

Diagnosis and alternative of the revitalization of spineless cactus in semi- arid of the state of Paraíba**Diagnóstico e alternativa da revitalização da palma forrageira no semiárido paraibano**

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ABSTRACT

The spineless cactus is the main food of the cattle herd in the semiarid Paraíba. However, with the advent of carmine cochineal (*Dactylopius opuntiae*) traditionally cultivated varieties were practically decimated. Therefore, the technical alternative is undoubtedly the replacement by varieties resistant to this pest. However, the scale cochineal that already existed in the traditional planting, also affects the varieties resistant to carmine cochineal. In view of this, a diagnosis of the traditional forage palm was carried out and the alternative of the revitalization with resistant varieties in the Paraíba semi-arid region was studied in three municipalities of Paraíba: Boqueirão, Caturité and Pedra Lavrada, these determinations being the main objectives. The spatial cut-off was made up of ten farms for each municipality, and the methodological procedures consisted of the application of structured questionnaires, a semi-structured interview and on-site observations, with questions regarding the production of this fodder and the development of livestock activity. In the plantations of resistant varieties of carmine cochineal, in the Pedra Lavrada farms, the diagnosis was for the incidence of scale cochineal. The main results showed that: the feeding of the bovine, goat and ovine herd is limited, basically, forage palm. The presence of carmine cochineal occurred

between mid 2009 and 2010 and decimated palms quickly. The drought, besides decimation of native pastures, affects clones of varieties resistant to carmine cochineal and seems to contribute with a higher incidence of scale cochineal. The revitalization of forage palm tree, with resistant varieties of carmine cochineal, is the only hope to continue farming in the semi-arid region of Paraíba. Although, it is recommended to expand studies on pluvial, thermal and water regimes for carmine cochineal resistant spineless cactus clones and their relationship to scale levels of scale cochineal infestation

Keywords: Animal feed. Forage cetaceous. Carmine Cochineal. Scale Cochineal.

RESUMO

A palma forrageira é o alimento principal do rebanho bovino no semiárido paraibano. No entanto, com o advento da cochonilha-do-carmim (*Dactylopius opuntiae*), variedades tradicionalmente cultivadas foram praticamente dizimadas. Portanto, a alternativa técnica é, sem dúvida, a substituição por variedades resistentes a essa praga. No entanto, a cochonilha em escala que já existia no plantio tradicional, também afeta as variedades resistentes à cochonilha carmim. Diante disso, foi realizado o diagnóstico da palma forrageira tradicional e estudada a alternativa de revitalização com variedades resistentes no semiárido paraibano em três municípios da Paraíba: Boqueirão, Caturité e Pedra Lavrada, sendo estas determinações principais objetivos. O corte espacial foi composto por dez propriedades rurais para cada município, e os procedimentos metodológicos consistiram na aplicação de questionários estruturados, entrevista semiestruturada e observações in loco, com questões referentes à produção dessa forragem e ao desenvolvimento de atividade pecuária. Nas plantações de variedades resistentes de cochonilha de carmim, nas fazendas da Pedra Lavrada, o diagnóstico foi para a incidência de cochonilha em escala. Os principais resultados mostraram que: a alimentação do rebanho de bovinos, caprinos e ovinos é limitada, basicamente, à palma forrageira. A presença de cochonilha carmim ocorreu entre meados de 2009 e 2010 e dizimou palmas rapidamente. A seca, além da dizimação de pastagens nativas, afeta clones de variedades resistentes à cochonilha-do-carmim e parece contribuir com maior incidência de cochonilha em escala. A revitalização da palmeira forrageira, com variedades resistentes de cochonilha-do-carmim, é a única esperança para continuar cultivando na região semi-árida da Paraíba. No entanto, recomenda-se a ampliação dos estudos sobre os regimes pluvial, térmico e hídrico para os clones de cactus resistentes à cochonilha carmim e sua relação com os níveis de escala de infestação de cochonilha em escala.

Palavras-chave: Ração animal. Forragem cetáceo. Carmim Cochonilha. Escala Cochonilha.

