The Horticultural Supply chain in the region of Thiès.

A Market study

MEYS Emerging Markets Research
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1. Introduction

1.1 National context

Senegal is a country in sub-Saharan Africa located in the far west on the Atlantic Ocean, with a Sudano-Sahelian climate: tropical in the south and semi-desert in the north. The country covers an area of 196,712 km^2, and shares its borders with Mauritania, Mali, Guinea, Guinea-Bissau and Gambia being an enclave. With its geographically strategic position, Dakar represents an important maritime hub for the sub-region, particularly for Mali but also for the Gambia, Mauritania and, to a certain extent, Burkina Faso. In terms of regional economic integration, Senegal is a member of the Economic Community of West African States (ECOWAS) and the West African Economic and Monetary Union (UEMOA). It is thus part of the West African free trade zone with the application of the common external tariff (TEC) vis-à-vis third countries and it shares a common currency, the CFA franc, with eight member states. Senegal remains one of the most politically stable countries in the sub-region, and even on the African continent. The Senegalese population, growing relatively high (2.9% per year), will number more than 18 million inhabitants in 2024, three-quarters of whom are aged 35 and under. In total, 58 percent of Senegalese live in rural areas. Nearly half of the Senegalese population lives below the poverty line, with a higher incidence in rural areas (57.1%) than in urban areas (41.2%). Administratively, Senegal is subdivided into 14 regions and 45 departments.

Senegal has relatively significant natural resources offering real potential for economic development, especially for the agro-sylvo-pastoral and fishing sector. Around 3.8 million hectares are cultivable. The average rainfall varies between more than 1000 mm in the south, and less than 300 mm in the north. Furthermore, the country is watered by relatively large rivers: i) the Senegal River: 1,770 km long and 337,000 km2 of watershed, ii) the Gambia River: 1,150 km long and 77,000 km2 of watershed, iii) the Casamance River: nearly 200 km long and 21,150 km2 of watershed, and iv) many other secondary watercourses: the Saloum and the Kayanga. These waterways, combined with a maritime coastline of approximately 700 km, offer significant possibilities for the development of agro-silvo-pastoral and fishing activities.

In Senegal, agriculture is essentially rainfed and seasonal, labour intensive, and dominated by family farming and the informal sector. The agricultural sector is traditionally based on both cash crops (groundnuts, cotton) and subsistence food crops (rice, millet, sorghum, corn). More recently, the production of fruits and vegetables with high added value (onions, mangoes, watermelons but also tomatoes and bananas) is increasing considerably thanks to the numerous comparative advantages of these products and the development support policies from which they benefit. However, Senegalese agriculture remains highly vulnerable to climate change due to its dependence on rainfall conditions and the availability of productive land. Thus, food and nutritional security, the fight against rural poverty and the promotion of sustainable agriculture continue to constitute pressing challenges in Senegal.

Since the colonial period, the eating habits of the Senegalese population, particularly urban ones, have evolved first with the introduction of imported broken rice into the diet and more recently with vegetables and fruits. Today, in almost the entire range of cooked rice dishes, vegetables are present in significant quantities.

1.2 Market operators

The profile of the horticultural farmer in Senegal is predominantly a small scale (subsistence) farmer. Ninety percent of all farmers in Senegal have a plot of one hectare or less. In the Niayes the farm plots are a little bigger. Approximately 89 percent of the horticultural farmers have a plot between 0.5 - 2 hectare. On average around twenty-four percent of the farmer's horticultural produce is for own consumption and seventy-three percent is sold.

In general, five categories of operators can be identified in the marketing of onions and other horticultural products in Senegal:

- *Producers*: Producers (farmers) are simply those who produce the onions. They are often individuals producing onions at fields located near their residence, but can also include larger commercial growers. Many producers also belong to producer organizations, which are often organized in economic groups known as "Groupement d'Interet Economique (GIE)" for the financing and the acquisition of inputs (e.g. seeds, fertilizers);

- *Coaxers (coxeurs)*: two types:
    - Rural coaxers: rural coaxers rely on their networks and understanding of local market dynamics to facilitate negotiations between buyers and producers who are looking to sell their onions. Specifically, rural coaxers are generally consignment agents who sell producers' onions on their behalf. In most such arrangements, rural coaxers are to turn over the full sale price received to the producer, and are then typically paid a fixed commission per unit sold. Some rural coaxers collect onions from farms/villages and sell in rural markets, but most operate only at rural markets waiting for producers to bring in their produce;
    - Urban coaxers: urban coaxers play a similar role as rural coaxers, rely on their networks and understanding of urban markets to facilitate negotiations between buyers in urban markets and sellers (usually producers or bana-banas). Urban coaxers are also generally consignment agents, that sell on behalf of another actor and receive a fixed commission per unit sold;

- *Bana-banas*: Bana-banas are itinerant traders that act as middlemen connecting upstream activity in rural areas and downstream activity predominantly in urban markets. They collect onions directly from producers at the farmgate or directly from producers or rural coaxers at rural markets. Occasionally, these transactions are pre-arranged by phone. Bana-banas leverage their market knowledge (of both rural and urban markets) and their network connections to perform spatial arbitrage, allowing them to capture part of the potential price surplus gained in moving onions between rural and urban markets. Bana-banas also often combine onions sourced from multiple producers to sell in larger quantities;

- *Wholesalers, semi-wholesalers and retailers*: Wholesalers (and other related actors) buy onions in urban markets and engage in last-mile distribution to retailers and/or consumers. Wholesalers often buy and sell in bulk, and play a role in the distribution of imported onions, such that they operate year-round (and not just during local production season).

In majority, small scale farmers sell directly at the outskirts of their farm plot to bana-banas. According to the baseline study carried out by MEYS and ENSA among 285 farmers in the Kayar area in October

2023, 79% of the farmers sell directly to bana-banas and only 7% to end consumers. That means most of the farmers don't receive direct information from consumers about their preferences, needs and prices they (want to) pay for the horticultural products. This lack of market knowledge and inability to store onions for better times, create a relatively weak bargaining position of farmers vis a vis traders.

The market place for the horticultural products of small scale farmers in the Niayes is primarily within their own administrative region or department. They hardly sell to other administrative regions in the country, let alone export. Also selling to the national food processing industry is solely attributed to large farms who can consistently deliver the same quality and quantities. Within the region the weekly and monthly markets in urban areas, like for example in Thiès, are the main destination for small farmers. Only a handful of large farmers are able to sell beyond their region and/or are involved in some export. The reason for this situation is manifold: lack of good produce, limited market knowledge, poor packaging, no (cold) storage facilities, lack of agricultural machinery & equipment, and limited access to formal financial capital. Also, most small scale farmers do not work together to create economies of scale. They only see each other as competitors. Farmers' cooperatives in horticulture in Senegal, who could play a pivotal role in such matters, is merely aimed at being a single point of contact for public organisations. There are exceptions like for example *RESOPP*, a union of rural cooperatives created in 2002 and approved in 2007 by the Ministry of Agriculture. Its headquarters and training center are located in Thiès. It is composed of 37 cooperatives, including a mutual savings and credit bank (COOPEC-RESOPP), spread over 8 regions of the country. RESOPP aims to defend the interests of its members, in particular by increasing their bargaining power and providing them with a significant gain in scale that allows them to buy inputs cheaper and better market their products.

The vast majority of horticultural farmers in Senegal are, therefore, not able to sell directly to consumers and/or going beyond the nearby rural and urban markets, thereby missing out on higher sales volume and higher profits that would result in increased income.

1.3 Current situation onion sector Senegal

The onion is key to Senegal's horticultural production. The Senegalese onion sector has seen a remarkable growth for more than a decade. With an average annual total production of 400 000 tons it's the leading market garden crop in the country, far ahead of potatoes (140 000 – 145 000 tons), sweet potatoes (70 000 tons), and cherry tomatoes(67 000 tons). Since 2012 the volume of local onion production has doubled. As a result of regulatory measures, such as introducing an import freeze during September and January, the area allocated to onion production has also increased considerably: it has doubled from 6 800 ha in 2012 to almost 14 000 ha in 2020. The most important areas of onion production are the Niayes and Senegal River Valley, accounting for around 80% of national onion production. Approximately three percent of the domestic onion production is exported.

Despite the steady growth of domestic onion production accompanied with public regulatory measures, the Senegalese market continue to be massively supplied from abroad. Imports - which dominate the national market six months a year - amount between 150 000 to 200 000 tons per year. The Netherlands counts for 80% of these imports.

Up till now the increased volumes of local produced onions have not changed the reality that the Senegalese consumer still prefers imported onions when they are available on the local market. This is due to a lower quality of the locally produced onions compared to imported onions, caused by a

number of agricultural, soil and climate factors such as depletion of nutrient reserves, increase of soil borne diseases due to lack of crop rotation and increased salinity. Also inefficient application of fertilizers (e.g. too much N in the beginning) results in watery onions that are not suitable for storage. The poorer quality of local onions doesn't allow for mid- and long term storage and need to be sold and consumed quickly. Up to 30% of the harvest is already lost before the onions can be sold on the market. Additionally, as the supply is very seasonal, the price of local onions plummets during the harvesting peak. This adds to the already vulnerable financial position of the vast majority of smallholder farmers.

2. Market study horticultural supply chain Thiès

To improve the quality and competitiveness of local produced onions, a Dutch Impact Cluster project was initiated in Kayar in September 2023. Kayar is a small village located in the Thiès region, southern Niayes. The Impact Cluster project is focussing on local farmers in the Kayar area by strengthening the local onion value chain through improved seeds, crop rotation, sustainable cultivation, harvesting, storage, transport and marketing. This is done by a cooperation between Dutch companies and Senegalese partners in transferring knowledge and expertise to farmers and investing in farm inputs (organic fertilizers, seeds, farm equipment, irrigation) and storage facilities.

The goal of the Impact Cluster is to improve the quality of the local produced onions and thereby making it more competitive towards imported onions. Such improved onions could also offer the opportunity to be stored properly after which they can be sold outside the traditional indirect sale channels and own regional market places. The central question is off course how can the (small scale) farmer do that ? Data to support the answer to this important question is currently not available. Focus of research on the horticultural sector in Senegal is primarily on how to increase production and overcoming production constraints.

Although onion is the main horticultural product in Senegal, most farmers cultivate - besides onions - also other crops like potatoes or carrots. The Baseline study already identified this type of production profile. Therefore, this market study will focus on the challenges and opportunities faced by the horticultural supply chain instead of only on onions.

An in-depth investigation into the possibilities for Senegalese horticultural (small) farmers to join forces, grasping economies of scale, selling directly to consumers and going outside their own local/regional/national market place is lacking. Simply put, the supply side of the agricultural economy has been thoroughly investigated in the last 10-15 years, but the demand side and marketing of horticultural products is more or less neglected. The present market study aims at filling this knowledge gap.

2.1 Research objective

The objective of this market study is to understand in more detail how to improve the income of horticultural farmers located in the region of Thiès by creating more value for its customers (buyers) and engage into durable customer relationships.

2.2 Research questions

To achieve the aforementioned study objective a central research question and several sub-questions were formulated by the research team:

Central research question: How can the horticultural farmer in the region of Thiès create value for its customers and build profitable customer relationships ?

Based on this central research the following sub-questions were formulated:

Sub-questions:

1) *What are the main marketing constraints for farmers of horticultural products in the region of Thiès ?*
2) *How does the current marketplace for horticultural products in the region of Thiès looks like ?*
3) *Who are the main buyers of horticultural products from farmers in the region of Thiès ?*
4) *Which marketing strategy must the horticultural farmer in the region of Thiès develop ?*
5) *What is the optimal marketing mix (4P's) of horticultural farmers* in the *region of Thiès* to deliver customer value ?
6) *Which type of organizational structure is most effective for horticultural farmers in the region of Thiès to create and capture customer value ?*

By answering the sub-questions through the collection of primary and secondary data the central research question can be answered and thereby achieving the overall objective of the study on the horticultural farmer located in the region of Thiès.

2.3 Research methodology of the study

Focus of this market study is on the horticultural farmer located in the administrative region of Thiès. This region extends over an area of 6 601 km^2, or 3.4% of the national territory, with an estimated population of 2.1 million people (12% of national). The region consist of three departments, namely Thiès (population 786 000 people), Mbour (787 000 people) and Tivaouane (532 000 people). The city of Thiès is the capital of the region and located in the department with the same name. With significant economic potential, combined with its relative close geographical position to Senegal's capital Dakar, the region of Thiès occupies second place, economically, after Dakar due to the dynamism of the sectors agriculture, fishing, tourism, industry, mining, handicraft and commerce. The region of Thiès occupies first place in terms of artisanal fishing (over 40% of national production) and delivers a third of national horticultural production.

To collect the necessary data for answering the aforementioned central research question, a narrower definition of the farmer and its produce was made. The group of farmers for this study was split in three types, depending on the size of the farm plot namely: small (<1 ha.), medium (1 – 5 ha.), and large (> 5 ha.). Besides plot size, the type of horticultural product cultivated is an additional selection criteria for this market study. The horticultural products selected were onion, potato, cabbage, tomato and carrots. These are the main crops cultivated in the region of Thiès. Thirdly, this research does not take into account non-agricultural households. According to a survey conducted by DAPSA in 2023[1], their contribution to horticultural production is relatively limited. Therefore, our focus was only on agricultural households active in horticultural production.

For collecting the necessary primary and secondary data to answer the central research question and sub-questions, the research team used the following research methodology:

Desk research

Collecting qualitative and quantitative secondary data on the horticultural sector in the region of Thiès from online and offline (inter)national sources like newspapers, magazines, databases, and research reports of reliable and objective sources like for example FAO, Intracen, ANSD, DAPSA, Ministry of Agriculture, ENSA, ANCAR, and ISRA.

[1] Rapport de l'Enquête sur les Exploitations Agricoles Hors Ménage (EAHM) 2021-2022, DAPSA, février 2023

Field research

In addition to secondary data, the research team collected detailed primary qualitative and quantitative data at the individual level of sellers (farmers) and buyers in the horticultural sector in the region of Thiès. In this research buyers of horticultural products were distinguished into two types: professional (wholesale, retail, bana-bana) and non-professional (individual consumer) buyer.

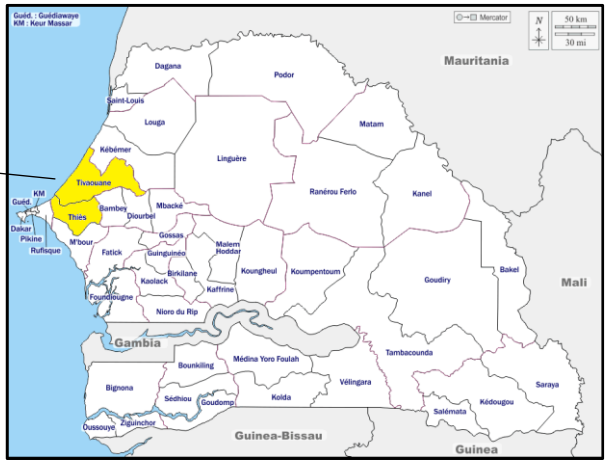
To collect the primary data a survey was carried out among 175 producers (horticultural farmers) and 230 different type of buyers using questionnaires with open and closed questions. There were three questionnaires created, one for producers, one for consumers, and one for traders. All three questionnaires were interviewer-completed face-to-face structured interviews. The interviewers were members of the research team and consisted of a total of 9 field workers. In total 405 net respondents were interviewed, and divided as follows among the 2 administrative departments[2] in the region of Thiès:

Type of buyer / Department	Producer	Buyer		Total
		Consumer	Traders	
Thiès	90	41	86	217
Tivaouane	85	30	73	188
Total	**175**	**71**	**159**	**405**

Note: number of net respondents

In Senegal farmers are not registered in the Commercial Trade Register. Therefore, to have a list with names of farmers from which a selection of 175 horticultural farmers could be made, the research team approached farmers' cooperatives active in the region of Thiès who have the names of all their members.

