prices as the main

problem, 16% of the dependency with the intermediaries (truck driver) and the rest considers that they do not have problems or they are not in capacity to identify them, due to this they propose as a solution the elimination of the intermediary, to create markets to place products (28%), to diminish the prices and the rest did not raise solutions. It was observed in the process of commercialization of harvested products, a high degree of dependency with the truck driver (intermediary), which determines a low participation of farmers. According to the results, it is possible to deduce that the participation or not of the farmers in the commercialization process, is associate with managemental and motivational variables type, that in order counts as much do not depend on external factors as political and laws, but of programs that fortify the technological and human capacities. A proposal strategic based on three basic aspects it is recommended such as: Qualification, Organization and Information. To create programs that include workshops of motivation and qualification that directed to distribute knowledge on agricultural marketing; rational use of the water; to elevate the technical level to improve its production and quality on service; administrative control, as well as the constitution of organizations for the collective work. To promote generation of rural communication programs by means of small farmers stay informed into the current prices in which the agricultural goods are commercialized.

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Analysis of the distribution of red meat by the butcheries in the urban area of Maracaibo

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Abstract

This descriptive non-experimental study was performed with the purpose to analyze the distribution of red meat by the butcheries located in Maracaibo municipality, Zulia state, identifying related problems and to propose strategic actions. A population of 554 butcheries it was considered distributed into 18 parishes of the municipality. A sample corresponding to the 20% (110 butcheries) randomly selected and stratified by circuits, was selected. An inquest was used as an instrument to collect the data. A descriptive non-parametric analysis, including an analysis of frequency and independency tests of the data was performed by using the Statistical Analysis System (SAS). This trade could be characterized as a traditional retail mart, with low technological level, performed by Venezuelan. Some problems could be identified: low educational level; deficient capacity of negotiation; lack of organization; lack of advertising and information; disproportional sale of retail cuts; unsymmetrical distribution of the butcheries per circuits, characterizing the urban distribution of red meat performed by the municipal butcheries as «deficient». In order to improve this stage of the process of red meat marketing, the strategic actions should based on the organization of the merchants; capacitation of the human resources; integration of the meat-market trading system, application of in force regulation.

Key words: Organization strategies, markets, urban distribution, red meat, butcheries.

Introduction

Urban food distribution is the last phase of marketing process, where are related structures, practices and institutions that allow that the product can be acquired by the consumer (8).

This phase is complex and is considered as one of the more sensitive links of food industry (8), because it is the responsible of satisfying the consumer request, and in a general way, present problems

that have effects on quality, distribution and price of the product, that join with the economical crisis of the country, affects in a negative way the consumption of red meat in the population (12), reflecting in the reduction of frequency and in quality of kilograms of meat per person-year (9).

To evaluate the meat marketing system, is justified if considering the importance of this product in the diet of the Venezuelan, especially to Zulia population, that for tradition and customs identify meat as a basic component in diet, but in the last years have been reducing and is tending to disappear from daily food (5).

The presence of meat in the diet makes sure the absorption of certain vitamins and minerals less approachable in other foods, it means,

a small quantity of meat provides a significant quantity of nutrients in a direct or indirect way (5), maybe that is not known for people with better economical situation. Despite, for people with lower economical situation that represent 70 % of Venezuelans, which health and ingest of food is seriously affected, have cause changes in the consumption toward products with a higher carbohydrate content and few proteins (5).

In this sense, the aim of this research is analyzing urban distribution of red meat made specifically by specialized commerce (butcheries), responsible of distributing 80 % of meat in the city, and the identification of main distribution problems in urban areas to design strategies that improve this activity (9).

Materials and methods

A non experimental and descriptive research was made, where were identified and described the structural and functional characteristics that incise in the distribution process of red meat in a detailed level in the city. By the descriptive character, the design used was the transversal or descriptive transectional, in order to investigate the incidence and values where appears one or more variables, measured only once (4).

The research took place in the nor-occidental part of Zulia State, including 18 parishes (table 1), with a total population of 1.289.610

habitants (1) being the limits: in the north with Mara, in East with Maracaibo's Lake, in South with San Francisco and West with Jesus Enrique Lossada. The population considered in this research were 554 butcherries, represented by database of the Venezuela Electric Energy (3) proportionally distributed in parishes that are part of the city. The sample of the research was randomized selected proportionally stratified (table 1). This technique was applied, so the sample has the same proportion where the elements are in the population, it means, to keep proportionality in the butcherries

Table 1. Butcheries and habitants distribution, and sample per parish. Maracaibo, Zulia state.