1 INTRODUÇÃO

The forage palm (*Opuntia ficus indica* L. Mill) is an exotic cactus, with more than 1400 species and 120 known genres (HOFFMANN, 1995; SOUZA and LORENZI, 2005), native to Mexico, where it is used in cooking, agribusiness, production dyes and cosmetics. In the northeastern semi-arid region, it is used to feed cattle, sheep and goats because it is the only forage that persists, especially, in the dry season.

In Brazil there are two species of the genus *Opuntia ficus-indica* (L) Mill, giant palm, and the *Nopalea (cochenillífera Salm-Dyck)*, sweet palm, both do not contain spines. The genetic

characteristics of rusticity, drought-resistant and high water use efficiency provide the adaptability to the semi-arid environment, which are associated with good acceptability of consumption by cattle (SILVA et al., 2010).

The agronomic characteristics of resistance to drought caused the forage palm to incorporate the livestock of Paraíba and other areas of the northeastern semi-arid region, because it is the only one that perseveres and remains nourishing during the long periods of drought and, therefore, guarantees the maintenance of the herd (ARAÚJO FILHO, 1977, NUNES, 2011) and can also be used in the form of bran (BARBERA, 2001), in addition to providing environmental conservation (CHIAICCHIO et al., 2006).

In the Northeast of Brazil, the genus *Opuntia* and *Nopalea* are spineless cactus without spines and the most used as fodder, standing out the giant palm, the round and the small one, for having fast growth and moisture content superior to the other cactus.

Encouraging the cultivation of forage palm is a strategy that aims not only the development of livestock in the Northeast, but the survival of this activity. However, with the emergence of carmine cochineal (*Dactylopius opuntiae*), palms with traditional varieties were practically decimated.

Cochineals are insects that suck the rackets of this forage by inoculating toxins. This process results in the weakening of the plants, causes the yellowing and the fall of the cladodes. When the infestation rate is high and if a control measure is not adopted, the infested area is practically decimated (CAVALCANTI et al., 2001)).

The name of carmine cochineal is due to the production of the natural red dye (carmine), from the synthesis of carminic acid, which has great commercial importance in the production of cosmetic and, therefore, an income generating activity.

In the northeastern semi-arid region, this pest was observed around 2001 in the states of Pernambuco and Paraíba and currently occupies the status that previously belonged to scale cochineal (LOPES, 2007). Their recognition is relatively easy, because on the surface of the cladodes appear small white circles similar to cotton threads and when they are crushed, it releases a reddish substance, which is carmine (SANTOS et al., 2006).

The failure to produce carmine dye in Brazil may have been motivated by the introduction of the "false" cochineal (*Dactylopius opuntiae*), because this pest has a high destructive power (PESSOA, 1967).

The advance of carmine cochineal in the state of Paraíba occurred in the plantations of the giant variety, the one most cultivated, especially in the geographic micro regions of Western and Eastern Cariri (LOPES, 2012). As a result of this pest, the extermination of this variety is

inseparable; therefore, the carmine cochineal has directly affected the follow-up of livestock, an activity that is the main generator of employment and income in this geographic cut.

The devastation of forage palm cultivation in Paraíba, due to this pest, is very worrisome even because the level of infestation comes to decimate the entire planting. If there is no food such as maintaining cattle ranching, especially in the main dairy, in the basin of the municipalities of Caturité and Boqueirão, for example, whose social and economic losses compromise even the small and medium-farmer's patrimony (LOPES, 2012).

The states of Paraíba and Pernambuco were the most affected by carmine cochineal where the infestation has already decimated about 90% of the traditional planting. With the advent of carmine cochineal, the option of planting is with varieties resistant to this pest.

This condition led to the establishment of a forage palm revitalization program, which consists of replacing more productive palm clones with higher nutritional value and, in particular, being resistant to carmine cochineal, such as small and elephant ear varieties (Cavalcanti et al., 2008).