Study area



The method of selection used for the farmers was stratified random sampling, with the strata farmer cooperative, plot size and horticultural product. For selecting the buyers for the interviews, a non-random self-selection sampling technique was used. This technique allowed the interviewers to self-select respondents who are relevant for this research. Relevancy is defined as those traders who locally buy and sell onions, potatoes, cabbages, tomatoes or other horticultural products locally produced, and having a shop at the main marketplace for horticultural products in the region of Thiès.

[2] Due to the timeframe and available budget it was not possible to do surveys in the department of Mbour

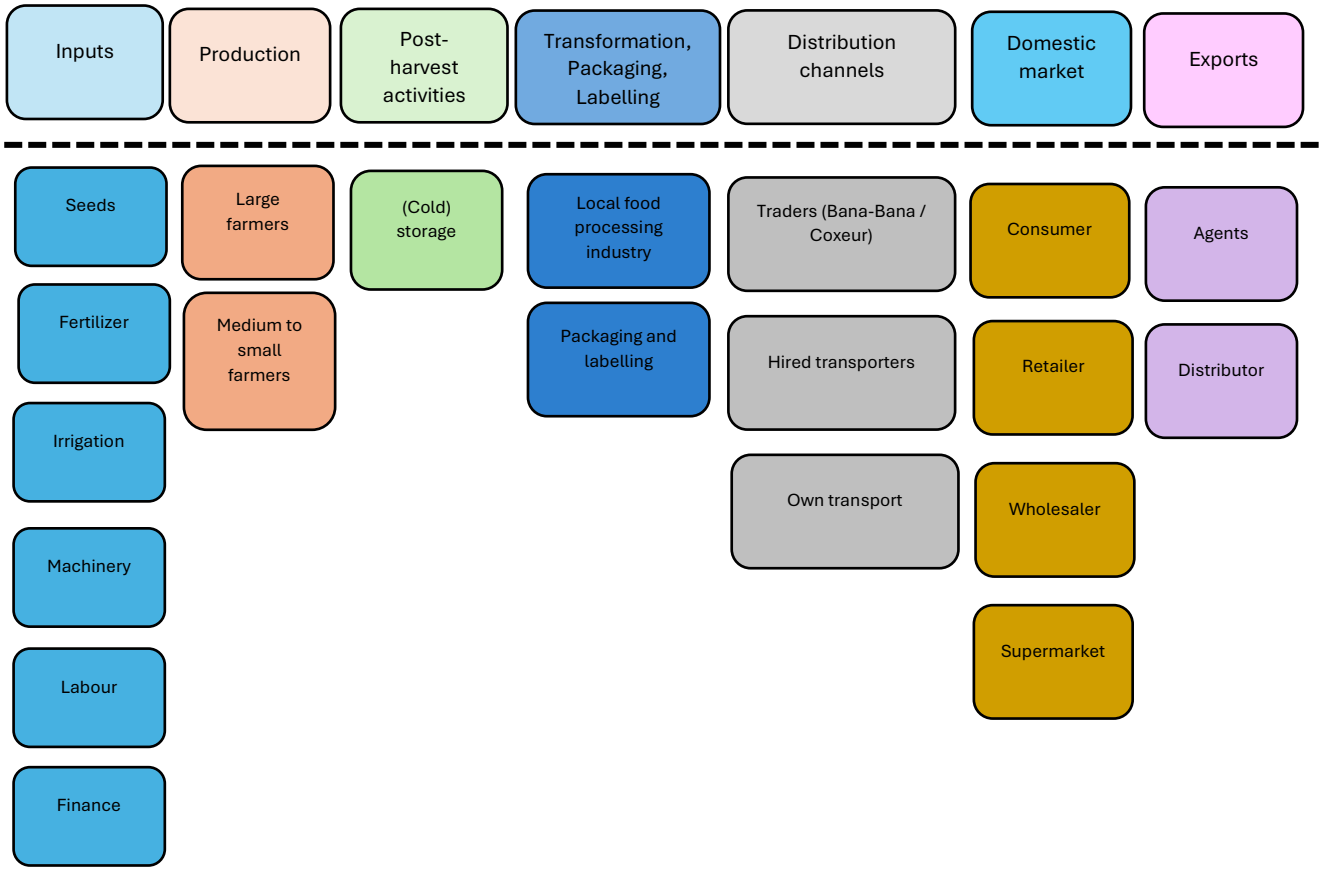
The number of respondents in the field research is in the opinion of the research team representative for the entire target population.

The research team used the online survey tool SurveyMonkey to collect and register the data from the interviews. Data collected was anonymous and was carried out during the period February 20 – 28, 2024. After collecting the primary and secondary data, a thorough analysis of this data was done by the research team and used for answering all research questions.

3. Horticultural Value Chain Senegal

With an added value estimated at 123 billion FCFA, the horticultural sector in Senegal plays a key role in the social and economic development of the country. The horticultural sector is characterized by different actors such as input suppliers, farmers, different intermediary actors such as traders (including bana-banas) or coaxers (brokers), as well as markets. Farmers are of different types, mainly depending on the size of their agricultural plot. There are a relatively small number of large farmers (10%) who have access to storage facilities and are able to sell directly to the local agribusiness industry, wholesalers, supermarkets and even export markets. Most farmers (90%) have small or medium-sized plots which are sold mainly to rural and urban traders.

The horticultural value chain in Senegal can be schematized as follows:

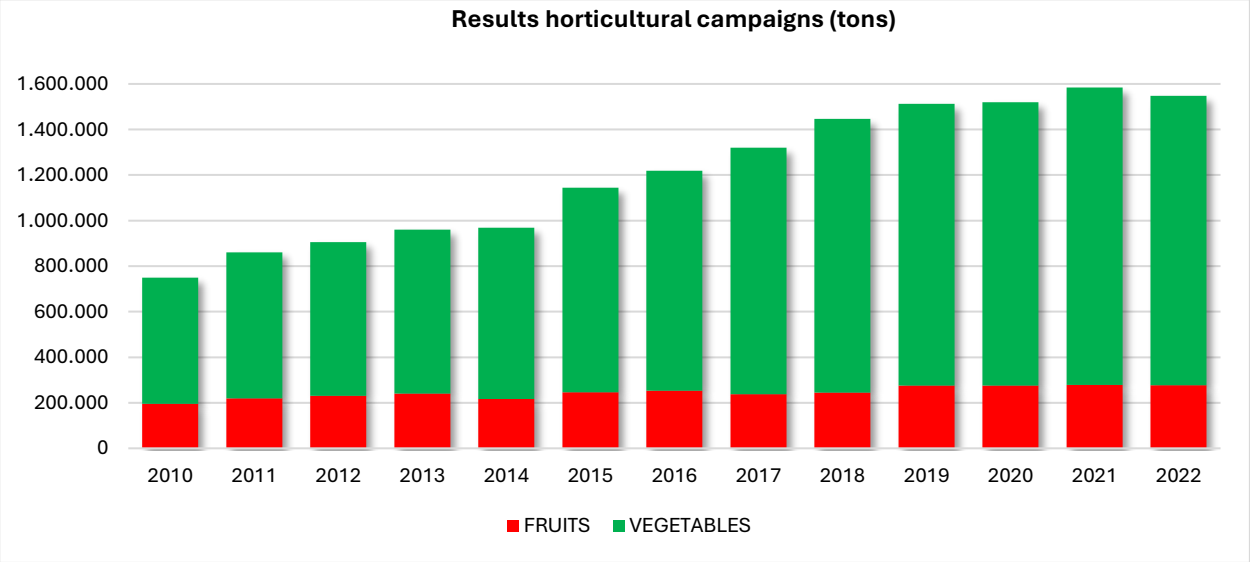


In the following paragraphs, an overview of the Senegalese horticultural sector is presented as well as the different actors and the roles they play in the value chain.

3.1 General overview of the Senegalese horticultural sector

With an average annual population growth of 2.9% over the past decade, demand for food is also growing rapidly. Market gardening sectors have developed to meet this growing demand for vegetables. Vegetable production increased almost thirty-fold between 1960 and 2023, going from 42 000 tonnes to 1.4 million tonnes. This development in production was favoured by several factors, notably the decline in rice production in the Senegal River valley with the problems of competitiveness compared to imported rice, the devaluation of the CFA francs in 1994 and the liberalization of the

peanut nut sector in 1997. The effect of these trends has led Senegal to embark for fifteen years on a policy of strong diversification and promotion of market gardening activity through state projects and (inter)national support programs.



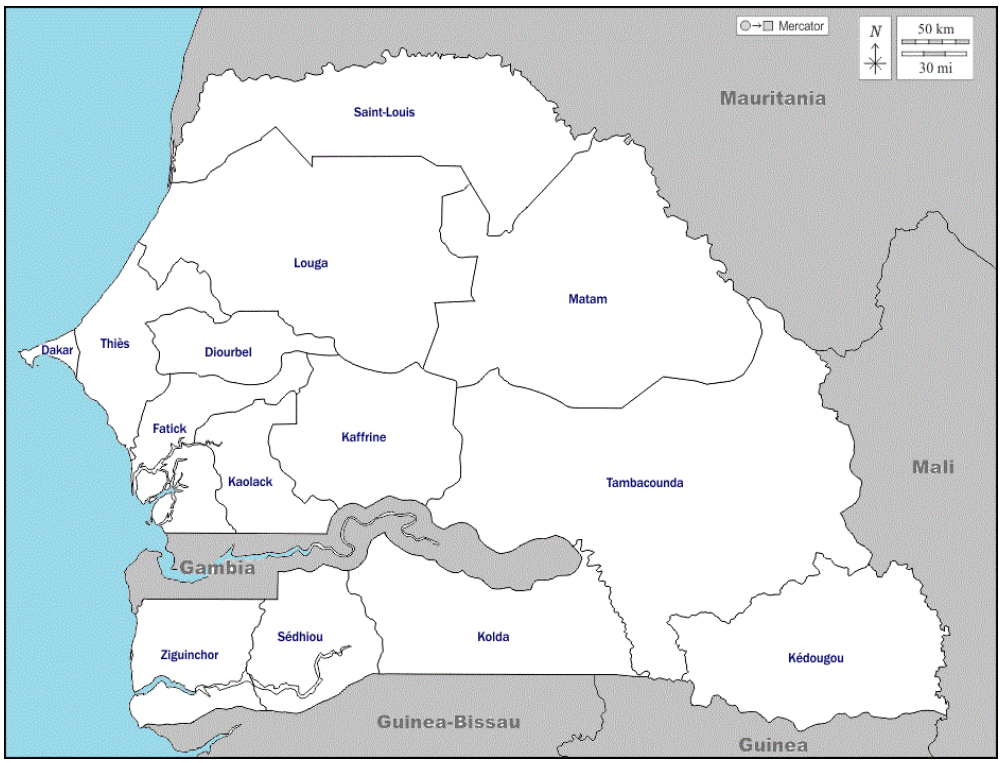
Source: ANSD

In the horticultural sector we can distinguish three types of farms, depending on the size and development of the plots:

- small farms (size < 1 ha), which are more individual or family farms, dominated by a strong diversification of crops, mainly intended for self-consumption and supplying local markets. Only at the urban and peri-urban level is production spread over the entire year;
- medium farms (size between 1-20 ha), alone provide 80% of the country's market gardening production and can be considered modern and semi-modern depending on their development, which provides tools to extract water for irrigation and employs hired labor. Crops are less diversified than at the small farm level, because production is mainly intended for the wholesale market and export. The main crops are onion, tomato, green beans, cabbage, eggplant, diakhatou[3], chili and pepper;
- modern farms (size > 20 ha) are concentrated in the Dakar region, in the Niayes (Pout, Mboro, Saint Louis) and in the Senegal River Vallee in the north. Their production consists mainly of export crops such as green beans, tomatoes, and melons, while surpluses are intended to supply local markets.

Horticultural farmers in Niayes, the main horticultural area, are mainly made up of men (91%), women only represent 9% of the population. Adults aged between 35 and 60 dominate with 48% of the horticultural population. Older-age farmers (60 years and over) represent 38%, while young people under 35 are poorly represented with 14% of horticultural farmers. This low representation of women and young people among farmers reflects the difficulties of access to land for these social categories. However, the population of young people and women active in horticulture is much larger.

[3] Local variety of the eggplant



Map of administrative regions of Senegal

In Senegal, the overwhelming majority of agricultural farms are family type: in fact, in 2019 (latest figures) there were only 3 862 non-household agricultural operations (EAHM) compared to more than 900 000 agricultural households, representing less than 1% of the total number of agricultural operations. At the national level, an EAHM operates on average 6.6 ha. However, there are disparities between regions. The highest average surface area per EAHM is found in the Kaffrine region with almost 15 ha, followed by Saint-Louis, Sédhiou and Kolda. The EAHMs in the regions of Fatick, Kédougou, Ziguinchor and Dakar operate less than 2.5 ha.

Horticulture constitutes one of the most effective components of the agricultural subsector. Indeed, fruit and vegetable production was estimated at 1.6 million tons in the 2022/2023 campaign, recording an increase of 0.7% compared to 2021/2022. Compared to the average of the last 5 years, production increased by 2.5%.

3.2 National vegetable production

Vegetable production in the 2022/2023 campaign increased by 0.4% compared to 2021/2022 to almost 1.3 million tons, and an increase of 2% compared to the average during the last 5 years. A result of the provision of quality inputs (seeds, fertilizers) as well as protective measures against imports of certain products for part of the year.

In the 2022/2023 campaign, onions remain the leading horticultural crop in Senegal with a production of 398 750 tons compared to 420 000 tons in 2021/2022, despite a drop of 5.1% compared to the 2021/2022 horticultural campaign and a decrease of 7% compared to the average of the last 5 years. Onion production remains insufficient to cover entirely domestic demand, due to high losses incurred during the marketing of the crop. As the marketing campaign only last six months in Senegal, the level of imports to fill this gap is still significant.

Potato production increased from 140 500 tons in 2021/2022 to 146 200 tons in the 2022/2023 campaign, an increase of 1.4% compared to 2022 and -2.5% compared to the average of last five years. This production allows national needs to be covered for 8 months in 2023, compared to 7 months in 2018. These results can be explained on the one hand by a significant increase in the quantities of subsidized seeds of up to 50%. On the other hand, the favourable climate for production during the months October to April (whole dry season) allows a spread of planting and good crop performance, as well as increased private interest in the potato value chain.

Results horticultural campaign[4] (tons)

Cultivation	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023p
Vegetables:							
Onion	400 000	434 112	444 871	412 305	435 000	420 000	398 750
Potato	118 783	140 000	158 875	147 985	143 640	140 500	142 500
Tomato industrial	70 000	77 000	73 048	65 850	88 350	84 000	85 500
Tomato cerise	68 000	71 000	78 396	69 560	66 700	67 000	67 600
Melon	28 000	24 532	26 632	24 850	25 308	25 500	26 650
Haricot vert	18 700	18 815	20 879	19 560	21 122	20 300	19 900
Cabbage	76 116	105 096	105 096	158 412	159 166	155 000	161 500
Gombo	14 500	14 000	22 115	23 112	21 250	21 500	22 300
Sweet potato	72 000	89 397	72 000	89 730	107 670	110 600	111 400
Carrot	16 000	17 085	17 875	22 300	30 000	28 500	30 500
Bissap	1 300	1 500	1 678	1 510	1 500	1 480	1 650
Other vegetables	200 000	209 751	215 875	208 960	205 000	195 500	206 500
Total vegetables	**1 083 399**	**1 202 288**	**1 237 340**	**1 244 134**	**1 304 706**	**1 269 880**	**1 274 750**
Fruit:							
Mango	132 000	128 450	130 000	121 000	122 905	121 500	123 200
Banana	30 000	31 422	33 110	36 500	35 500	36 000	37 500
Citrus	45 000	48 500	52 580	56 800	58 000	58 400	60 500
Other fruit products	30 000	35 700	59 750	61 350	62 550	61 500	62 100
Total fruit	**237 000**	**244 072**	**275 440**	**275 650**	**278 955**	**277 400**	**283 300**
Fruit & Vegetables	**1 320 399**	**1 446 360**	**1 512 780**	**1 519 784**	**1 583 661**	**1 547 280**	**1 558 050**

Source: ANSD, (p) date of 2022/2023 are preliminary

3.3 National fruit production

Fruit production experienced a slight increase of 2.1% in the 2022/2023 campaign compared to 2021/2022, and a growth of 4.8% compared to the average of the last five years. Despite the efforts made, production is faced with phytosanitary problems and the non-renewal of certain plantations (mangoes). Mango represents a significant part of fruit production. However, the performance of this sub-sector still falls short of expectations. It faces many problems linked to fruit flies which slow the expansion of the sector, but also poor market access and insufficient conservation infrastructure. As for citrus fruits, their production increased from 58 400 tonnes in 2022 to 60 500 tonnes in 2023, with strong growth of more than 10% compared to the average production over the last five years.

