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The Mango Sector in Senegal: Cultivation Systems and Techniques and Constraints



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ABSTRACT

A survey of mango sector in Senegal Although Senegal is one of the first mango exporting countries in Africa, the sector is far from being mastered. This study reveals a predominance of traditional orchards whose owners are small producers who do not master good production practices. These orchards are in the south and center of the country. Modern and industrial orchards are not very present and are most often found in the Niayes area. The lack of training of the farmers make the density in the orchards very varied, which limits the yields of certain producers. This study shows for an average density of hundred and twenty plants per hectare yields are high, below ninety plants per hectare and above hundred and thirty plants per hectare yields are low. The actors of the sector are confronted with many constraints including the fruit fly, the lack of water, the infrastructures with a difficult access to certain zones of production and the lack of organization of the sector of the trade. With good supervision of farmers in this sector, the mango sector has a large role to play in terms of socio-economic development in Senegal; it can contribute significantly to poverty reduction.

1. INTRODUCTION

The mango tree today is very popular in West Africa for its fruit and its shading is yet a recent introduction in Africa. Originally from India, the mango tree was first reported in West Africa, Senegal, in 1824 [1]. The production of mangoes in Senegal has long existed but without a real organization, especially in regions with a vocation for the production of fruit (south and center of the country), in box (whose distance between the plants is not taken into account) orchards and in plantation, at the level of the family farms as well as small operators [2].

The reduction of major cash crops, such as groundnuts, has led farmers to look for alternative income generating activities. This situation has driven the promotion and development of fruit growing and, in particular, the mango sector in parts of central and southern Senegal, which has seen the traditional orchards and the creation of new export-oriented plantations, the dissemination of improved varieties, application of appropriate cultural techniques, market research and especially actions that can add value to the productions (export, processing).

The evolution of Senegal's exports, more than 3200 tons in 2004, is the major phenomenon of recent years. As an illustration, these exports have increased from 619 tons in 2000 to 11515 tons in 2013 [3]. In addition to a period of late production, without much African competition, Senegal benefits from regular and fast maritime links with Europe [4].

The mango production systems in Senegal are very different according to the area. This study was conducted on a survey to fully understand the techniques and cropping systems. The objectives of this field study are: understand the composition of orchards by locality, the techniques and farming systems, the types of producers by zone and the constraints encountered by farmers. Many studies have been conducted on the mango tree sector but not for some areas in the south and center of the country. It is of particular importance to discover these lands which are little visited until now.

Mango production is mainly concentrated in Casamance (57%) in the Niayes zone (37%), a favorite zone for export mango and the central zone (Horticulture Ministry of Agriculture 2011).

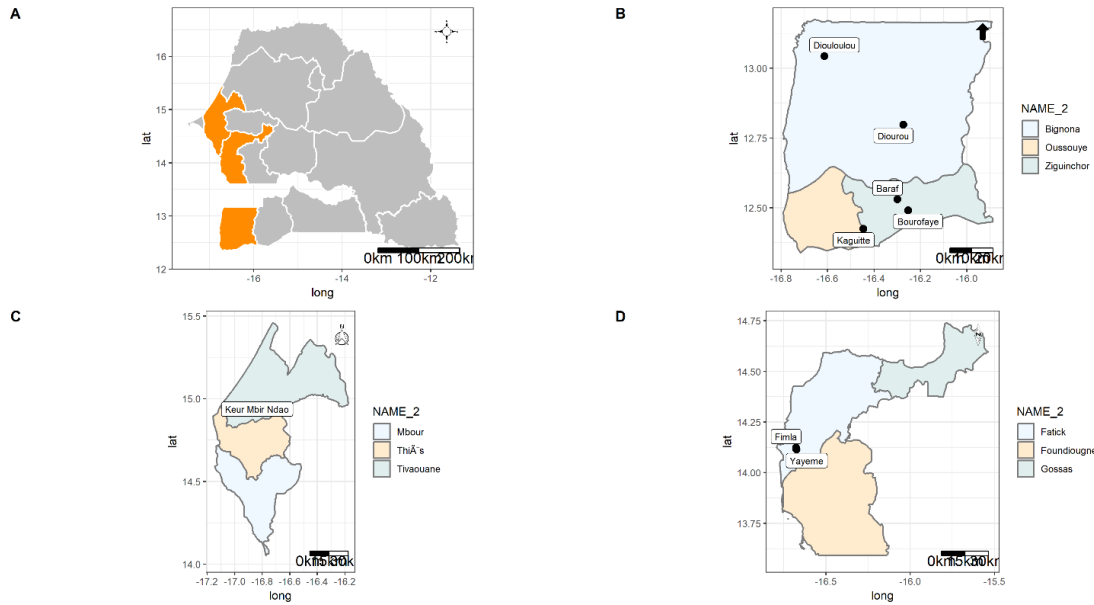


Figure No.1: Mango production areas in Senegal

2. MATERIALS AND METHODS

To carry out this study, a questionnaire is prepared from the koBo Collect software. In the field this questionnaire was submitted to owners or to people working in orchards. All questions were answered on the spot in the orchards.