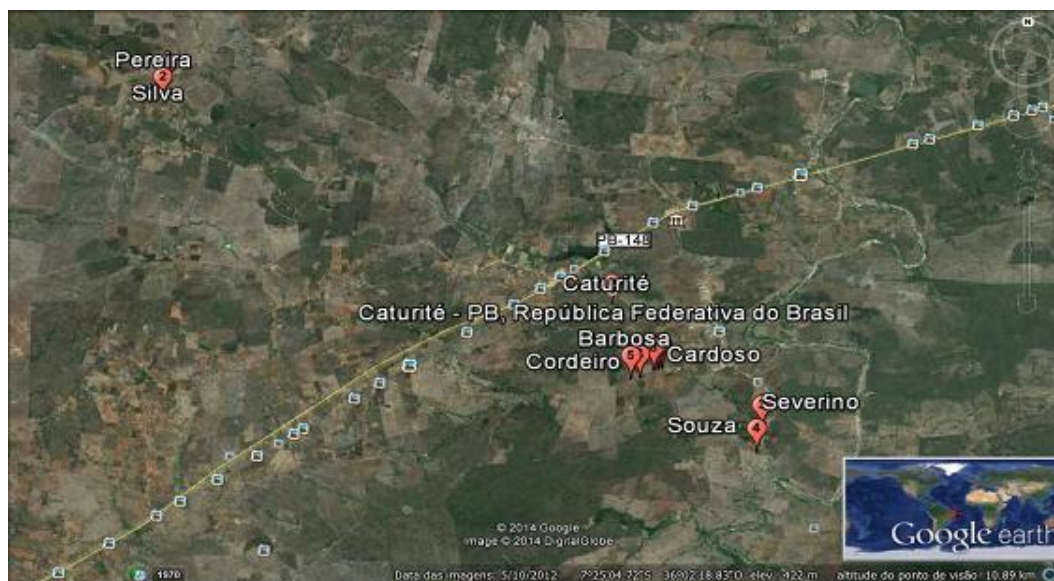
This alternative technology has been the hope for the continuity of livestock, goat and sheep farming, bases for sustainable rural development in the semi-arid region of Paraíba.

In view of this, it was necessary to diagnose the quantitative of the traditional plantations and to investigate the alternative of the forage palm revitalization, with new varieties resistant to carmine cochineal, with emphasis on the milk producing basin of the western Cariri micro region of Paraíba, these the determinations the objectives of this work.

2 MATERIAL AND METHODS

The area covered by this study consisted of twenty farms (Figure 1), located in the largest dairy basin of the Cariri Oriental region of the State of Paraíba, ten in the municipality of Caturité (7° 25 'S, 36°01' W) and ten in Boqueirão (7° 30 'S, 36° 08' W).

Figure 1. Identification of the farms of the municipality of Caturité, by satellite image Google Earth.



All the farms of Boqueirão and Caturité were geo-referenced, using GPS and images of satellites Google Earth, enumerated algebraically and identified by the geographical coordinates and the red captions, as exemplified in Figure 1, for the municipality of Caturité, State of Paraíba, PB.

The methodological procedures consisted of the application of structured questionnaires, a semi-structured interview and on-site observations, with questions that included development indicators aimed at the production of forage palm (cultivated area sizes, with traditional and revitalized palm, access mode the new varieties, area for cultivation, among others).

The interviews were carried out with the responsible ones, producers and/or technicians involved in the rural activities, specifically, in the culture of the forage palm, including the program of revitalization of this cactus, for more resistant materials, the carmine cochineal.

Data were collected quantitatively and/or qualitatively. The statistical analysis procedures included several technical research resources, such as: interviews, on-site visits, photographic records and bibliographic sources (maps, books, periodicals, among others). Statistical analysis was paramount for understanding the proposed study.

In order to make a diagnosis of the incidence levels of scale cochineal, in the areas revitalized with resistant varieties of carmine cochineal, in ten farms in the city of Pedra Lavrada, PB (06°45'S, 36°28' W) structured and semi-structured questionnaires were applied to the farmers in their properties that use the forage palm both to commercialize and also to feed their herds.