[4] October - June

3.4 Horticultural practices by region

The latest population census (RGPH 2023) counted 908 628 households with an agricultural activity in Senegal, or 45.6% of all households (1 991 012). Among the 14 administrative regions, the largest number (in absolute terms) of agricultural households is in the region of Thiès, followed by Dakar, Louga and Saint-Louis. The average size of an agricultural household in Senegal is made up of 11 people. In the Matam, Sedhiou and Tambacounda regions this number is higher (13 people) while the Ziguinchor region has relatively the smallest size of agricultural households in the country (8 people).

Distribution and average size of agricultural households by region (2023)

Region	Number of agricultural households	Average size
DAKAR	85 351	10
DIOURBEL	74 973	12
FATICK	64 144	11
KAFFRINE	58 613	12
KAOLACK	76 453	12
KEDOUGOU	15 892	10
KOLDA	63 967	12
LOUGA	85 236	10
MATAM	50 694	13
SAINT.LOUIS	84 095	10
SEDHIOU	34 455	13
TAMBACOUNDA	59 223	13
THIES	110 918	12
ZIGUINCHOR	44 614	8
TOTAL	**908 628**	**11**

Source: ANSD

With the exception of the Dakar region, rainfed agriculture dominates the activities of agricultural households across the country. Four out of five households are active in this type of cultivation. Livestock farming is also practiced by agricultural households almost equally, although this varies between raising a few chickens on the farm to commercial meat production on a large scale. Horticulture (market gardening, arboriculture) is practiced on average by around 10% of agricultural households in Senegal, but there are relatively large differences between regions. In Casamance (Ziguinchor, Sédhiou, Kolda), market gardening and arboriculture are a much more important activity than the national average. Also in the regions of Thiès and Fatick is market gardening above national average.

Distribution (%) of households according to the type of agricultural activity practiced, by region

REGION	Rainfed	Market gardening	Arboriculture	Cattle breeding	Forestry	Fish
DAKAR	8,4	2,1	5,2	85,6	0,8	1,4
ZIGUINCHOR	69,9	24,7	41,9	92,5	52,3	13,0
DIOURBEL	82,6	2,7	1,1	90,6	22,5	1,0
SAINT-LOUIS	37,9	9,0	2,4	83,2	18,9	6,2
TAMBACOUNDA	87,2	3,5	6,4	96,1	13,9	1,6
KAOLACK	85,8	10,1	10,7	96,8	30,4	3,2
THIES	68,4	10,1	6,7	96,8	25,8	3,0
LOUGA	71,6	5,5	6,1	97,0	15,2	0,8
FATICK	87,7	10,4	19,4	99,4	52,9	10,9
KOLDA	87,1	12,9	23,0	98,9	62,7	4,4

MATAM	69,3	4,1	0,4	88,6	8,7	3,3
KAFFRINE	93,5	4,9	4,0	98,7	63,6	1,3
KEDOUGOU	86,7	20,0	18,0	88,6	24,8	0,9
SEDHIOU	91,1	20,8	46,8	99,3	61,5	10,5
Total	**74,0**	**9,1**	**11,8**	**94,3**	**32,4**	**4,2**

Source: DAPSA EAA 2021-2022

National horticultural production comes mainly from three areas: Niayes, the Senegal River Valley and Casamance. The so-called Niayes zone concerns a coastal strip which extends from the suburbs of Dakar to that of Saint-Louis in the north. It constitutes a privileged space for market gardening which develops there in interdune basins. The speculations carried out differ depending on the distance from urban centers. Thus, if the north of the Niayes zone is known for the production of onions and tomatoes, the south, closer to Dakar, is experiencing a diversification of speculations with in particular the practice of more quickly perishable products (potatoes, eggplants, cabbage, carrot). In the Senegal River Valley, horticultural crops have developed more recently, following the low profitability of rice and its marketing difficulties. In the southern regions of Casamance (Ziguinchor, Sédhiou, Kolda), fruit bearing trees dominate horticultural production, notably mangoes and cashew nuts.

3.5 Seasonal market gardening activities

In Senegal, the agricultural calendar is essentially rainfed and seasonal. But market gardening activities take place following two specific periods, the hot dry season which begins in April and ends in June and the cold dry season which is from October to March. Cold dry season market gardening mobilizes a large number of horticultural households in Senegal, more than fifty-three thousand. The most cultivated crops during this season are onion (40.1%), pepper (35.5%), bitter eggplant (28.4%), cabbage (27.2%) and sweet eggplant (26.3%). It is in the regions of Thiès, Saint-Louis and Ziguinchor that we find the greatest number of households practicing market gardening during the cold off-season.

Distribution of households practicing market gardening during the cold dry season

REGION	Oignon	Aubergine amère	Aubergine douce	Chou	Pomme de terre	Gombo	Piment	Fraise	Melon	Pastèque	Navet	Concombre	Laitue/Salade	Autres
DAKAR	812	706	660	847	205	445	894	79	129	176	766	626	670	575
ZIGUINCHOR	2 255	2 116	1 584	1 416	275	2 198	2 442	38	77	96	639	731	1 467	911
DIOURBEL	204	135	127	178	24	71	204	9	25	55	103	52	162	50
SAINT-LOUIS	3 652	1 417	1 624	1 949	118	1 545	1 502	49	610	716	998	758	937	737
TAMBA	673	508	533	653	193	634	758	29	107	136	300	307	655	162
KAOLACK	752	486	482	534	67	414	660	32	94	133	254	211	553	117
THIES	4 490	2 707	2 876	3 460	1 235	1 802	3 531	69	284	459	2 070	1 564	1 237	914
LOUGA	1 035	436	411	667	258	105	619	13	70	166	741	201	358	152
FATICK	2 338	1 700	1 634	1 169	111	1 347	2 240	42	89	242	390	327	1 079	536
KOLDA	810	979	839	513	191	1 607	1 544	24	49	85	124	463	470	407
MATAM	963	796	776	1 018	194	744	869	74	154	247	727	191	871	197
KAFFRINE	227	296	290	218	32	308	449	34	25	69	190	87	233	156
KEDOUGOU	667	623	517	578	94	662	546	8	33	14	115	113	462	120
SEDHIOU	2 373	2 129	1 574	1 195	234	2 573	2 576	66	122	183	298	648	987	479
SENEGAL	21 251	15 034	13 927	14 395	3 231	14 455	18 834	566	1 868	2 777	7 715	6 279	10 141	5 513
ENSEMBLE (%)	40,1	28,4	26,3	27,2	6,1	27,3	35,5	1,1	3,5	5,2	14,6	11,8	19,1	10,4

Source : ANSD RGPHAE 2013

On the other hand, there are around thirty thousand agricultural households who practice market gardening in the hot dry season. And just like the cold dry season, onion (38.3%) and pepper (37.3%) are the most widely grown crops by significant percentages of market gardening households. In order

of importance: tomato (36.5%), eggplant (28.9%), okra (27.5%), and cabbage (26 .3%). The regions with most market gardening activities during the hot dry season are Thiès and Saint-Louis.

Distribution of households practicing market gardening during the hot dry season

REGION	Oignon	Aubergine amère	Aubergine	Chou	Gombo	Piment	Fraise	Melon	Pastèque	Tomate	Carotte	Navet	Concombre	Laitue/Salade	Autres
DAKAR	625	556	504	685	343	659	56	100	131	714	470	589	504	490	491
ZIGUINCHOR	1426	1375	1178	838	1352	1566	67	38	45	1494	403	437	418	866	603
DIOURBEL	105	62	84	60	29	124	2	15	25	107	34	55	26	113	25
SAINT-LOUIS	1441	583	675	740	650	682	27	307	328	979	357	439	365	348	382
TAMBACOUNDA	319	190	202	262	260	377	10	40	48	349	145	131	125	304	76
KAOLACK	292	249	253	247	218	298	14	49	47	331	131	143	95	269	98
THIES	2676	1877	1868	2350	1204	2407	72	192	320	2427	1408	1507	1229	840	734
LOUGA	704	304	271	501	94	318	9	47	53	431	458	338	136	170	65
FATICK	1270	976	938	669	729	1284	32	43	95	1147	171	219	182	536	390
KOLDA	558	695	553	372	1188	1126	18	35	46	852	138	49	322	224	274
MATAM	150	100	121	150	119	151	19	40	30	154	90	111	28	116	42
KAFFRINE	128	156	210	98	168	262	21	41	23	156	56	147	52	143	112
KEDOUGOU	124	134	91	123	165	105	1	11	6	107	93	23	41	99	35
SEDHIOU	1621	1369	1098	755	1673	1757	58	62	83	1640	328	228	334	625	327
SENEGAL	11439	8626	8046	7850	8192	11116	406	1020	1280	10888	4282	4416	3857	5143	3654
ENSEMBLE (%)	38,3	28,9	27,0	26,3	27,5	37,3	1,4	3,4	4,3	36,5	14,4	14,8	12,9	17,2	12,2

Source : ANSD RGPHAE 2013

3.6 Arboriculture

In Senegal, out of 908 628 agricultural households, 12.4% are practising arboriculture. The types of fruit crops most cultivated are mango and cashew nut, followed by citrus (orange, lemon, mandarin, etc.).

Proportion of households with fruit production	
REGION	**Fruit growing**
DAKAR	1,0%
ZIGUINCHOR	40,0%
DIOURBEL	1,5%
SAINT-LOUIS	4,4%
TAMBACOUNDA	5,9%
KAOLACK	8,3%
THIES	14,3%
LOUGA	5,5%
FATICK	23,3%
KOLDA	26,0%
MATAM	0,2%
KAFFRINE	1,9%
KEDOUGOU	24,2%
SEDHIOU	51,8%
Total	**12,4%**

Source: DAPSA EEA 2022-2023

At the national level, the cultivation of mango is widespread, with the exception of the Louga and Matam regions. Mango cultivation is largely practiced by households in the regions of Kédougou,

Kaffrine and Kaolack. Cashew nut cultivation exceeds 50% in the Sedhiou, Kolda, and Fatick regions. For citrus growing, the regions where households practice it the most are Ziguinchor, Dakar, and Louga. It is less practiced by households in the regions of Kédougou, Kolda, Tambacounda, and Fatick.

Proportion of households according to fruit crops grown						
	Mango	**Cashew nut**	**Citron**	**Orange**	**Papaya**	**Other citrus fruits**
DAKAR	69%	0%	98%	1%	1%	2%
ZIGUINCHOR	34%	33%	24%	43%	1%	5%
DIOURBEL	46%	0%	75%	0%	2%	0%
SAINT-LOUIS	81%	22%	76%	0%	0%	0%
TAMBACOUNDA	93%	2%	5%	0%	19%	5%
KAOLACK	99%	5%	29%	0%	17%	0%
THIES	87%	27%	18%	0%	0%	0%
LOUGA	0%	2%	98%	9%	2%	1%
FATICK	37%	69%	2%	0%	2%	2%
KOLDA	40%	81%	5%	3%	1%	0%
MATAM	0%	0%	56%	0%	88%	0%
KAFFRINE	100%	0%	35%	0%	35%	0%
KEDOUGOU	99%	1%	17%	14%	10%	0%
SEDHIOU	37%	91%	10%	4%	0%	1%
Total	**50%**	**49%**	**20%**	**10%**	**3%**	**2%**

Source: DAPSA EEA 2022-2023

3.7 Marketing of horticultural products

The marketing of horticultural crops can be divided between sales on the local market and foreign (export(markets.

1) Marketing players in the local market

The direct actors in the local market place concern producers (farmers), bana-banas, wholesalers and retailers:

- Producers are the first link in the supply chain. They carry out the production function by combining various production factors. They are of different types and adopt diversification strategies with a view in reducing the uncertainty linked to crop production and sales;
- Bana-banas are itinerant traders responsible for collecting and transporting horticultural products to wholesale markets. There are three types of bana-banas in Senegal:
  - The bana-banas collectors (type 1) who crisscross the production areas, traveling to individual farms to buy products directly from the producers;
  - Bana-banas (type 2) which obtain their supplies from rural markets;
  - The Bana-banas (type 3) that are at the same time producers, established in the production zones. This dual function allows them to acquire specific knowledge facilitating their commercial partnerships and collaboration with certain producers to whom they provide seeds and fertilizers on credit;
- Semi-wholesalers or wholesalers, who provide a classic function of grouping horticultural products at the level of urban wholesale markets. They are regularly installed at these markets and ensure the connections between bana-banas and retailers;
- Retailers are traders who sell in bulk or sometimes by the kg at the request of customers in the market. They source their supplies from semi-wholesalers and wholesalers. Some retailers obtain facilities from coaxer who give them the products on credit.

The indirect actors involved in marketing are the transporters and the coaxer:

- Transporters are service providers responsible for transferring crops from production areas to collection or consumption areas. We distinguish :
  - Primary transporters who operate in the most isolated areas and ensure the transportation of crops from the field to collection markets;
  - Secondary transporters who provide the link between collection markets and urban markets. The means used are 20, 30 and 35 ton trucks. The transport of products is generally done in bulk or in bags without respecting quality and safety standards;
- The coaxer (coxeur). We distinguish, according to their place of intervention, between rural and urban coaxer:
  - Rural coaxer, located at rural markets, receive the harvests from farmers and are responsible for marketing for a fixed commission per bag;
  - Urban coaxer, who are in the wholesale markets, are responsible for receiving the product, finding buyers and negotiating prices for the bana-banas or for the producers.

2) Export circuits

A distinction can be made between international trade with Europe (which is the main destination for horticultural crop exports) and regional trade (West Africa):

Export channels to Europe: the players identified in the export channels to Europe are:

- Producer Organizations (PO): they carry out the functions of production, collection, packaging and delivery of the product. The POs are market gardening unions mostly located in the Niayes, Senegal River Valley and Casamance;
- Private horticultural companies with the financial and material resources necessary for (large scale) production. They also have packaging centers and logistics and transport means to transport the product to wholesalers or purchasing centers;
- Shippers/Exporters: these are operators responsible for marketing the product to Europe. They have a network of customers in European markets. They are looking for quality products to facilitate sales in these foreign markets;
- Wholesalers and purchasing centers: they provide the function of grouping the product before its marketing to retailers or large medium-sized stores (GMS);
- Retailers or Large Medium Stores (GMS): they obtain their supplies directly from wholesalers or purchasing centers.

The export channel shows that the distribution of the product can be done directly with wholesalers or purchasing centers or through agents (shippers, representatives). To access the European market, POs can use the services of an intermediary. They must, however, pay for issues related to the quality and packaging of the product (e.g. organic labelling).