Parish	Numbers of habitants	N°of butcheries	Sample
Antonio Borjas R.	58182	6	1
Bolívar	20408	18	4
Cacique Mara	71086	16	3
Caracciolo Parra P.	53804	45	9
Cecilio Acosta	70381	13	3
Chiquinquirá	57234	230	46
Coquivacoa	80019	8	2
Cristo de Aranza	105995	12	2
Francisco Bustamante	134780	22	4
Idelfonso Vazquez	88366	4	1
Juana de Avila	78952	54	9
Luis Hurtado H.	76804	12	2
Manuel Dagnino	93060	10	2
Olegario Villalobos	97981	33	7
Raúl Leoni	61598	28	6
Santa Lucia	39104	13	3
Venancio Pulgar	101856	30	6
Total	1289610	554	110

Source: 1 Maracaibo Office of Major 1998

2 ENELVEN. 1999

distribution per parish. The size of the sample was determined in 20% of the total population (110 butcheries) applying the equation proposed by Martinez C. (7) with sample mistakes less than 8%.

As variables of this research were considered: the socio-economical identification and characterization of the retailer, store description, definition of the functional relation supplier-retailer and retailer-buyer, as well as the respective indicators

The compilation of information in the field, was made through the structure interview technique, and as

compilation instrument was used the questionnaire, that has the complex variables described before. This instrument was previously submit to an evaluation process to the identification of the validity with 5 experts, who check concordance and coherence of the question with variables, dimensions and indicators, which opinions and advices were considered to the application of the final version, to then been applied directly in each analysis units (butcheries).

The data analysis was made using descriptive statistics,

specifically the application of frequency analysis and independent test (χ^2) (4). Tables of double entrance were used to make the analysis and discussion of tendencies in answers. A categorization of butcheries in the parish was done, according to the indicated by the decree 2.527 published in March 26, 1993 (2,6) where is pointed the decision 197 of the Agreement Committee of Cartagena, where butcheries are classified as type (A,B,C), in base of conditions and availability of equipments and installations. Considering this classification, was

made an adaptation according to the characteristics observed in this research, as is described in table 2.

The problems manifested by retailers during the application of interviews and those problems identified by the researcher, were considered as weakness that affect urban distribution, and represent the actual situation, and with the application of the situational strategic planning were designed strategies to improve the process, and have obtained a favorable change in the distribution of red meat in the urban area (10, 13).

Results and discussion

Percentage butcheries distribution by category in Maracaibo

38% butcheries in the parish were classified type A, considering that in these stores is made an adequate management and conservation of meat and that also have the required equipment to make

this activity. 40% butcheries were classified type C, it means, without the necessary equipments to make this activity in a efficient way, also 22% butcheries were classified type B, because do not have pay machines separated from the counters and freezers to the conservation and exposition of cuts (table 2)

Table 2. Characterization criteria of butcheries in Maracaibo, Zulia State.

Type A	Type B	Type C
Icebox	Icebox	Weight
Electric saw	Electric saw	
Weighting machine	Weighting machine	
Electric miller	Electric miller	
Refrigerated cabinet		
Pay machine		

The presence of equipment in bad physical and mechanical conditions were not considered to the classification.

These results define urban distribution of red meat deficiently and the realization of this activity in stores that do not have adequate conditions to manipulate and expand a product highly perishable, specially when is related to refrigeration.

Butcheries distribution by type in the parish

The butcheries distribution per parish do not have a determined pattern, neither a physical location nor a socio-economical level of habitants. That is why that in parishes Cristo de Aranza, Luis H. Huigera, Raul Leoni, Idelfonso Vazquez, Cacique Mara and Bolivar, with 16% butcheries types A-B, that suppose a red meat distribution in adequate stores. All the same, is observed butcheries predominance type C in parishes Antonio Borjas R, Coquivacoa, Chiquinquirá, Francisco E. Bustamante, Manuel Dagnino, that represent 50% of butcheries, besides are inside the most popular parishes and with a lower number of butcheries, which affect the accessibility and meat quality that is consumed in these areas (table 3).