The data were collected at Pedra Lavrada farms, between November 2017 and February 2018. Data analysis was performed using the statistical distribution of frequency and measures of central tendency.

The calculations and statistical analyzes performed in the present work, as well as the preparation of graphs, tables and tables were made using the Excel worksheet.

3 RESULTS AND DISCUSSION

In general, feed for cattle, goats and sheep in the semi-arid region of Paraíba is limited mainly to forage palm, mainly during prolonged periods of drought.

It is known, however, that the uses of other types of fodder, other than the natural pasture existing in the short rainy season, are little used, since it is not common practice to grow other types of fodder in the rainy season, and to store them in silos trenches, for example, to be used in the dry period.

As most of the year is dry, there is no native pasture, so the cost to keep the herd is raised, due to the need to purchase rations to feed the herd. Like the scenario without forage palm, the situation becomes even more complicated.

The Figures 2 and 3 show the relative frequencies of the area extracts, with forage palm, in 10 farms, from Caturité and in Boqueirão, PB.

Figure 2. Relative frequency of the size of the areas with the forage palm, in 10 farms of Caturité, PB.

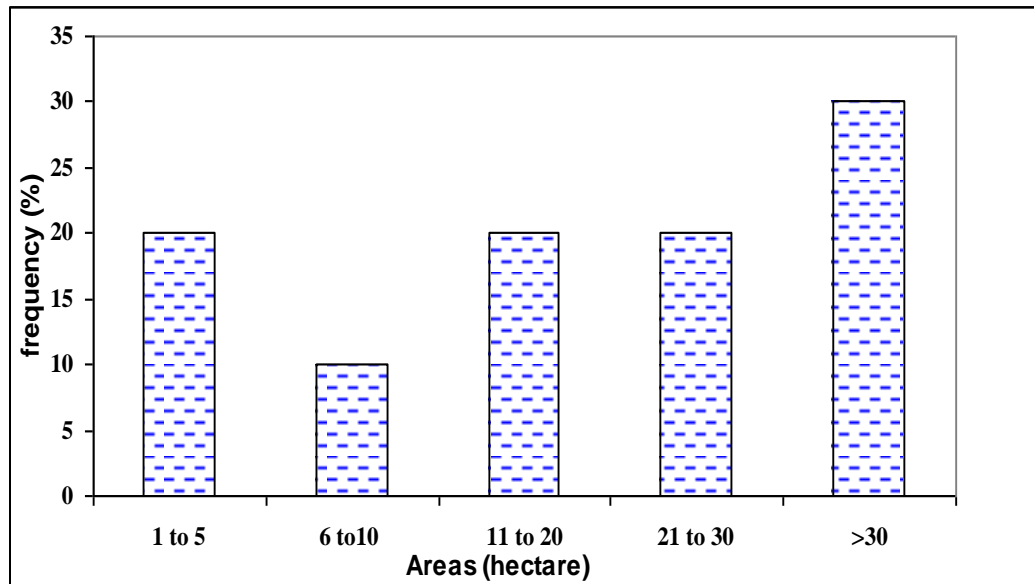
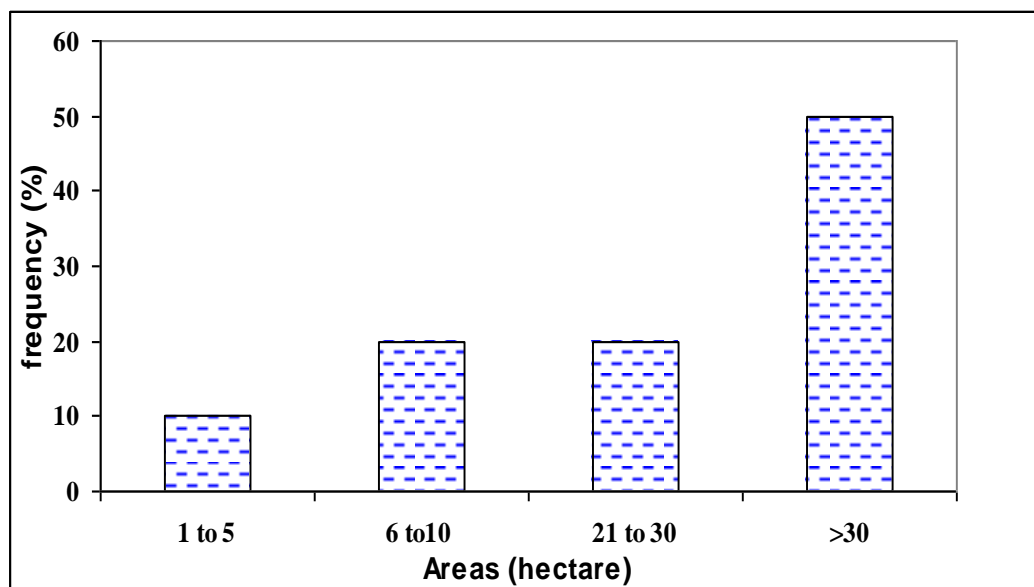