Export circuits to the sub-region: export circuits to the sub-region (e.g. West Africa) involve the following actors:

- Producers: these are producers who operate areas of more than one hectare. They often group production in rural parks while awaiting shipment to wholesalers or importing traders;
- Wholesale exporters: they are mainly located at the Diaobé market in the Kolda region. These wholesalers act as relays between large producer farmers and importing traders from neighbouring countries such as the Gambia;
- Commission agents: they carry out the functions of collection and centralization/consolidation of the product at the rural market level. They are often located in the main collection areas such as Rao, Gouye Renne and Potou in Niayes and Thillé Boubacar, Boubé in the Valley;

- Import traders: these are operators who obtain their supplies from exporting wholesalers or through commission agents in rural markets. They come in groups to the collection markets to get supplies;
- Retailers: They source their supplies from importing traders and sell to retail in rural and urban markets.

The export of horticultural products is most often reserved for farmers with more than one hectare planted, and who can guarantee the same quantity and quality to their foreign buyers each year. However, the sale is often made indirectly through a commission agent or a wholesaler. So to access the sub-regional market, producers from Niayes and the Senegal River valley normally go through a wholesaler or commission agent depending on the targeted country.

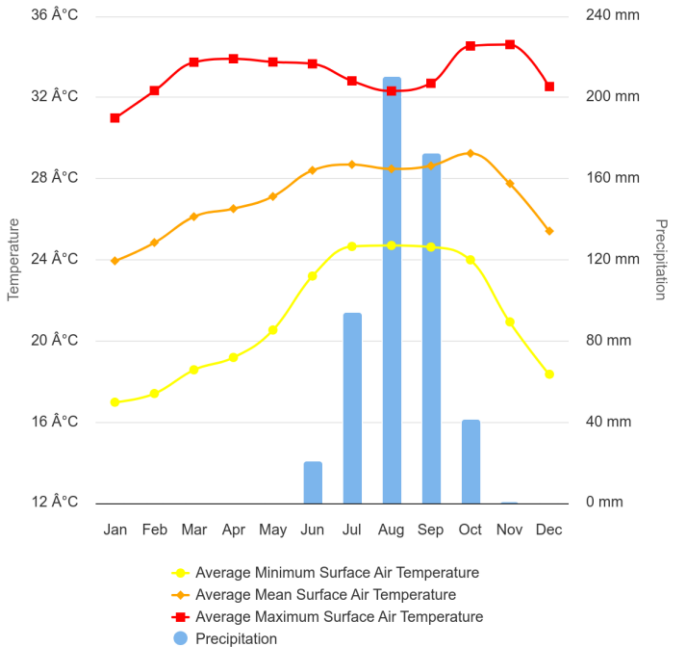
4. Field research findings

While the supply side of Senegal's agricultural economy has been extensively researched, the demand side and marketing of horticultural products have received far less attention. Especially at the sub-regional level. Recognising this crucial research gap, MEYS undertook a market study to fill this gap in knowledge.

The market study focused on 3 different actors in the onion value chain:
- Farmers
- Traders
- Consumers

The market study was carried out in the administrative region of Thiès. This region is considered as the leading market gardening region in Senegal. On average, it accounts for almost a third of the national horticultural area exploited, representing a third of national production. Horticultural production, especially vegetable production, is also an activity that generates much employment and income for farmers.

Average temperature and precipitation
1991 – 2020 region of Thiès



Source: World Bank

As noted earlier, the horticultural season in Thiès is divided into two seasons: cold dry season and the hot dry season. Normally the cold dry season starts at the end of September/beginning of October, although rainfall is still possible during this period, and runs until the end of March the following year. The hot dry season is from the end of March until the end of June/early July. Due to climate change the start and the end of the rainy season is becoming more unpredictable, impacting the period of sowing and harvesting of crops.

4.1 Farmers

4.1.1 Profile of the farmer

The personal profile of the average farmer in the region of Thiès, is that the vast majority are male[5], age 25 to 45 years, and owner of a farm plot. Only 4% of the farmers in Thiès are younger than 25 years. Becoming a farmer is for many young people in the region not a choice that is automatically made.

Figure 1

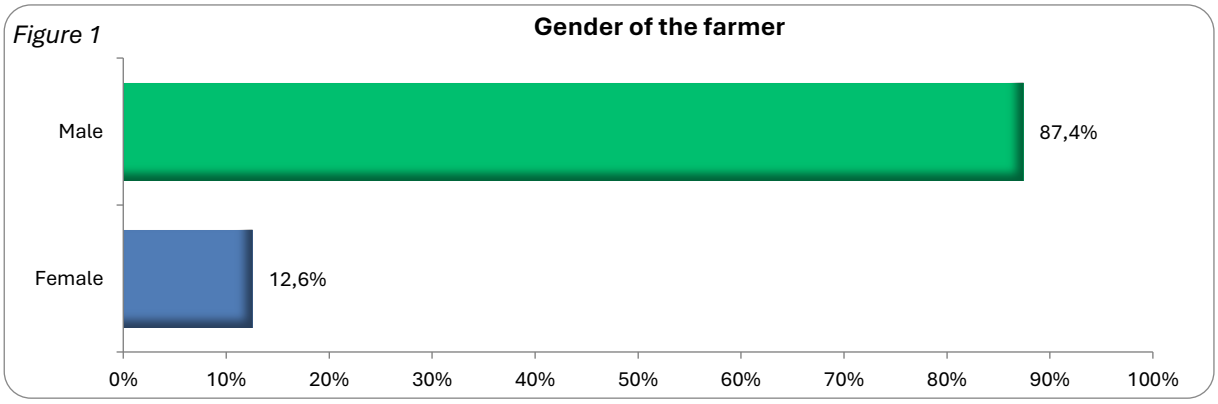


Figure 2

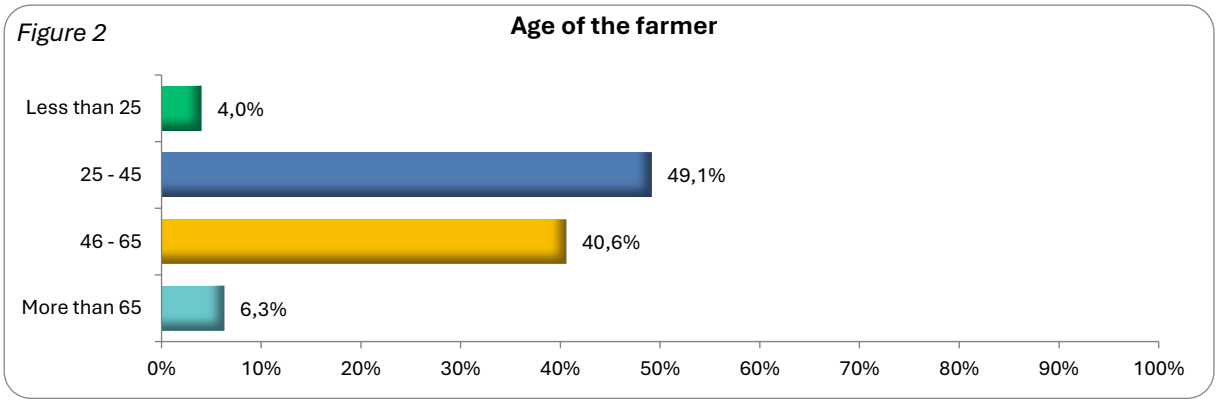
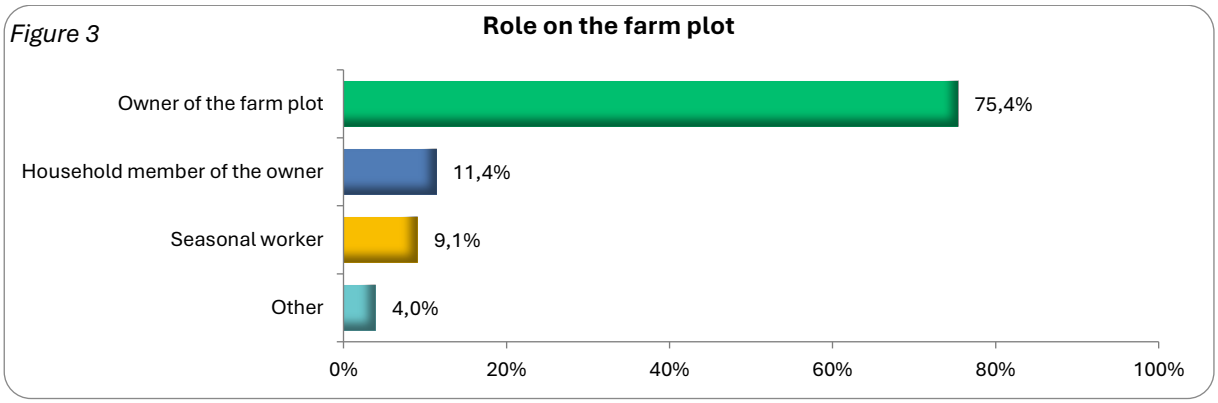


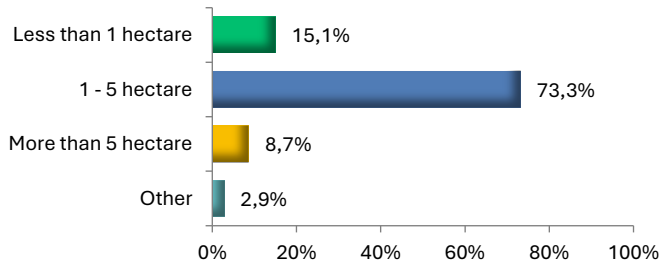
Figure 3



The farm plots cultivated in the region of Thiès are relatively small. Three-quarters of the plots have a size between one and five hectares. Less than 10% of the farmers have a plot larger than five hectares. This is a situation seen in many other horticultural regions in Senegal as well.

[5] The gender difference in ownership of farm land corresponds with that of the agricultural sector in general (Source: Les exploitations agricoles de type familial au Sénégal. Mise en application avec les données de l'Enquête Agricole Annuelle, DAPSA, Juillet 2021).

Figure 4

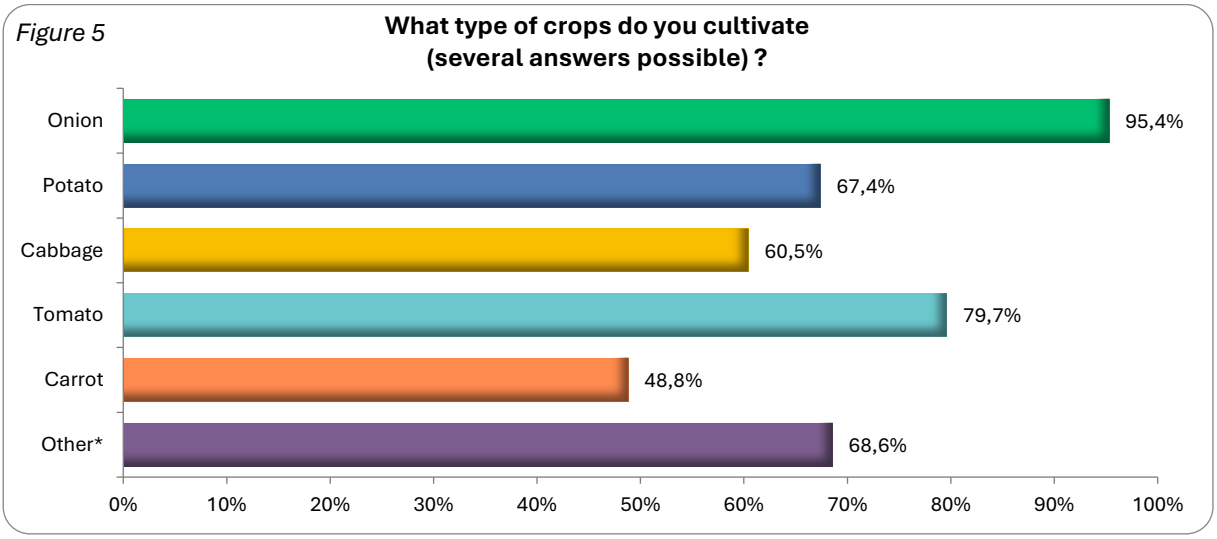


Farm plots are in general relatively quite small in the region of Thiès

4.1.2 Crop production

As part of the fertile coastal area Niyaes, the region of Thiès is known for the cultivation of a wide range of horticultural crops. The most important market gardening crop cultivated is onion, followed by tomato, potato and cabbage. Tomatoes produced in this area are for direct consumption, and not for selling to the tomato processing industry. Those type of tomatoes are grown in the north of the country, in the region of Saint-Louis. Also pepper and aubergine are cultivated on a relatively large scale in the region of Thiès.

Figure 5



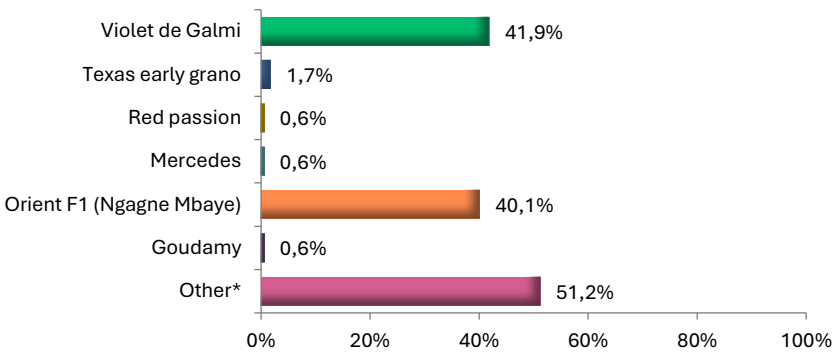
Note: (*) mainly pepper and aubergine

The most common onion varieties cultivated in the region of Thiès are Violet de Galmi and Orient F1 (Ngagne Mbaye). The main reasons why farmers choose for these onion varieties are that they are best adapted to the local climate, offer a relatively good yield, and the availability of onion seeds in the area. Almost all (97%) farmers buy these seeds from local suppliers (retailers, wholesalers). Only a very small number of owners (6%) receive a subsidy for purchasing onion seeds.

Thirty-one companies that are producing horticultural seeds are present in the region of Thiès. The dominant seed supplier is Technisem which produces almost 50% of the seeds recorded in the region. It is followed by Monarch Seeds (10.1%), and Green Seeds (9.0%). The companies Bejo, Eastwest Seeds International, ENZA Seeds, Green Senegal, Neuman Seeds, Sais, Syngenta and Unigen Seeds are to a lesser extent present in the region of Thiès. The seeds are distributed by several suppliers in the region. The most prominent distributor is Tropicasem which supplies 48.4% of the local traders

with seeds, followed by Traoré et fils (29%), SPIA (16.1%), Les Producteurs (16.1%), Niayes Sarraut (16.1%), ARYSTA life science (6.5%), Brising (6 .5%), and Vikima (6.5%).[6]

Figure 6

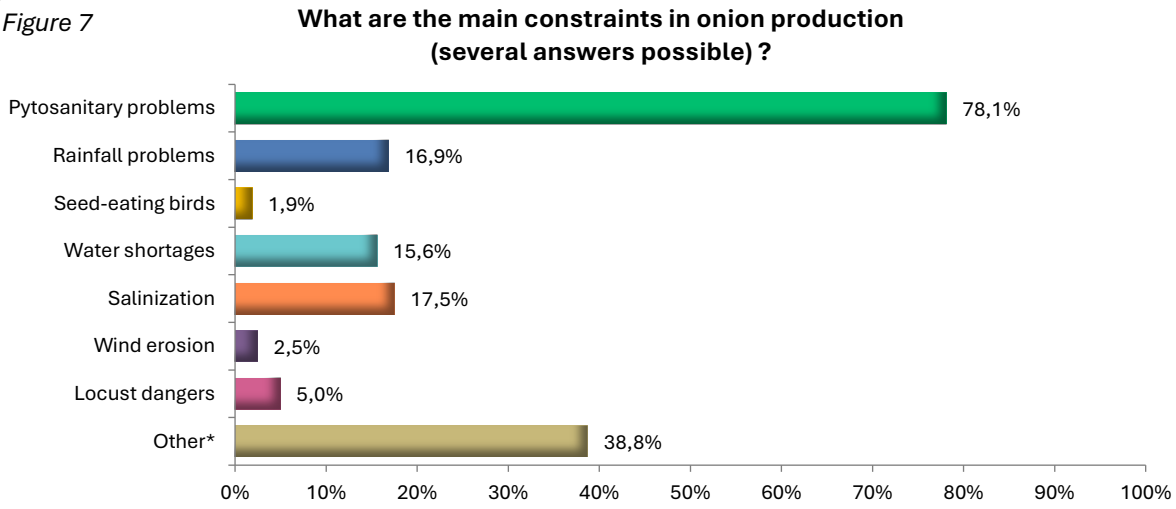


Note: (*) mainly Takahe F1 and Quartz F1

Violet de Galmi dominant onion variety in region of Thiès

During the last decade onion production in Senegal, and also in the region of Thiès, increased considerably. Despite this success, 93% of the farmers in the region experience constraints in the production of onions. The most common production constraint are phytosanitary problems followed by salinization and problems with (enough) rainfall. The latter causes, among others, lack of sufficient water to irrigate the farm plot. Climate change also raises another water issue, namely the unpredictability of the start and end of the rainy season.