This study was carried out in three regions: Ziguinchor, Thiès and Fatick. The survey was conducted during the period from 21/12/2017 to 12/01/2018 and the form is available on (<https://kobo.humanitarianresponse.info/#/forms/a4V6orTNoZo5ceB8Rb>).

The choice of these localities is explained as follow:

- Mango is mainly produced in these areas,
- There are orchards specific to each region,
- The types of producers in each locality.
- Some areas in the south and center are poorly visited.

2.1- Cropping system in the southern zone

For the southern zone, this study was carried out in the Ziguinchor region in the following localities: Ziguinchor department (Baraf, Bourofaye and Kaguitte), Bignona department (Diourou and Diouloulou Koubanak).

In this area, village orchards and family orchards represent the largest areas. These are small plantations (ten to a hundred trees) and local varieties that do not benefit from irrigation and adequate farming techniques. Normally, mango trees have low yields that are difficult to estimate. The farmers are small and medium producers, family farms and groups.

In recent years there has been a strong presence of improved orchards in this area.

These improved orchards are traditional orchards where local varieties have been substituted/replaced with improved varieties (Kent and Keitt), highly prized by traders, exporters and consumers. The average yield can be estimated around ten tons per ha, depending on density of plantation and the adopted cultural techniques.

The southern zone is rainy, which is why it is easy to develop arboriculture. In these orchards, we find other plants such as citrus fruits but also vegetables.

2.2- Cropping system in the central zone

In the central zone, this study was carried out in the region of Fatick, in the locality of FimlaYayeme. In this area are practically the same types of orchards found in the southern zone. With rainfall deficits in parts of this region, improved orchards are slowly developing with irrigation systems such as drip irrigation. In these orchards, intercropping is practiced during the rainy season (peanuts, millet, etc..) and vegetable are grown in the dry season.

2.3- Cropping system in the Niayes area

For the Niayes area, this study was carried out in the Thiès region of KeurMbirNdao locality as shown on the map Figure 1: This is the preferred area for export mangoes (Horticulture Branch, 2011). In this zone, there a strong predominance of modern or industrial (or fewer) orchards is reported.

These orchards are those made to have an improved mango production (dominated by Kent and Keitt) intended almost exclusively for export. These plantations with four hundred to four

hundred and fifty mango trees per hectare, benefit from irrigation (drip), the trees are pruned, fertilizer and treatments. Yields can reach 30 tons per hectare. The owners of these plantations are large producers/traders who operate with labor and often are themselves exporters (ex: Safina).

3. RESULTS AND DISCUSSIONS

3.1-The types of orchards in Senegal

Results showed that there are different types of orchards: industrial orchards, orchards under control and village orchards that generally do not benefit from irrigation or maintenance.

These plantations belong to family farms in which there are also secondary crops: citrus fruits and legumes.

In this figure, we have represented the orchard types by zone and their area.