Figure 3. Relative frequency (Fr) of the size of the areas with the forage palm, in 10 farms of Boqueirão, PB.



Although the forage palm has an extraordinary production capacity, in the climatic conditions of the northeastern semi-arid region, it should not be used as the only source of food due to its low content of dry matter, fiber and crude protein, compared to other bulky foods. However, the palm is practically the only forage to feed your herd in the dry season.

It is observed that the extracts from areas with palm cultivation differ from each other, with larger plantations in Boqueirão, where half of the farms have an area larger than 30 hectares, compared to 30% of Caturité.

The palm, a giant variety, is known as tall, sour or holy, has a more erect profile, slightly leafy vertical growth and less branched stem.

As can be observed in Figures 4 and 5, there is a predominance of this species *Opuntia fícus indicis*, in the two localities, with a small percentage difference of 10.0%, more, when comparing the areas of Caturité with those of Boqueirão.

Figure 4. Relative frequency of cultivated areas with the giant palm variety in 10 farms in Caturité, PB.

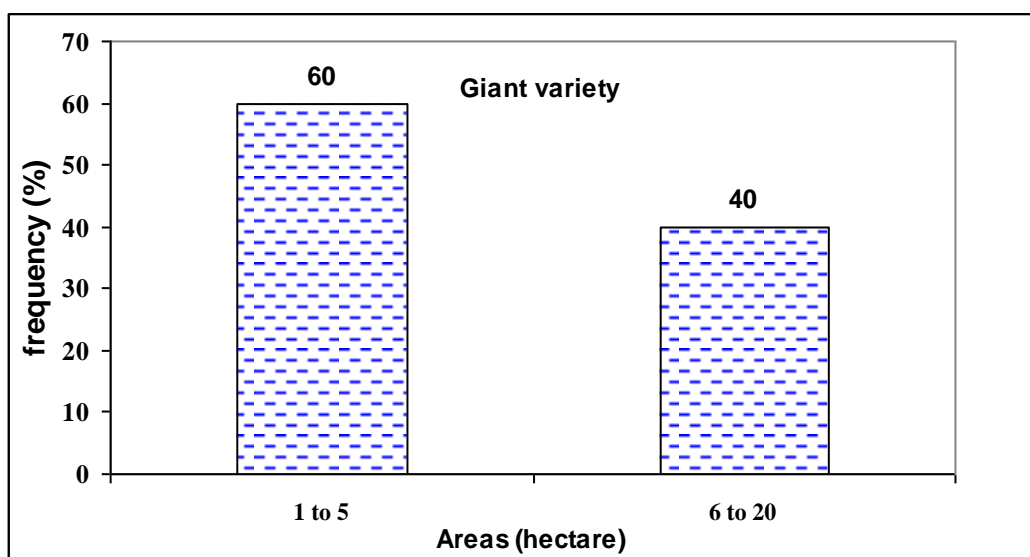
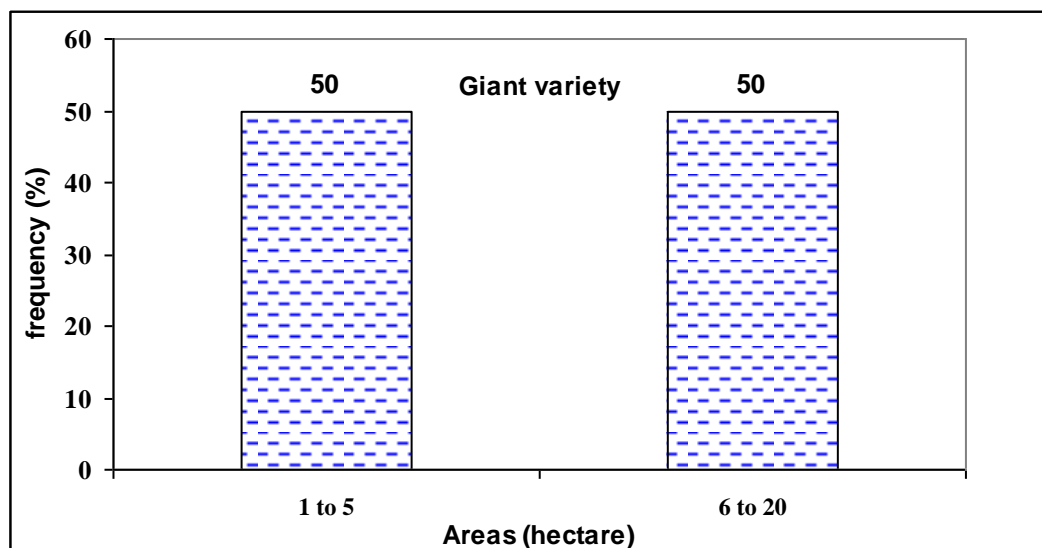