Figure 7

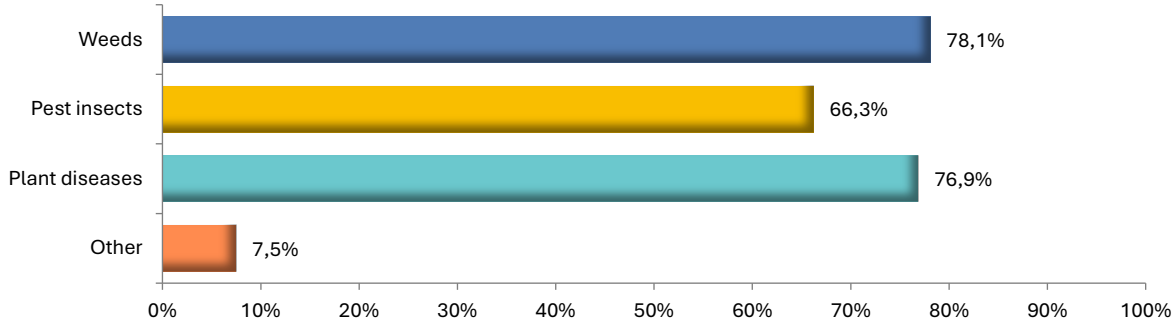


Note: (*) mainly insufficient water for irrigation, presence of iron

The phytosanitary problems that are most common at the farm level in the region of Thiès are weeds, plant diseases (e.g. mildew) and pest insects like locusts.

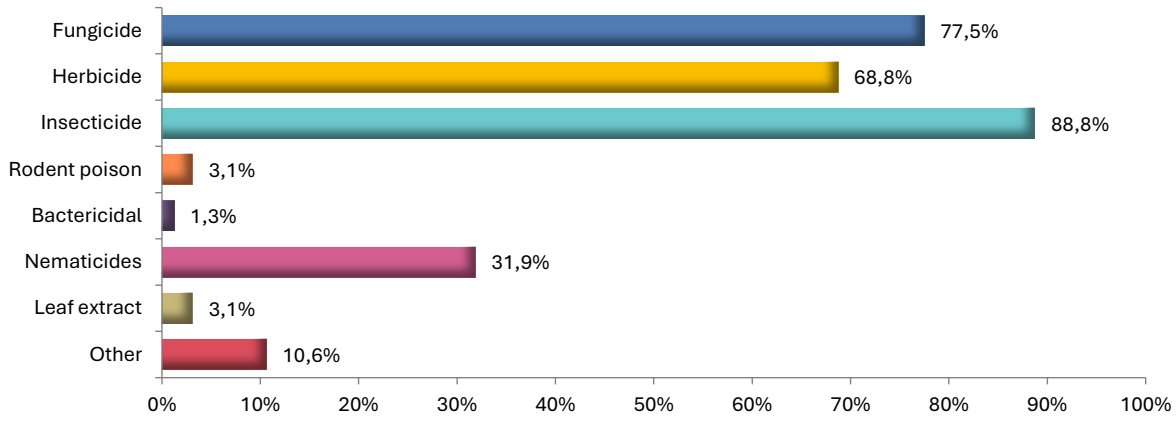
[6] Production et Commercialisation des semences horticoles dans les régions de Thiès, Diourbel et Fatick, Rosella Giunta et al., PAPSEN

Figure 8 **At the farm level, what are the phytosanitary problems that concern you the most for onions (several answers possible) ?**



All farmers use synthetic chemicals such as insecticides, fungicides, and herbicides to counteract the phytosanitary problems. They buy these products in cash.

Figure 9 **To protect your crops from weeds, rodents, insects or fungi, what type of plant protection products do you use (several answers possible) ?**

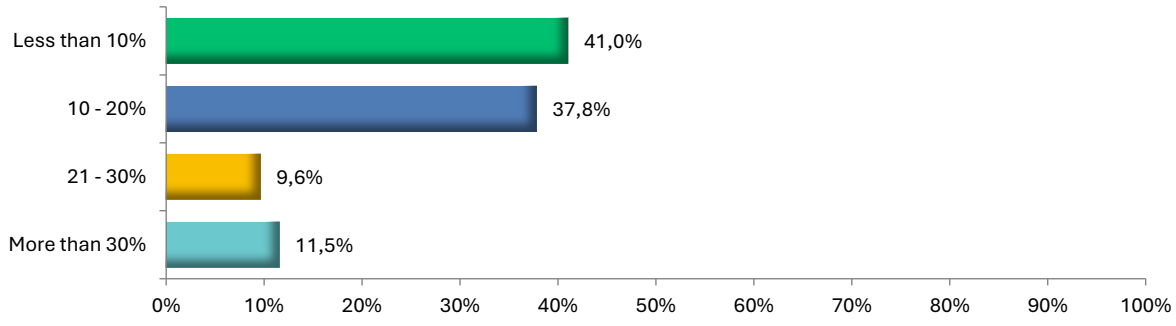


The vast majority (94%) of farmers in the region of Thiès, who are cultivating onions, harvest only once a year. The main onion season in this region is the cold dry season, that runs from the end of September to the end of March. The sowing period depends on the onion variety: early season sowing starts in October with onion varieties like Violet de Galmi, Texas early grano, Noflaye, Goldor, F1 Gandiol, Orient F1, Red passion, Goudamy; the main season starts in November/December with onion varieties Violet de Galmi, Texas early grano, Noflaye, Goldor, Gandiol F1, Orient F1 (Ngagne Mbaye), Red passion, Goudamy, Mercedes, Safari; and late season sowing starts in January/February with varieties like Red créole, Yaakar, Rouge d'Amposta (Saune San), Jaune espagnol, Gao, Violet de Galmi, Orient F1, and Gandiol F1. The harvest of onions takes place during the import freeze on onions, which has been implemented by the Senegalese government to protect local farmers from massive foreign imports.[7]

The various problems with onion production results in harvest losses. Ninety percent of the farmers are confronted with harvest losses. For more than twenty percent of the onion farmers these losses can run up to 20% or more, impacting directly the farmer's household income.

[7] The usual period for the import freeze on onions, especially from the Netherlands as the largest supplier, runs from January to August, although this period is sometimes altered by the Senegalese government when domestic onion production lags behind domestic demand.

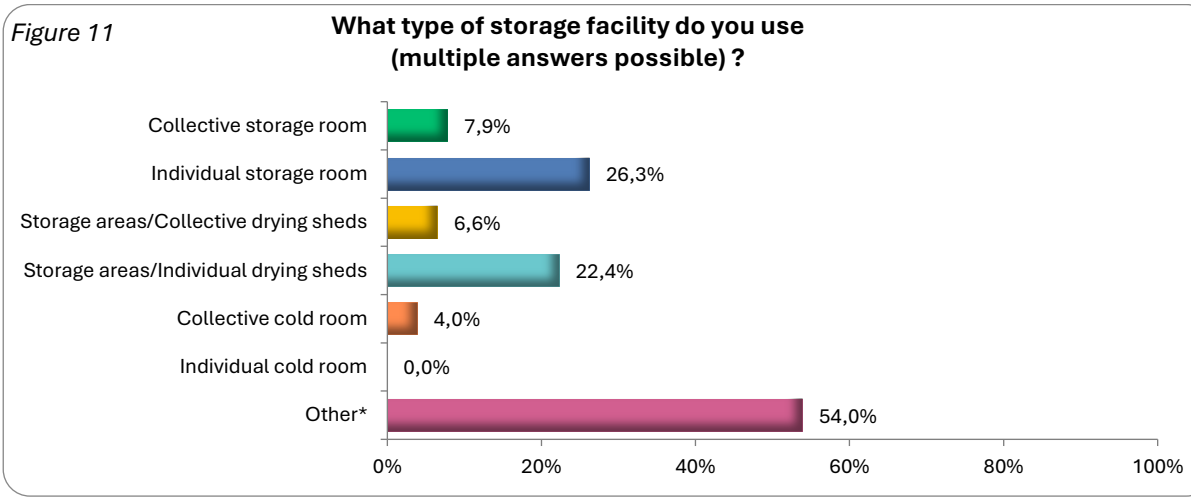
Figure 10



4.1.3 Storage

Not only are farmers confronted with losses due to plant diseases or insects, also after harvesting losses can occur. According to the FAO, depending on the type of crop, post-harvest losses can vary between 17% to 70% of production across the horticultural supply chain. Post-harvest losses are often related to a lack of (affordable) cold storage facilities. In the region of Thiès only 44% of the farmers store their crops after harvest. The crops that are stored are primarily onions and potatoes. Less than 4% of the farmers store other crops like tomatoes, cabbages and carrots.

Figure 11



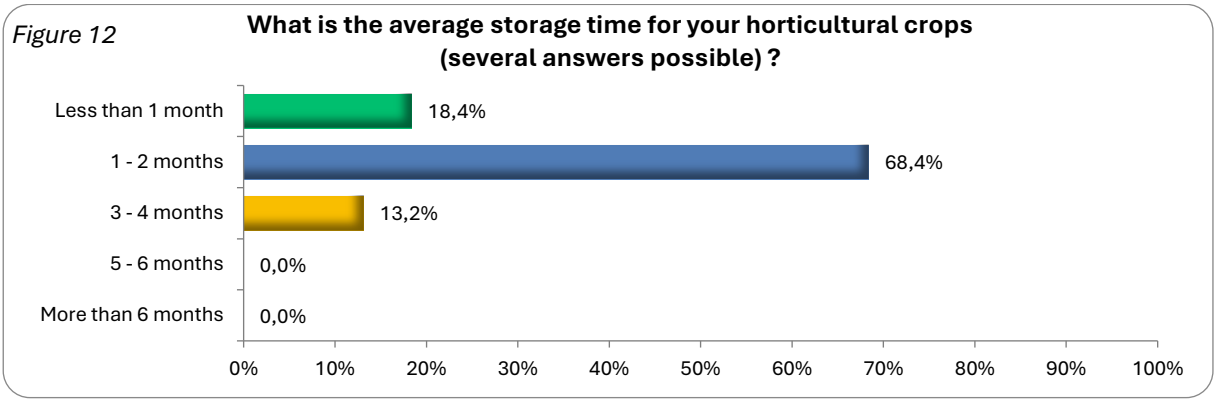
Note: (*) mainly under a tree or on a heap in the open air

The type of storage facilities used by farmers are in general quite simple structures. Most of the farmers that store their crops use either an individual storage facility (not cooled), or a simple individual drying shed. Also, a relatively large number of farmers store their harvest just under a tree or let it lying in a heap on the field in the open air.

Storage facilities for farmers in the region of Thiès are insufficient in quantity and quality

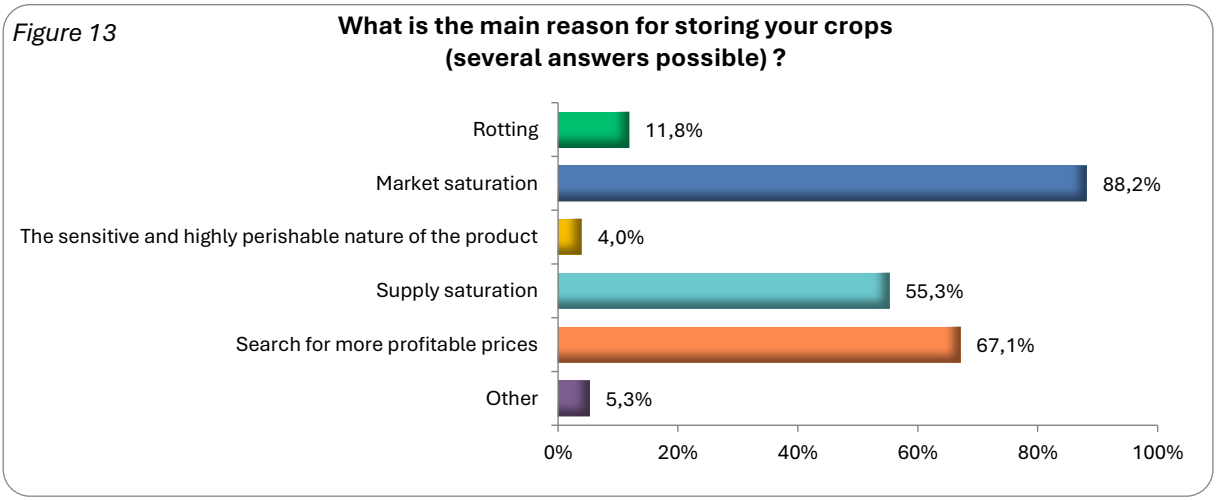
Despite the simple structures for the storage of onions and potatoes, most farmers in the region of Thiès indicated that they (can) keep the crops in storage up to 2 months before selling it on the local market. The fact that these storage facilities are more than often not (mechanically) cooled or properly ventilated, the question arises if they can keep the quality of the stored onions and potatoes at the same level when it entered the storage room just after harvest. From earlier studies[8] it is known that, depending on the quality of the onion harvested, on average between 2% and 5% of the stored quantities is lost due to poor conservation techniques like no proper ventilation, naturally or mechanically, and insufficient or total absence of racks.[9]

Figure 12



The main reason for farmers to store their crops is in fact quite straightforward; waiting for better times. Saturation of supply and demand on the local market for onions, which is directly linked to low market prices, are therefore the main factors for conservation. In the region of Thiès, like elsewhere in the Niayes, almost all farmers harvest their crops at the same time. The result is an excess supply in many horticultural products with low market prices.

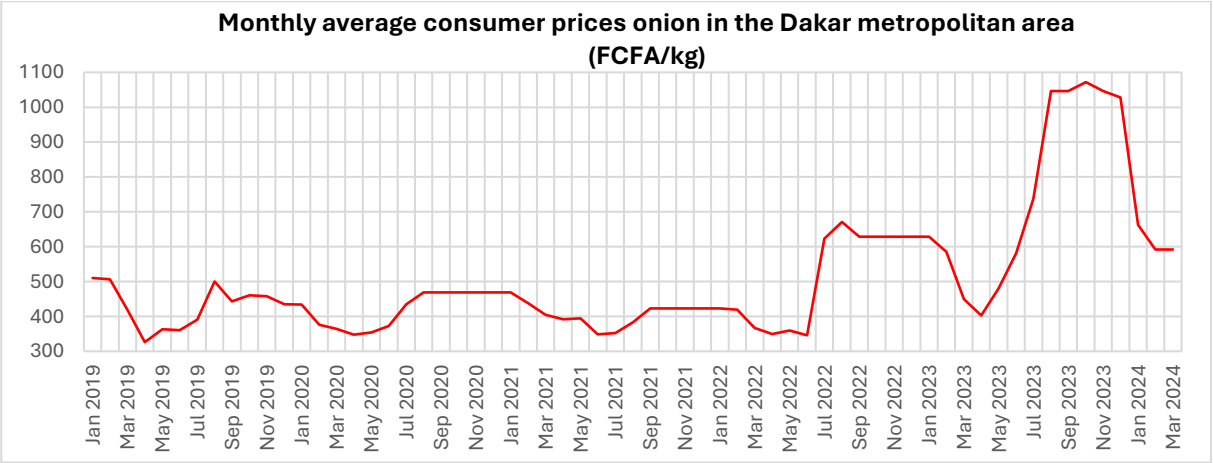
Figure 13



Depending on the region, the peak period of local onion harvest in the north of the country (Senegal River Valley) is during the months March – May, while in the Niayes it is between May and June. As many farmers are unable to store onions for a longer period of time and need cash to buy inputs for next campaign, supplying the domestic market all at the same time results in low sales prices.