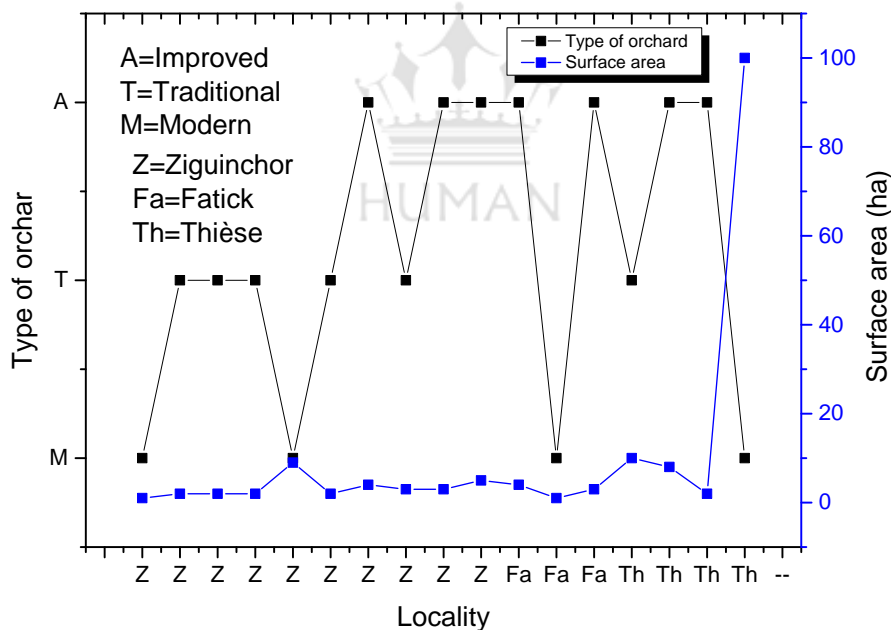


Figure No. 2: the orchard types by zone and their area in hectare

In the southern zone, this study shows a predominance of traditional orchards. With the intervention of export stakeholders (Saveurs du Sud), most traditional orchards are improved (5 ha on average).

There is a growing development of grafting techniques for varieties such as Kent and Keitt at the expense of local varieties.

In the central zone, the orchards present are improved or modern. In the Niayes area there is a strong presence of industrial orchards (fifty ha on average). Plantations close to hundreds or more are rare. In Senegal or Côte-d'Ivoire, they belong to exporters who use them to guarantee their supplies and to control the quality of the product. These orchards, irrigated in Senegal but little or not in Ivory Coast, are conducted intensively and they benefit from a technical supervision: mineral fertilizer, system of phytosanitary warnings with control of diseases and pests, etc. [5].

3.2-The most common varieties in Senegal

The popular and exported varieties are Kent and Keitt, although there are other interesting ones for export (Tommy Atkins, Zill, Palmer) and several local mango varieties (Diorou, Sierra-Leone, Papaya, BoukoDiékhal, Balanta, Passy, Thias, etc...).

Kent remains the most sought-after variety for its color and taste. More and more producers invest in plantations of this variety and / or renew existing orchards with the technique of over grafting [6].

In this Table No. 1, we have the most common varieties by zone.

Table No. 1: The mango varieties most present in an area.

Region	Variety								
	Kent	Keitt	Boukodiékhal	Sewe	Diourou	Papaye	Peche	Sierra-Leon	Thiass
Casamance	Green	Green	Black	White	Black	Black	White	Black	White
Fatick	Green	Green	Black	White	White	Black	White	Black	Black
Thiès	Green	Green	White	White	White	Black	White	Black	White

The colors in the columns show the presence of the mango variety in the locality and the absence of colors means that the variety is not present.

The improved varieties are present in all localities of the country. These varieties are the most popular for consumers and for export. Local varieties such as Papaya and Serra-Leon are also

present throughout the country, unlike the Diourou variety which is more exploited in the southern zone. Other local varieties also exist but are less popular. (Source: 2018 survey).

3.3- The types of farmers in Senegal

In this figure, we have represented the types of orchards and their surface.

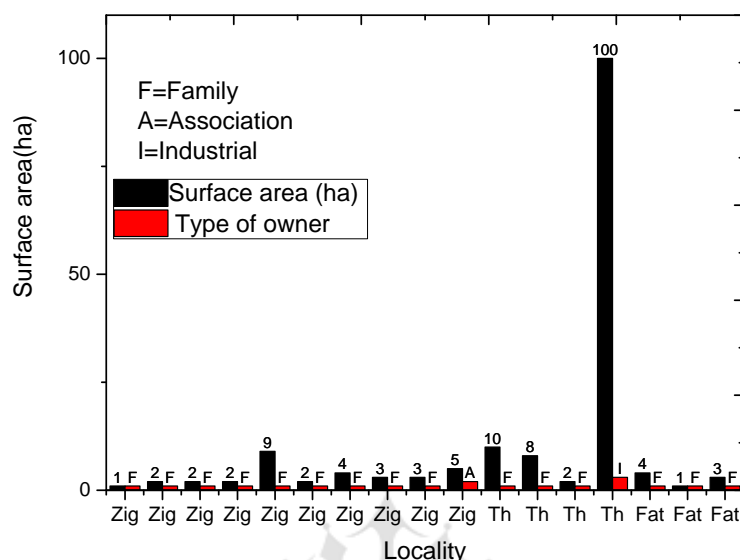


Figure No. 3: Area (ha) by type of owner

This survey shows that 98% of Senegalese orchards are family farms. Orchard surfaces are very variable (one to ten). However, orchards with industrial exploitation are gradually developing in the Niayes area with areas of up to hundred ha.