Figure 5. Relative frequency of areas cultivated with the giant palm variety, in 10 farms, in Boqueirão, PB.



Regarding the percentage of areas infected with carmine cochineal, it is reported that they are frightening since the percentage of infestation is 100%. These results agree with those of Lopes (2012) when reporting that carmine cochineal has already decimated almost all palm trees in the state of Paraíba, where it recorded the incidence of this pest in 81 of the 223 municipalities.

Farmers reported that the appearance of carmine cochineal began between mid 2009 and 2010, but the decimation of palms occurs very quickly. Without having this forage to feed the herd, the only way out to buy food (soybean meal, cotton pie and palm from other areas of the state, among others) was to sell part of the stock, that is, some animals were sold to keep others.

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After being planted the new varieties presented a new problem to the incidence of another plague denominated scale cochineal, the producers reported that it is as severe as the one of the carmine in the traditional palm, with respect to the development.

It should be noted, however, that even before the appearance of carmine cochineal, scale was considered the main pest of the forage palm in the Northeast. Just to illustrate, Figure 6 and Figure 7 shows giant palm rackets attacked with scale cochineal.

Figure 6. A sample of giant palm variety attacked by scale cochineal, Pedra Lavrada, PB.



Figure 7. View of a racket of the elephant ear variety attacked by scale cochineal in one of the farms sampled in Pedra Lavrada, PB.



The farmers, a priori, hoped that the varieties resistant to carmine cochineal would also be for scale cochineal. However, the producers noticed the appearance of clusters of scales, with light brown coloration, something about six months after the planting.

In relation to the scale cochineal attack, in the elephant ear clones, some of the producers claim that when they received the rackets they were already infected with this type of cochineal, as shown in Figure 7.

The occurrence of scale cochineal in forage palm (Figure 7) has a very typical symptomatology, which usually occurs in older rackets during drought periods. The same dried scales remain in the rackets, being able to be easily removed with slight friction.

If the elephant ear racquets, resistant to carmine cochineal, have already been infected with the scale cochineal, as some of the producers stated, there was a technical negligence, because it is recommended to plant, same as traditional varieties, be made with rackets in order to avoid the presence of the pest at the beginning of the plantation.