[8] For example : Améliorer la qualité de l'oignon au Sénégal. Contractualisation et autres mesures transversales, FAO, 2018

[9] Studies in neighbouring countries revealed that losses during the storage of onions can be 10% to 50%, depending on the type of storage.



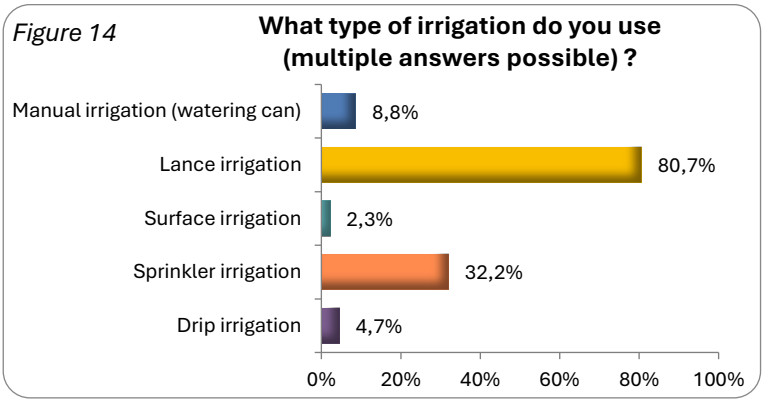
Source: ANSD

The consumer price hike in 2023 was a direct result of poor onion harvests in Senegal, resulting in more expensive imports to cover domestic demand. Unfortunately, farmers didn't receive a higher price for their onions as their bargaining power vis-à-vis traders is relatively weak. A direct consequence of the lack of available storage facilities.

4.1.4 Irrigation, Energy, and Inputs

For irrigating their farm plots, the vast majority of farmers (81%) in the region of Thiès use an irrigation lance, followed by a sprinkler irrigation. Despite the water shortages, the technique of drip irrigation, using and wasting much less water, is done by no more than 5% of the farmers. Three out of four farmers use groundwater as their main source of water for irrigation, followed by surface water (26%).

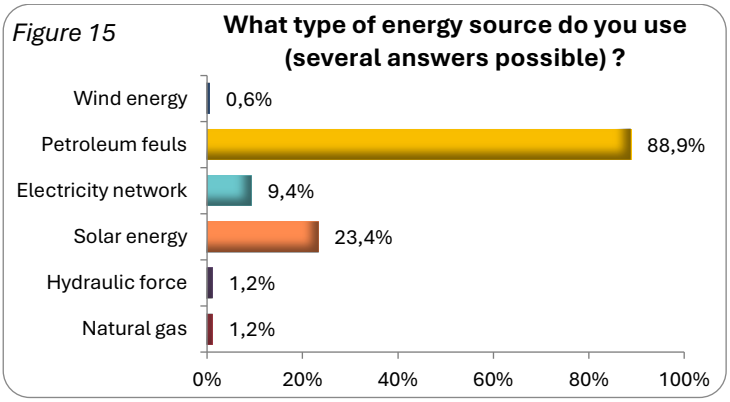
Figure 14



Different types of irrigation used in the region of Thiès

Despite the abundance of sunlight and the relatively high costs for petroleum, almost 90% of the farmers in the region of Thiès use mainly petrol for their agricultural machinery and irrigation pumps. Only one out of four farmers use solar panels. The hight dependency on expensive petroleum fuels puts a large burden on the income of farmers.

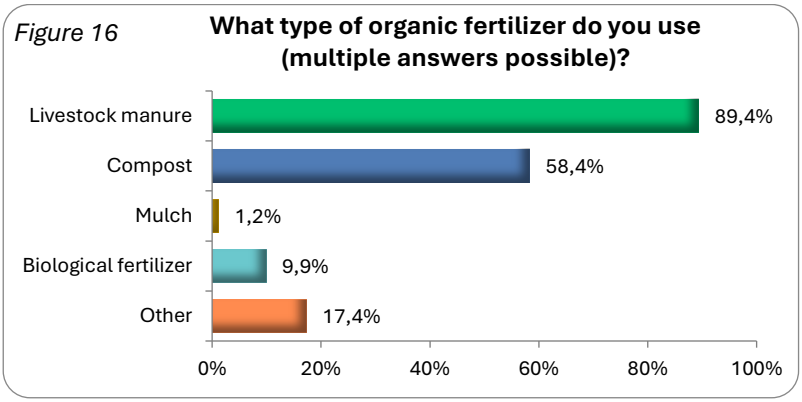
Figure 15



Use of solar energy by farmers is still limited

To improve soil conditions, more than 90% of the farmers in the region of Thiès use organic as well as chemical fertilizers. Livestock manure, especially from chickens, are widely used as organic fertilizer by farmers. Also the use of compost is done by more than half of the farmers. They buy organic fertilizer from commercial traders (86%) or an agricultural cooperative (35%). Rarely horticultural farmers themselves have these kind of fertilizers.

Figure 16

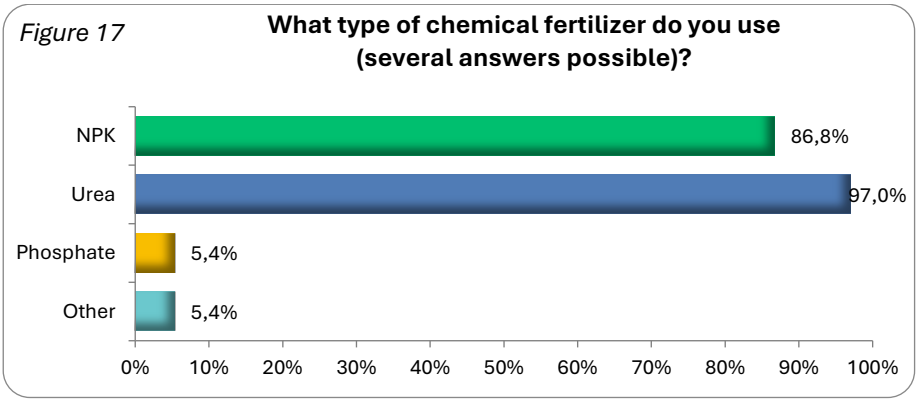


Organic fertilizer is widely used by farmers in the region of Thiès

Concerning the use of chemical fertilizers, Urea and NPK are widely used by farmers. The Senegalese government largely support the use of these mineral fertilizers through subsidies put in place since the country's independence in 1960: over the last decade, the use of mineral fertilizers has doubled, from 84 000 tons in 2012 to 150 000 tons in 2023 (180 000 tons in 2022). Even if the average of 25 kg of mineral inputs used per hectare of arable land in Senegal is far from the global average of 146.4 kg, the soil and the environment have been degraded by this use, coupled with monoculture, the absence of fallow land and climate change (salinization of the land, decreasing rainfall, etc.). In 2019 the Government, therefore, put also in place a subsidy scheme for organic fertilizers. Bags of organic fertilisers are subsidised at 50% of their sales price, the same level as subsidies granted to the purchase of chemical fertilizers.[10]

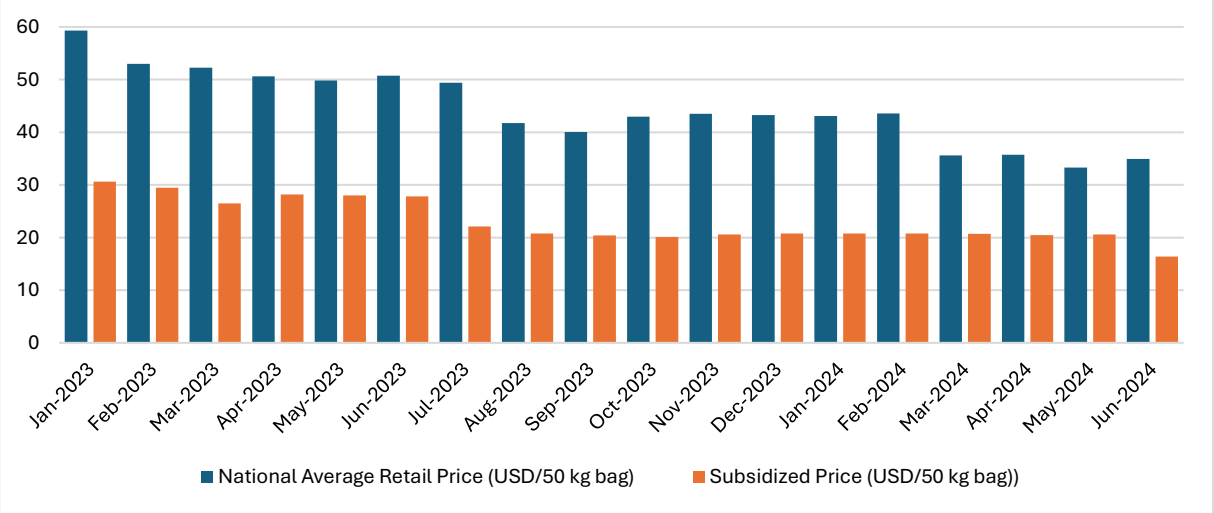
[10] Alice Hautbois, Face à la pénurie d'engrais chimiques, le Sénégal promeut des alternatives « vertes », Le Monde Afrique, 18 mai 2023

Figure 17



NPK is widely used mineral fertilizer by farmers in the region of Thiès

At the national level, Senegal produces around 2.5 million tons of chemical fertilizers each year, which is insufficient to cover domestic demand. Imports, therefore, are still necessary to fill this demand from the agricultural sector. Traditionally, imports were mainly from Morocco (NPK) and Russia (Urea, KCl). Since the war in the Ukraine, Russian imports are replaced by imports of mineral fertilizers from Nigeria. At first instance this led to higher retail prices for mineral fertilizers in Senegal, but its effect has gradually faded away. Since March 2024 retail prices have decreased with more than 30% compared to the same period in 2023.

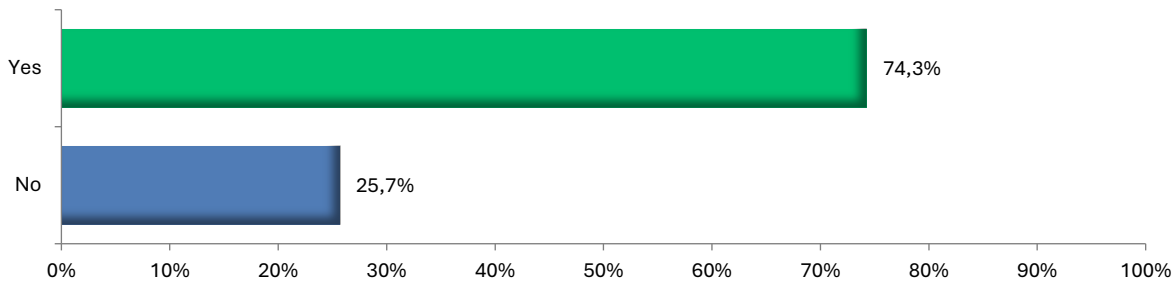


Source: AfricaFertilizer

4.1.5 Employment

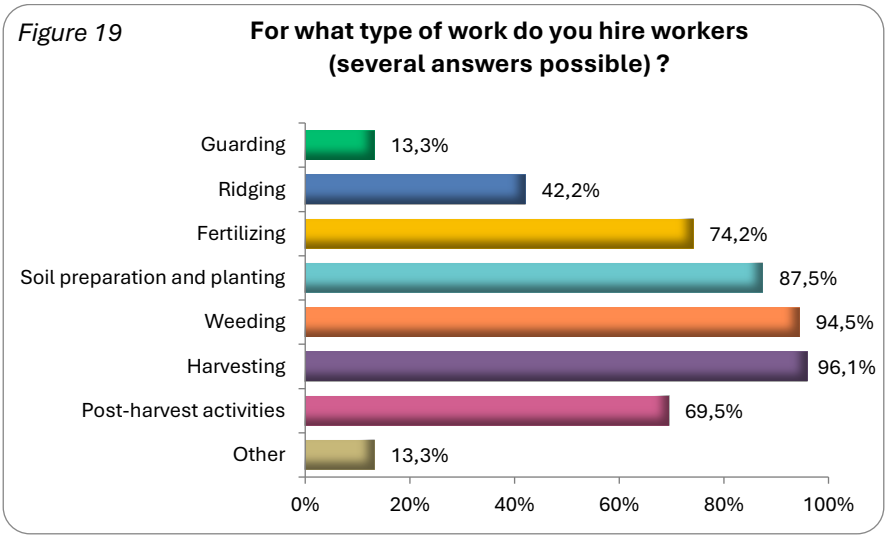
Despite the fact that most of the land owners have a farm plot which is smaller than five hectares, the majority have paid workers (family, non-family members) to help them in cultivating their plot of land. Only one out of four farmers don't use paid labourers.

Figure 18



The work that is done at the farm plot consist of a wide variety of tasks, varying from safe guarding the plot against wandering cattle who are trying to eat the crops to post-harvest activities and everything in between. Most of the hired work is deployed for soil preparation and planting, maintenance of the plot (e.g. weeding) and harvesting. Activities which are quite labour intensive, and can hardly be done solely by the land owner.

Figure 19

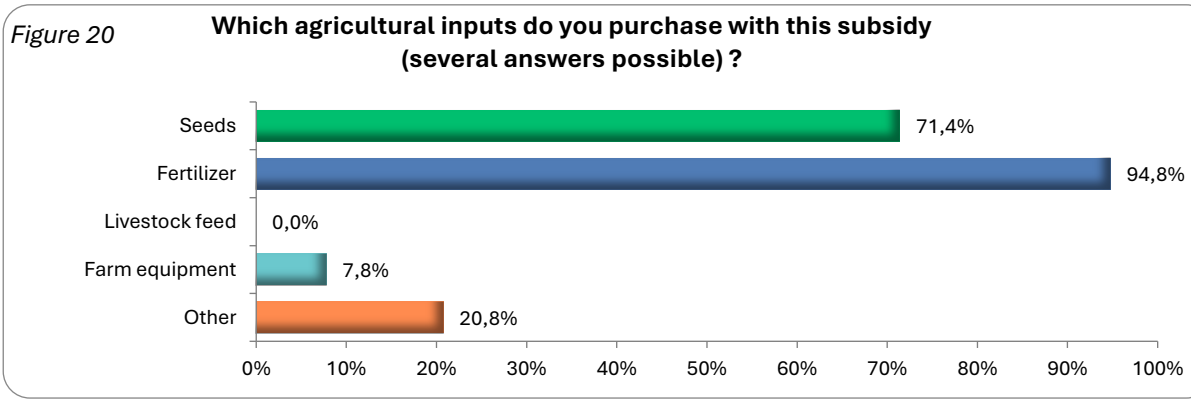


Post-harvest activities are done using hired workers

4.1.6 Finance & Marketing

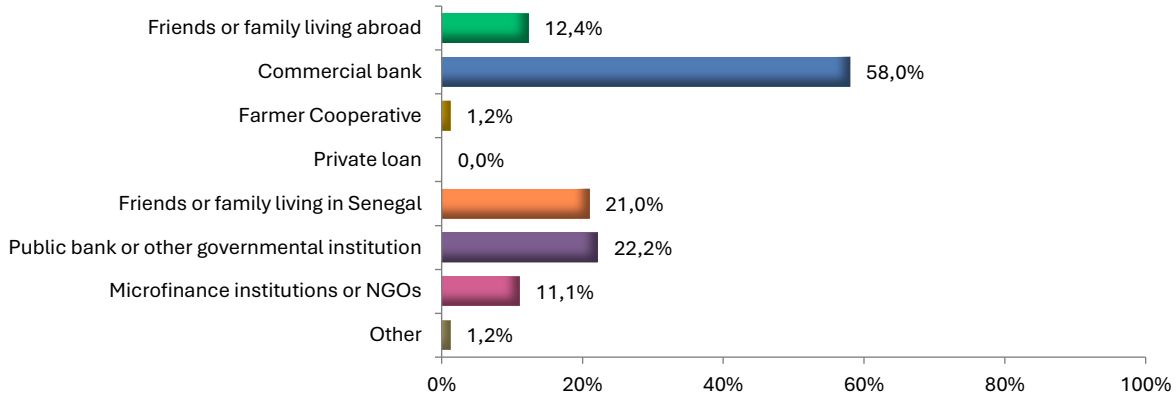
Four out of ten farmers in the region of Thiès receive a subsidy from either the government or a farmers cooperative to purchase agricultural inputs. Almost all farmers (95%) use this subsidy to buy fertilizer, and 71% to buy seeds as well.