Industrial farmers have modern means and techniques for the maintenance of orchards (irrigation, input, a good system of cultivation, means for the fight against flies ...). In family farms, the areas depend on the means (fence, input, resources for the fight against flies ...) that the operator has. This is why there is a big difference in the size of these family farms.

Farms run by an association of people have a low presence in the country. For the different localities visited, only in the region of Ziguinchor, an associative exploitation A.P.A.D. (Association of Planters of Diouloulou District) was found. This association is also involved in the supply of plants, chemicals for pest management and fruit processing products.

3.4-Densities compared to the type of orchard

The distances recommended by studies at research stations have been adopted. Between eight m × eightm and twelve × twelve, they are usually ten m × ten m (hundred trees/ ha). However, other tree densities were more rarely observed during the assessment, ranging from forty-five up to five hundred and fifty trees per ha [1].

In this figure, we have represented the type of orchard relative to the number of Treesper hectare.

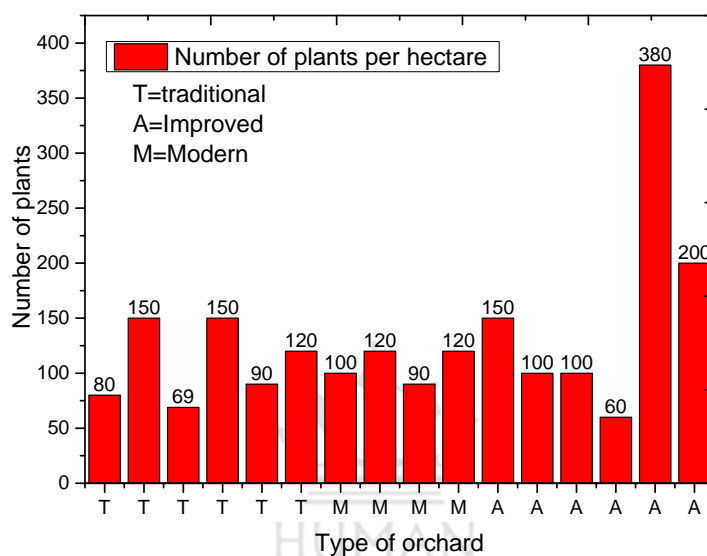


Figure No. 4: Number of trees in (ha) in relation to the type of orchard

Compared to the number of trees per hectare, this study shows that in traditional orchards and improved a great difference ranging from sixty strees per hectare up to one hundred and fifty strees per hectare.

On one hand, this difference in the number of plants per hectare in traditional and improved orchards is explained by a lack of training for family farmers, and on the other hand, it is explained by the replacement of local varieties by those intended for export and national marketing.

In modern orchards, the average number of plants per hectare is one hundred and twenty because industrial farmers have a mastery of good cropping systems. However, the number of plants per hectare remains a factor that influences the production yield according to this survey.

Densities versus yield in traditional and improved orchards

The average yield of an adult mango tree is about hundred kg per year [7].

In this figure, we have represented the influence of the number of trees per hectare and the type of orchard relative to yield.

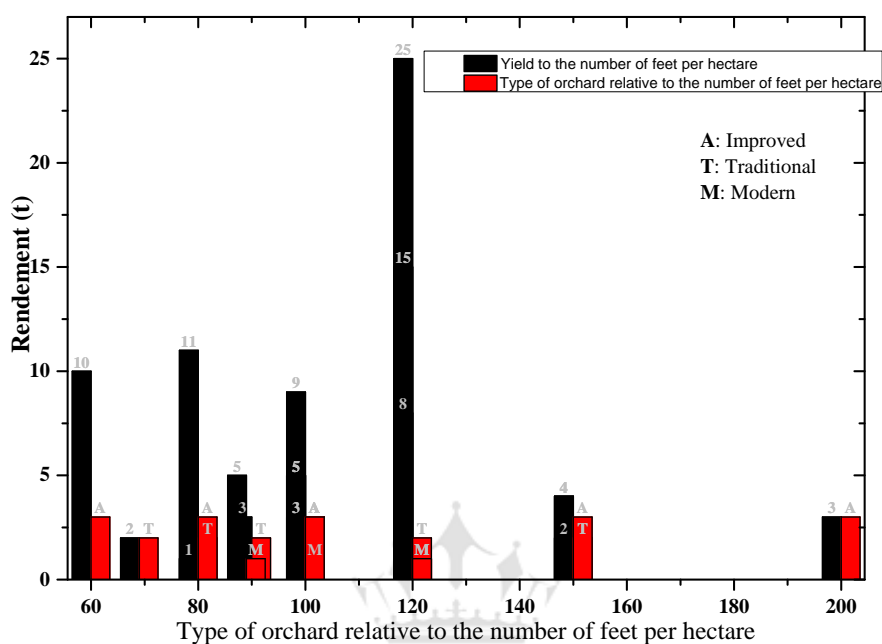


Figure No. 5: Number of feet per hectare and type of orchard versus yield.