The symptomatology of scale cochineal is very typical and, therefore, should not be confused with the so-called physiological evil that occurs, generally, in older rackets in the periods of drought.

As can be seen in Figure 7, the scale cochineal covers all the cladodes of the palm preventing the reception of solar energy and, consequently, affecting the photosynthetic processes. The greatest aggravation of this pest is that the infestation covers almost the entire racket and the colonies when feeding sucks the sap of the plant causing a hole causing chlorosis and then the rotting caused by the infestation of other microorganisms, causing the rackets fall until even the tipping of the clump, as can be seen in Figure 8.

Figure 8. Partial view of a tilting of a forage palm plant (Elephant's Ear), infected with the scale cochineal, in one of the farms analyzed in the municipality of Pedra Lavrada, PB.



According to the observation of the producers, the incidence is much higher during the drought period and, therefore, becomes much worse and decreases in the rainy season, due to the decrease of the colonies.

Forage palm, in particular, carmine scale resistant varieties, its productive growth is influenced by the pluvial and hygothermal regimes due to the relationship between its physiological and biochemical processes.

Although a more precise study of the effect of rain on the production of this fodder has not been done, it agrees with the results found by Nobel (2001), in which palm growth is related to the occurrence of 400 to 800 mm annual rainfall. On the other hand, there are reports in the literature that drought contributes to the occurrence of scale cochineal. Thus, the producers think that the rainy periods contribute in the reduction of the colonies.

The decapitalization and loss of wealth of producers was especially high because small producers have low purchasing power to acquire resistant clones and therefore without palm to feed the small herd, the only alternative was the sale.

It should be noted, however, that the drastic reduction of the area planted with forage palm. The planting of new varieties is undoubtedly an important alternative, even with the difficulties of accessing them, either for financial reasons or for lack of governmental initiatives. Even so,

ranchers are optimistic about the forage palm revitalization program. Without the palm, there is no way to feed the herd.

It should also be noted that the semi-arid rancher does not exploit the different sub products of the palm, whether for human consumption, medicine, the cosmetics industry or the production of natural additives. These byproducts represent an additional revenue source in the property, which is not being used, which agrees with the results of SÁNZ et al. (2004).

The sub products of forage palm are potential source of income more in the properties. However, it is still marginalized as food that only serves to feed the herd of cattle, goats and sheep, in times of drought, vision that is distorted, that is, the palm is the "green gold of cariri"

As the forage palm is the main source of feed for the cattle, sheep and goats of the Paraíba semi-arid region, the dryness decimates not only the native pastures, but also affects the production of clones of palm fodder resistant to carmine cochineal, associated with the incidence of cochineal of scale, whose contribution seems to be associated to the occurrence of soil water deficit

In this context, a comprehensive study is needed to relate the "behavior" of carmine cochineal resistant clones and scales to the environmental conditions of the semi-arid region, establishing not only the main characteristics of water and thermal regimes, but also the need for irrigation techniques.

4 CONCLUSIONS

The alternative of the sustainability of the livestock activity in Paraíba, especially in the dry season, can not depend exclusively on the forage palm with the main or only source of feed of the herd.

The incidence of carmine cochineal in traditional forage palm varieties in the semi arid Paraíba occurred between mid 2009 and 2010, and decimated palms very quickly. Without the forage palm, the only way out was to sell part of the herd for not having fodder to feed.

The alternative of forage palm revitalization has led to the planting of clones resistant to carmine cochineal, in areas where they were cultivated with traditional palm varieties, and is therefore the only hope to continue the livestock activity in the semi-arid region of Paraíba and Northeastern.

In areas cultivated with resistant varieties of carmine cochineal, the incidence of scale cochineal, which although existed in traditional cultivation, is higher in the dry season and lower in the rainy season.

It is recommended to expand studies on rainfall, thermal and water regimes suitable for carmine cochineal resistant forage palm clones and their relationship to scaled scale cochineal infestation levels.

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