Figure 20



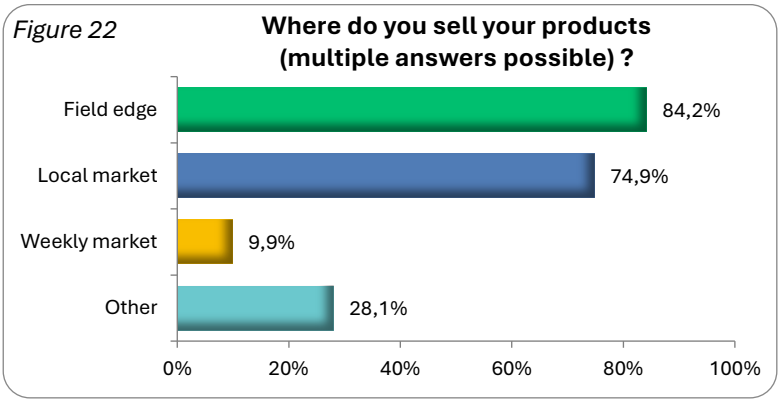
Besides a subsidy, 47% of the farmers in the region of Thiès also use a loan to buy agricultural materials. The main provider of such loans are commercial banks, followed by friends and family either living abroad or in Senegal. Much less popular of a loan provider are farmer cooperatives. Their financial role is more acting as an intermediary between the State and the farmer in providing state subsidies.

Figure 21



The majority of farmers in the region of Thiès sell their horticultural products from the edge of their field and on the local market. They sell their products primarily in mesh bags of 25 kg, plastic bags of 35 kg or plastic crates of 40 kg. Smaller volumes are not offered by farmers.

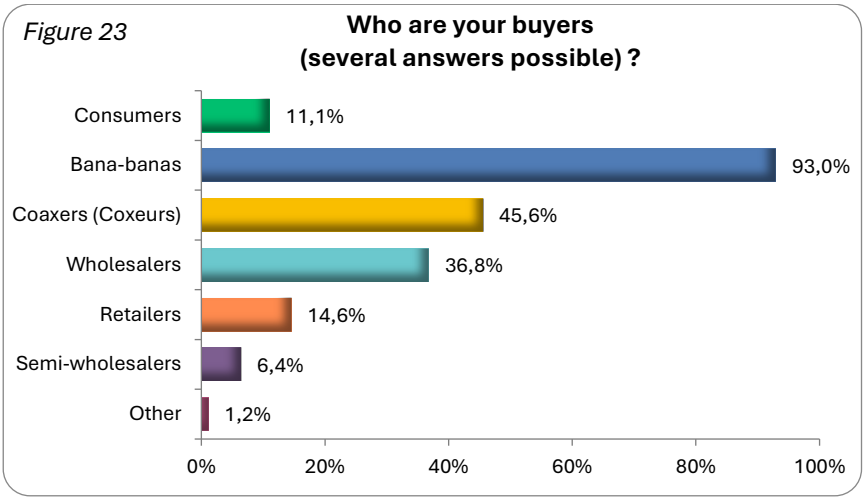
Figure 22



Poor packaging by farmers leads to post-harvest losses

The most important group of buyers for farmers in Thiès are bana-banas. Almost all farmers sell their horticultural products to them. Also coaxers (coxeurs) and wholesalers are important groups of buyers. Only around one out of nine farmers sell directly to consumers.

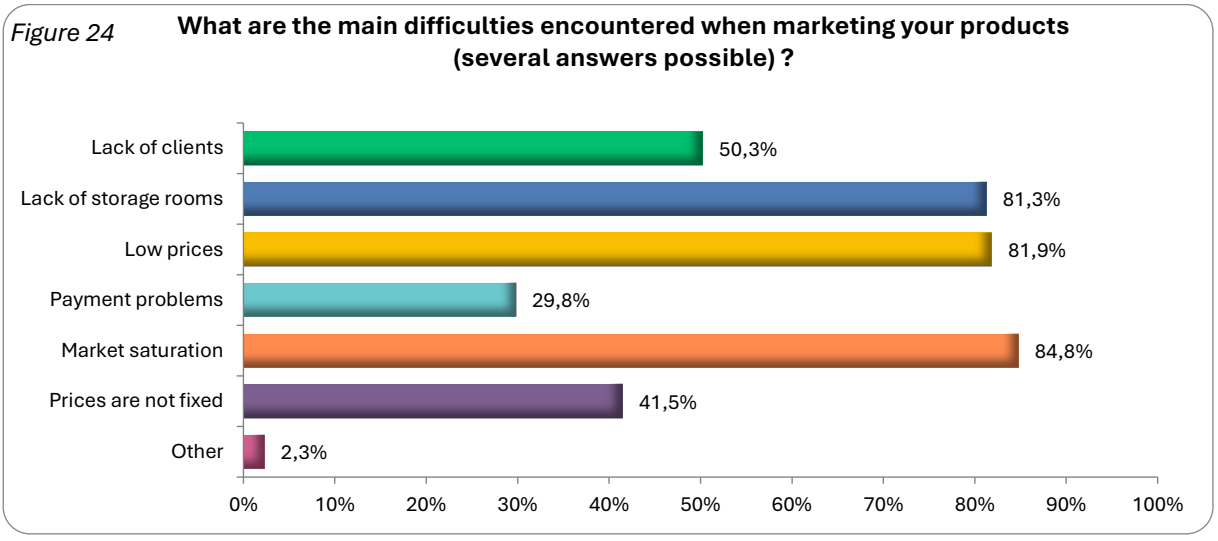
Figure 23



For transporting their horticultural products, farmers use mainly a horse cart

Information about market prices for their horticultural products is obtained by farmers from going to the market and talk to traders. For transporting their products after harvest, farmers use mainly a horse cart. This traditional mean of transport doesn't give much protection against the sun or the shaking and bumping of the products against each other. It is estimated that around 10% of the products transported are lost due to poor transport means.

Figure 24



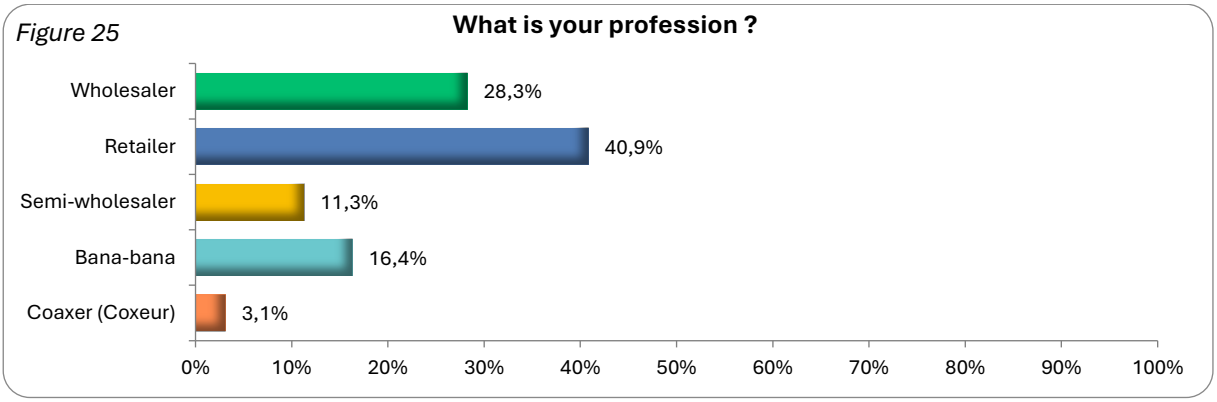
Horticultural farmers in the region of Thiès are confronted with a wide variety of marketing constraints that influences their household income. More than 80% of the farmers state that the lack of storage rooms is a major marketing constraint, leading to the problem that many must sell almost directly after harvesting, causing local market saturation with low prices. To solve these marketing issues almost all farmers (98%) agree that the construction of much more cold storage facilities is crucial, followed by 100% state subsidies on seeds and fertilizers to lower the costs of crop production.

4.2 Traders

4.2.1 Profile trader

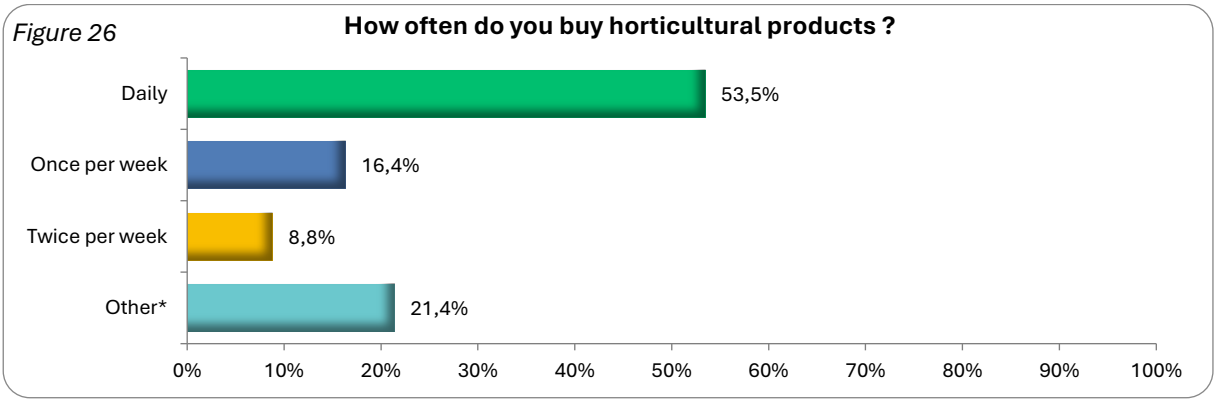
In the horticultural supply chain traders play a key role in bringing the products to the market. There are various types of traders active in the region of Thiès. The main types are retailers and (semi-) wholesalers.

Figure 25



Traders are not focusing on a single product that they can sell. Depending on the horticultural season they sell a wide assortment of crops like onions, potatoes, cabbages, tomatoes, carrots and other crops that are in high demand from local buyers.

Figure 26



Note: (*) primarily when products are available

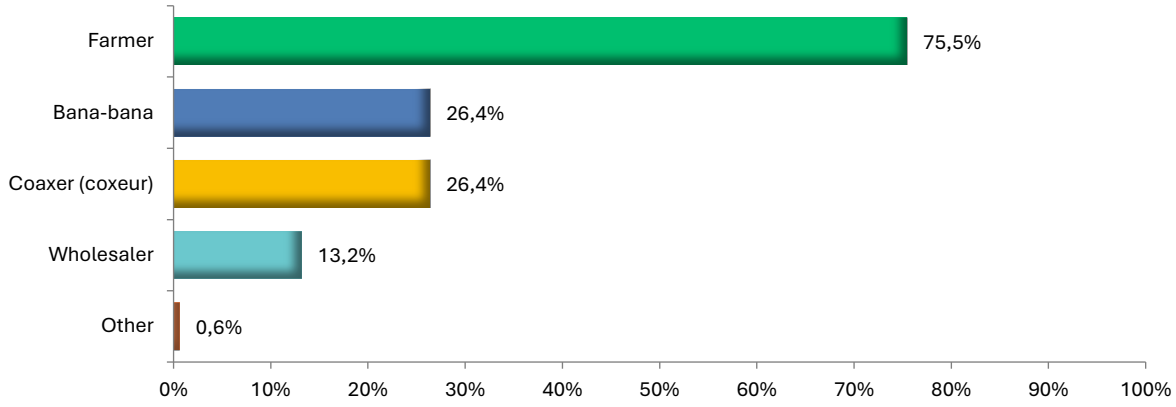
Most of the traders buy the horticultural products on a daily basis, but it also depends on the availability (seasonality) of the products. The high frequency of buying horticultural products on a daily basis is mainly caused by a lack of storage facilities among the vast majority of traders. Without proper cold storage it is very difficult to keep product quality at the same level for more than a few days in the hot climate of Senegal.

Traders in the region of Thiès offer a wide variety of horticultural products

4.2.2 Sourcing of products

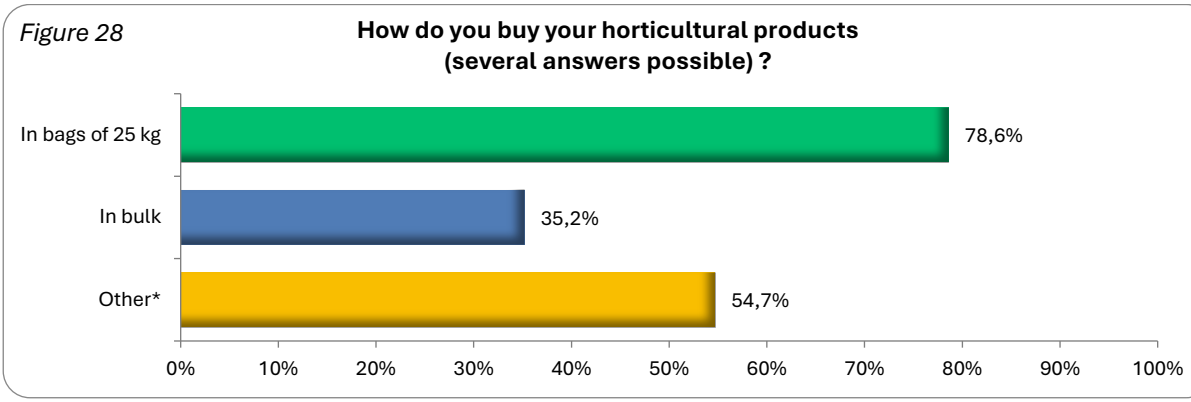
The horticultural supply chain in the region of Thies is short-circuited. Three out of four traders buy directly from the farmer. Nonetheless, one-quarter of the traders buy the products not from farmers but from intermediaries like bana-banas or coaxers (coxeurs). The reason for this more indirect marketing circuit is that most farmers sell their produce to bana-banas and coaxers, providing them with a key role in the marketing of horticultural products in the region of Thiès.

Figure 27



More than three-quarters of the traders buy the horticultural products in mesh bags of 25 kg. Other types of volumes are in 50 kg bags or in bulk. Smaller bags of for example 2.5 kg or 5 kg do not exist in Senegal.