Retailers and commercial store characterization:

A) Retailers description: the results of this research allow to describe retailers as traditional, 61% have more than 11 years in this activity, 97% are Venezuelans, 92% are men, 55% with ages between 20-40, and 51% has finished high school. Considering that these results are very favorable when it will required to make a changes in the process. However, must be highlighted the

lack of preparation of 73% of retailers in the commercial area. This also indicates the deficient specialization in this activity, so this concise with those results obtained by Rincon *et al* (10) and Segovia-Martinez (13), in the study of detailed traditional and specialized commerce in the parish, in 1998.

B) Description of commercial stores: in general terms, butcheries in the parish are characterized in: 53% stores are rented and 91% are not associated or organized, 63% open everyday with more than 8 hours of customers attention, 73% work in the counter, it means do not have car service. Besides, 71% buy the meat in a slaughterhouse. In table 4 are identified by butchery type other elements that characterized commercial stores, where are included some socio-economical aspects. It is observed that in butcheries type A, with less time of established, where innovations have been incorporated to make this activity more efficient, but these only represent 38% of butcheries in the parish, the rest 62%, is determined by butcheries with high deficient in equipment and physical space. These results characterized the detailed urban red meat commerce as efficient to distribute this product highly perishable.

Main identified problems in urban red meat distribution made by butcheries.

The actual situation identification of red meat distribution by butcheries, allowed to identify and define causal relations that generate main strategically problems, as a

Table 3. Percentage distribution of butcheries per class/parish

Parish	Type of butchery(%)		
	A	B	C
Antonio Borjas R.	0	0	100
Bolívar	100	0	0
Cacique Mara	67	33	0
Caracciolo Parra P.	56	33	11
Cecilio Acosta	33.3	33.3	33.3
Chiquinquirá	18	15	67
Coquivacoa	0	0	100
Cristo de Aranza	50	50	0
Franc. Bustamante.	25	25	50
Idelfonso Vazques	0	100	0
Juana de Avila	67	11	22
Luis Hurtado H.	50	50	0
Manuel Dagnino	50	0	50
Olegario Villalobos	57	29	14
Raúl Leoni	83	17	0
Santa lucia	33.3	33.3	33.3
Venancio pulgar	33	50	17

result of «have to be» and «might be». Besides, product of the retailer's answer to the question of identifying main problems that affect detailed red meat commerce.

Main identified problems

1. Low preparation level of retailers in the commercial area, and food management. Proved for the instruction level, 51% are high school graduated, 29% have only coursed primary school, besides 73% of retailers have not done course in the administration food management area. This determines that the management store, is product of their experience, and can be translated in low technology application. Besides, this situation is also reflected in

persons that are hired in these stores, where the only requirement is to have experienced, because there do not exist or is not common specialized courses for butchers.

2. Lack of organization, where 91% are associated. This situation is caused because of the few information about the existence of organizations, and benefits, that are evident by the education level, and negative experience that is in these organizations, which cause the non exploitation of these benefits, as the scale economies for a more negotiation power.

3. Deficient negotiation capacity. This is a causal effect of the previous problem, it means, individualism and

Table 4. Characterization of butcheries per class. Maracaibo parish

Quality	Type A	Class B	Class C
Established time	74% lees of 10 years	38% more than 20 years	70% more than 20 year
Sell volume	52% more than 300.000 Bs.	63% less 300.000 Bs.	87% less 300.000 Bs.
Employment capacity	46% more than 4 persons	73% more than 2 persons	41% one person
Kind of supplier	60% slaughterhouse - icebox	42% icebox	64% icebox
Frequency of provisions	60% every two days	63% every two days	57% daily
Buy volume	33% 7-8 cattle/week.	42% 3-4 cattle/week.	43% less than 4 cattle/w.
Price	50% slaughterhouse	42% supplier	64% supplier
Package used	64% plastic bag	88% plastic bag	98% plastic bag
Average prices	6% more than type C	2% more than type C	Highest prices

incapacity of looking for collective solutions, which caused the management of small capital investments and low volumes of buying and selling. 64% retailers sell 6 or less cattle per week, with incomes less of 300.000 Bs/day for 66% of the same, which generates a retailer dependence, limiting the negotiation capacity, as well the opportunity to evaluate others agents to be supplied. Besides, the supplier dependence is due to the deficient refrigeration capacity, limited or non existent in butcheries type C, that represents 40% of the sample, forcing them to be provided with a supplier that warranty the low volume and/or high frequency (78% are daily provided or every other day, with 1 to 2 cattle per buy). This supplier provides 46% butcheries, which limited other route election, increment in prices, expenses and reduction of retailers profits.