In any tree farm, farmers always seek to maximize their yields. However, the yield depends on several parameters: the quality of the soil, the mastery of techniques and cropping systems, the means available to the farmer, the fight against the fly, etc... “A good mastery of production techniques can lead the orchards of Burkina Faso to reach 10t / ha ” [8].

Studies on this survey show the determining influence of the number of plants per hectare relative to yield. To study this parameter, this survey is based on the same types of orchards, the same types of farmers and the same varieties in the same locality. After studying this factor in the same locality, it is studied in different production areas.

Very high planting densities are the major defects of many orchards older than 10 years. In the absence of regular sizes and thinning, the foliage fits into each other. In this case, the young twigs are naturally pruned and the mango trees carry leaves and fruits only at their summit. Insects and diseases multiply thanks to a favorable microclimate. The few fruits

produced in the middle and low parts remain green and are often covered with sooty mold [9].

This study reveals that for a planting density lower than one hundred and twenty trees per ha, the yield in traditional orchards is two to four tons and for modern orchards is included between three to eleven tons.

The best yields are obtained in orchards with an average of hundred and twenty trees/ha: for traditional orchards up to fifteen t / ha and for modern orchards at twenty-five t / ha. For densities greater than hundred and thirty trees/ha and less than ninety trees/ha yields are low.

Considering a correct tree density during planting can help small producers to optimize their production efficiency.

4-The constraints linked to this exploitation

4.1-Orchard management

The constraints related to the management of orchards are very variable from one locality to another. However, in the southern zone, most operators have problems related to animal attacks, on orchards due to the lack of good fences. And if in the south, a naturally rainy region, producers do not face a water problem, it is quite the opposite in the regions of Thiès and Fatick. In these areas, the lack of water is a very limiting factor, especially during the early stages after planting.

4.2- Diseases

The establishment of an orchard in Senegal by smallholders requires a lot of patience, i.e. at the beginning of planting, producers lose many plants due to termites or rodents attacking the plants. For the plants in production, fruit flies remain the true producers' puzzles. Producers in the southern zone suffer the most, wintering sets in full production and this leads to a rapid proliferation of the fruit fly. So many losses are recorded by the producers. The annual loss of 20 to 30% of mango production can be estimated at hundreds of one thousand seven hundred and five dollars, according to the president of the federative cooperative of horticultural actors in Senegal [10].

4.3-The marketing

Producers are confronted with many constraints in marketing, among other things, we can mention a few:

- Difficult access to production areas (especially in Casamance) where insufficiency and/or poor track conditions and roads can affect the quality of the mango and increase the cost of product flow and transportation.
- Lack of knowledge of actual quantities of product sold. The use of random units of measurement, such as baskets, sacks or standing sales (package for orchard production), determines the sale and therefore the revenue on estimates and not the actual quantities of the products.
- Very low prices in Casamance due to the lack of competitors in marketing.

Table No. 2: Price of mango in Kilograms (kg) (Kent) for export (Source survey 2018)

Region	Ziguinchor	Fatick	Thiès
Price per Kg (USD)	0,256	0,512	0,767
Locality	Kaguitte	Fimla Yayeme	Keur Mbir

The south remains the region most affected by marketing constraints due to a lack of infrastructure, the lack of supervision of stakeholders in the sector, and instability in the region.

With a good accompaniment of the actors of the sector, the southern zone can ensure a good production of mangoes and increase the contribution of the sector to the socio-economic development in Senegal by contributing to the reduction of poverty with the creation of jobs.

5. CONCLUSION

Senegal occupies an important place in the mango sector in West Africa.

Geographically, the country has a favorable situation that allows to ship more than 95% of intercontinental exports to Europe and late in the season compared to mai competitors West Africans.

However, despite the potential and various support, the performance of the mango sector is limited. This study reveals that most of the actors in the sector are small producers who do not have the capacity to set up modern and productive orchards. The most common orchards are traditional, so that fruit production is periodically negligible. Good cultural practices are by far to be mastered: tree density, orchard monument and pest control.

While in some areas, producers control the market, this is still not the case for others.

To make the sector more dynamic, the State must set up initiatives to support small producers: training of staff on good practices, logistical support and organization in the marketing sector on the one hand and the involvement of all resource persons on the other.

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