4. Lack of publicity and information by retailers to consumers. This problem is related to the type of meat they sell, which is a law exigency, the correct preparation of different cuts and qualities of cattle meat, which cause few consumer information and interest reduction in this kind of product.

5. Disproportion sell in different cuts. Only 32% channel cuts have high quality and more than 50% of consumers prefer these cuts, because are very easy to prepare, which lead to a reduction of cuts request of second and third. This also happens because of the low technology application that give more value to the meat, in a way that reduces preparation time in

harder cuts and increment request.

6. Disproportion butcheries distribution in parishes. This provoke that many persons have to drive many miles, to obtain meat in butcheries. In that way, are obtained relations of 249 habitants/butcheries (Chiquinquira parish) and 22.092 habitants/butcheries, which implies that one butchery provides an approximate average of 465 homes (of 5 members) in Maracaibo. According to table 5, there are parishes where this relation determines deficiencies, and makes think a shortage, and are precisely the most popular and farthest parishes in the urban area, where the relation habitants/butcheries is higher.

Besides, it has to be considered that this research embraces urban distribution made by butcheries, because are responsible of providing 80% of meat that are distributed in the city, the other 20%, is made by organized commerce, like supermarkets, hypermarkets, others commerce that also sell meat (ENNE, Centro 99), as well as illegal or spontaneous stores. However it has to be said, that these stores are distributed in the urban area, where most of the people do not have access, maybe for the distance or by the economical situation.

Strategically proposals.

According to the detected reality to meat commercialization in

Table 5. Distribution of butcheries/habitants/parishes in Maracaibo

Parish	Habitants	Habitants butchery	N°.butcheries
Antonio Borjas R.	58182	9697	6
Bolivar	20408	1134	18
Cacique Mara	71086	4443	16
Caracciolo Parra P.	53804	1196	45
Cecilio Acosta	70381	5414	13
Chiquinquirá	57234	249	230
Coquivacoa	80019	10002	8
Cristo de Aranza	105995	8833	12
Francisco Bustamante	134780	6126	22
Idelfonzo Vazques	88366	22092	4
Juana de Avila	78952	1462	54
Luis Hurtado H.	76804	6400	12
Manuel Dagnino	93060	9306	10
Olegario Villalobos	97981	2969	33
Raúl Leoni	61598	2200	28
Santa Lucia	39104	3008	13
Venancio Pulgar	101856	3395	30
Total	1289610	2328	554

Maracaibo, strategically actions are proposed, based in the methodology approach of situational strategic planning that allow to establish a competitive and productive sell system to recover the consumption levels:

The posing of strategically proposal search the following objectives:

- To organize retailers with the purpose of increasing the participation level in the system.

- To improve the distribution process through the development of a efficient distribution logistic (car services, house services, sells on the internet) obtaining the presence of the product in a continues way.

- To improve the product quality through investigation and development actions that give value to the product.

- To increase the managerial capacity of retailers with the aim of getting and efficient administration of the process and fortify the manager knowledge.

- Fortify the financial capacity to increment investments.

- To promote support services to commercialization and customer services.

- To promote the adequate adoption of physical practices in the commercialization process to improve competitiveness.

- To promote the application of techniques to the meat with the purpose of facilitating the preparation.

The following strategic proposals, are the analysis result that

are part of systemic-causal red of main problems previously identify, defined as critical points, which changes originate a significant alterations of actual situation to obtain the objectives proposed before. These strategic actions lay in: retailers organization, retailers capacitation, and the application of existents laws.

Retailers organization: promoting the detailed stores organization, can be obtained a productive and effective cooperation in the activity to face deficiencies and obstacles that are presented inside the red meat commercialization chain, these organizations can be: detailed chain and/or cooperative chain or buy unions.

These organizations offer theirs services as: buy of quantity of products, transport, storage, meat processor, where each retailer obtain the operative economical autonomy.

With this strategy is pursued that retailers develop direct commercialization ways, promoting the scale economy, avoiding having unnecessary intermediates and facilitating buys in quantity, storage to keep the request in critical times, distribution of products, to offer better prices, provides their associates, to have financial incomes to fortify the investment capacity and represent them in the governmental, legal and commercial instance, which provokes more benefits and higher competitiveness.

This detailed organization must be promoted by national and regional organism that are direct and indirect

involve with detailed meat commerce, these might be: Maracaibo's Office of Major, Production and Commerce Ministers, Agricultural and Land Ministers, CORPOZULIA, FEDENAGA, and others.

- Retailers and human capacitation: the implementation of capacitation and training programs for retailers and other people that work in the store, will be in function of achieving that the commercialization process be efficient and effective, improving the competitive store capacity. This capacitation must embrace knowledge in the marketing, technology, meat industry, administration and customer service areas. All the same, capacitation with base in technology that allow to improve supply processes, storage, processing and product dispatch, this can be done through workshops, courses, hand sheets, and others.

- Application of existence law: the application of existent law in the

decree N°2.527 where is put in evidence the decision 197 of the Agreement Committee of Cartagena, which establishes the technical salubrity requirements to the cattle commerce, and in chapter 4, point 4.5 about the wholesale and detailed red meat merchandise, where are highlighted the following articles: 4.5.2, 4.5.3, 4.5.4, 4.5.5, 4.5.13, 4.5.14.

Integration of the commercialization chain: to promote the integration of meat circuit from the producer to the buyer, with the purpose of reducing costs because in this way is obtained a more efficient participation of each actors of the merchandise process, and more and better services can done to the client.

With the integration is also obtained a better transference of information, from the consumer to the buyer according to theirs request and necessities, reaching to each participants of the integration, which will take the necessary measure to give the consumer a positive answer.

Conclusions

When characterizing the distribution process of red meat made by retailers in Maracaibo, have to be pointed: that are persons between 20 and 40 years old, all men, Venezuelans, with more than 11 years in the activity and instruction level low (high school); disorganized, butcheries type A have more selling volume; the owners in a general way, have the mission of obtaining economical benefits and the vision of staying and grow in the business; the

freezer man, is the provider in all butcheries except in butcheries type A, where also predominate the direct supplying of slaughterhouse; the supplying frequency is every two days with payment facilities; to buy the meat is considered the slaughterhouse classification, butcheries work from Monday to Sunday, approximately 8 hours per day, through the counter and the main package way is using a plastic bag; cut prices are more expensive in butcheries type A,

around 5%, among other aspects. These results coincide with previous research made in the urban area to the traditional detailed commerce, besides allow to conclude that these stores that sell red meat, have important deficiencies in order to provide food to the people, specially to those with lower social class, where meat with higher prices, less quantity and less merchandise service are sold.

What lead to the distribution of butchereries in the parish, was determined an inequality between the different parishes, specially parishes where exist less butchereries than habitants, and are precisely the farthest from the city, where do no exist any other near food stores (supermarkets, hypermarkets, among others), and makes think that the red meat consumption is lower, and also affected by quality and price.

The identified problems in the process that affect the urban

distribution of meat are: low preparation level of retailers in the commercial area and food management, lack of organization, deficient negotiation capacity, lack of promotion and negotiation, disproportional sell of different types of cuts and disproportion distribution of butchereries in parishes. The symptoms of these problems are defined as: low sell volume, low incomes margins, less meat consumption, higher prices, stores with lower quality, disloyal practices to the consumer and few merchandise services.

The strategic proposals to obtain a change in the actual situation, and to make the objectives, are pointed to the application of the following actions: to organize the buyers, buyers capacitating, the application of existence laws, and promote the chain integration.

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2. Presentation

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The methodology should specify the materials utilized during the development of the research, including registered names if it be the case. As far as possible methods and techniques employed should be specified by references, unless they are new or rarely used and unusual. Statistical methods employed should be specified as well as software employed in the process. This section should be ordered chronologically and in such a way that another researcher could repeat the process. References can be made to tables, figures and diagrams. Decimal numbers should be indicated by a coma (,).

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Corona, M., A. Diaz, G. Páez, J. Ferrer, Z. Mármol y E. Ramones. 1996. Extracción y caracterización de pectinas de la corteza de parchita. *Rev. Fac. Agron. (LUZ)*. 13(6): 785-791.

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7.8. Programs and software.

SAS Institute, Inc. 1985. SAS user's guide : Statistics. 5th edition. SAS Inst., Inc., Cary, NC.

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