Figure 28

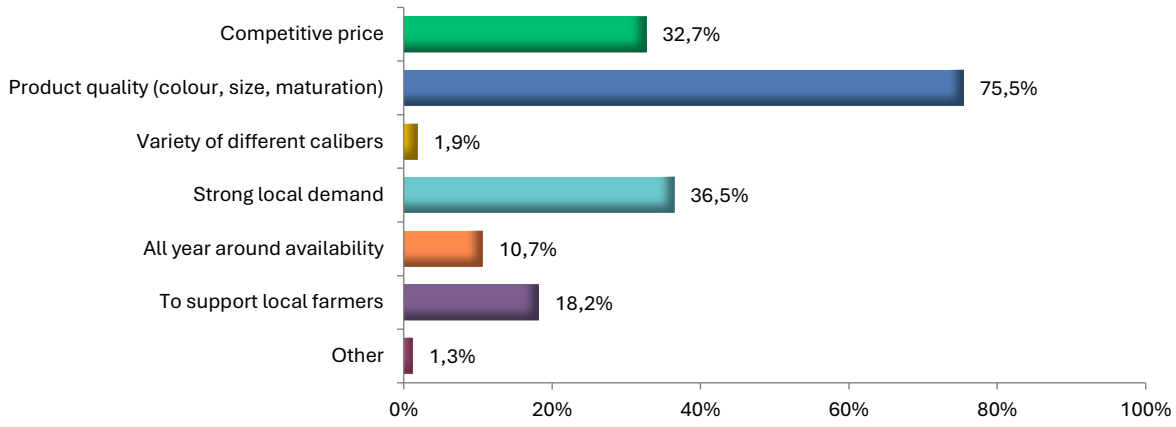


Note: (*) mainly in 50 kg bags

Despite the availability of imported horticultural crops like onions on the domestic market, traders are strongly motivated to buy local produced crops. The main reasons are product quality (colour, size, maturity), strong consumer demand, and a competitive price. More than ninety percent of the traders are more than satisfied with the quality of local horticultural products like onions, tomatoes, potatoes, and carrots. However, one of the biggest challenges is the all year round availability of these

local produced crops. The production of horticultural crops is seasonal. Without proper storage, selling outside the production season with the same product quality is almost impossible.

Figure 29 **What motivates you the most when purchasing locally produced horticultural products (multiple answers possible)?**

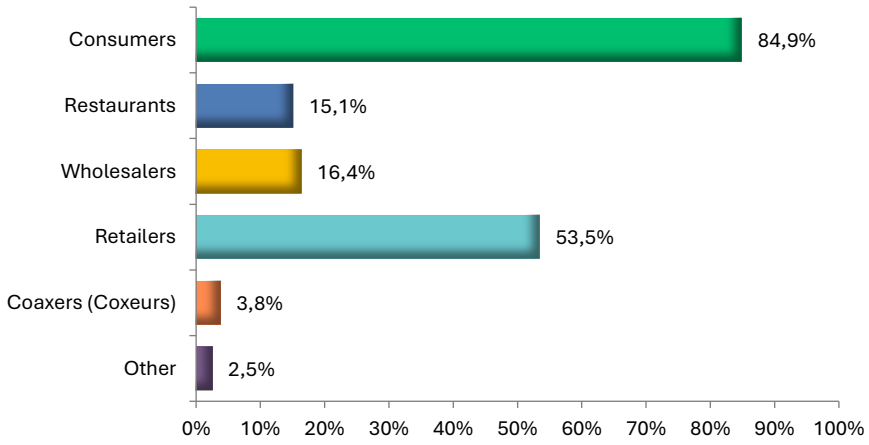


Less than twenty percent of the traders have a storage room to store horticultural products that can be sold at a later date. Of those traders who do have a storage room, two-third can only store up to a maximum of four weeks. To extend shelf life, optimal storage would be in airtight conditions, low humidity and low temperatures, but many traders do not have the money to invest in this.

4.2.3 Local demand

The main task of a local trader is to connect supply with demand. Over eighty percent of the trader's main customers are individual consumers. They come to the local market or retail shop to buy the product(s) in small quantities. Besides these consumers, local retailers are also an important group of buyers. They are sourced by wholesalers, who sell in large volumes, whereas retailers sell in large as well as in small(er) volumes depending on the type of client. Professional clients like restaurants are less important for most of the traders in the region of Thiès. Often the chef himself goes to the market to buy his ingredients from retailers or wholesalers.

Figure 30 **Who are your main customers (multiple answers possible) ?**

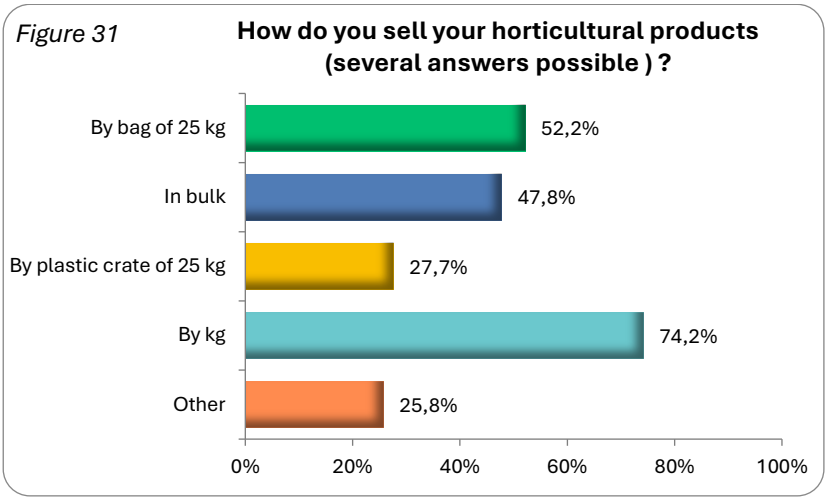


Main customers of traders are individual consumers

As most of the buyers of horticultural products are individual consumers and other retailers, traders sell most of their products like onions, potatoes and tomatoes by the kilo, in mesh bags of 25 kg, or in

bulk. This is also how the products are delivered to the trader by farmers. In that sense, the local trader adds little value to the quality of the product and is more of a service provider operating between the individual producer and consumer. Direct contact between individual consumer and producer, as noted earlier, is very limited in the region of Thiès.

Figure 31

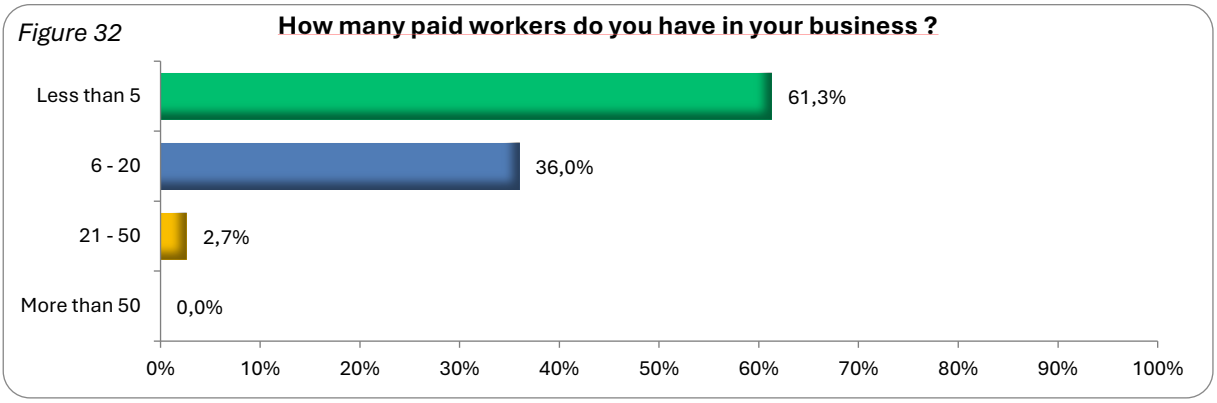


Most consumers buy horticultural products in small quantities

4.2.4 Employment

Traders in the region of Thiès provide local (youth) employment as well. Around 48% of the traders use paid workers. The majority of them have less than 5 workers on their payroll, and 36% between 6 and 20 paid workers. Almost all of these workers are non-family members of the business owner. Although they are identified as micro-enterprises, they play an important role for the labour market in the region of Thiès where (decent) paid jobs outside the agricultural sector are not available in large numbers.

Figure 32



The total working age population in the region of Thiès (> 15 years) is around 1.5 million people, of which 63% are in the age of 15 – 35 years. Almost half of the working age population has no level of education. This puts a lot of pressure on the regional economy to create enough jobs for this large group of young and uneducated people. SMEs in economic sectors like horticulture are key in employment generation, but struggle to find (sufficient) financial means for the necessary investments to grow their business.

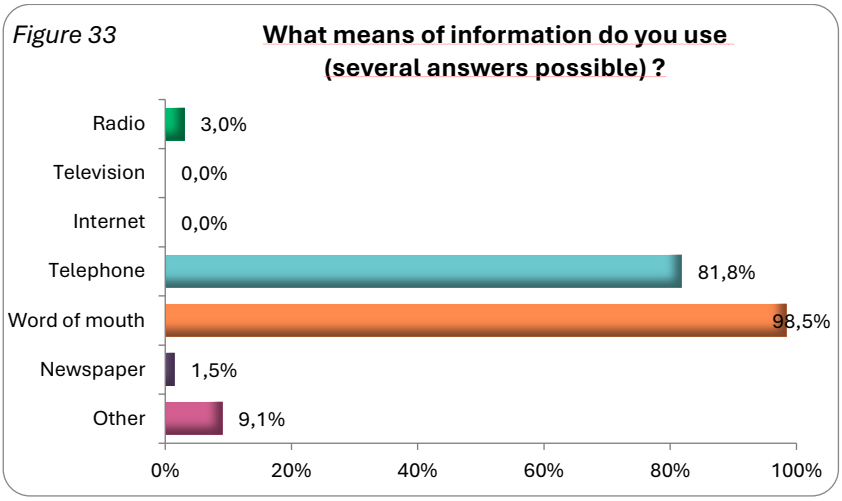
4.2.5 Communication

Before selling their products, the majority of traders inform themselves of the prevailing local market prices and demand. Almost all receive that information through word of mouth, followed by telephone. Other sources of information, online and offline, play almost no role in providing market information to traders. The relatively low coverage and usage of the internet in Senegal is the main

cause. Only 7% of the Senegalese households have access to internet at home and 16% have a computer[11]. In addition, only one out of four agricultural households use the internet or television for collecting information. The main reason for this relatively low usage of the internet and television is that many agricultural households don't see the benefits of it for collecting information about product availability and prices.[12]

Due to the fact that the domestic market for demand and supply of horticultural products fluctuates, about eighty per cent of the traders request market information on a daily basis.

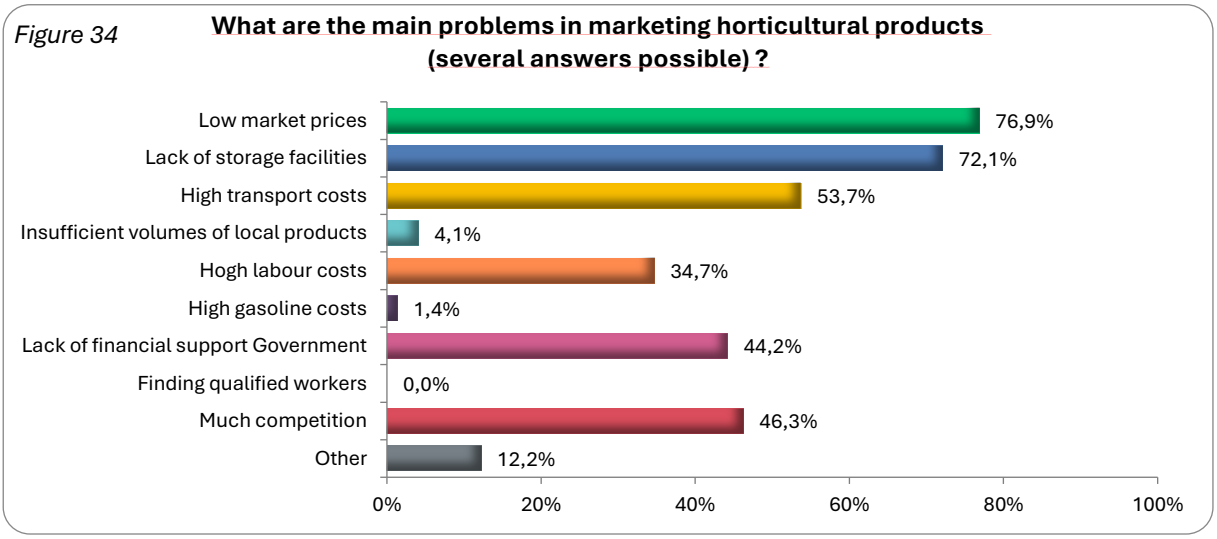
Figure 33



Word of mouth most important source for market information

Despite that the majority of traders inform themselves about prevailing market prices and consumer demand through word of mouth and by telephone, they are struggling with the low market prices and the lack of storage facilities for their horticultural products. Also high transportation costs to bring the products from the farmer to their store has an impact on the financial situation of the traders. More than 40% indicated that lack of financial support from the Government is an important problem in marketing the horticultural products.

Figure 34



[11] ITU

[12] Rapport de l'Enquête Agricole Annuelle (EAA) 2022-2023, DAPSA, Octobre 2023

Many traders lack a proper storage facility for their horticultural products

4.3 Consumers

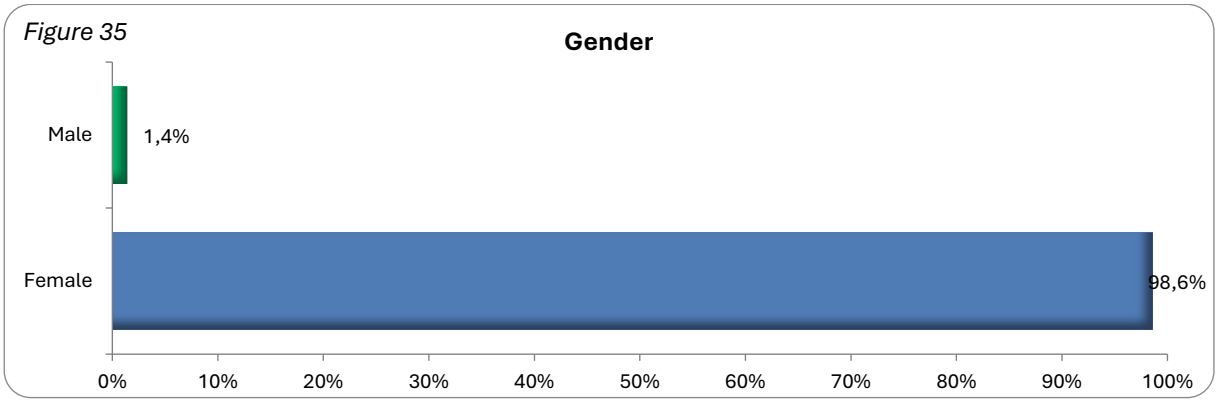
The total population in the region of Thiès is around 2.5 million people, making it after Dakar the most populated region in Senegal. Half of the population in the region are women. Fifty per cent of the population is younger than 20 years. A large share in total household expenditures goes to buying food. Over fifty per cent of the households devote more than 65% of their total expenditures on purchasing food.

The average per capita consumption of fruit & vegetables in Senegal is around 80 kg per year. With on average 32.4 kg per person per year onions are the most consumed horticultural product and a basic necessity in Senegalese cuisine (e.g. in traditional dishes like thiéboudienne and chicken yassa). This results in a demand for onions of approximately 80 000 tons in the region of Thiès. Potatoes have also been present in Senegalese consumption for decades, with an average per capita consumption of 8.3 kg per year. Consumption of tomatoes (fresh, processed) is estimated at 10.9 kg per person per year. Processed tomatoes are a relatively recent innovation in traditional dishes such as a colouring/flavouring for the famous thiéboudienne rice/fish dish.[13]

4.3.1 Profile of the consumer

With three-quarters of the daily fruit and vegetables needs bought at the local market, the position of the individual consumer as end buyer is key in the horticultural value chain in the region of Thiès. The average profile of these buyers is that almost all are female, with two-thirds in the age of 21 – 45 years, coming from relatively large families with more than 9 persons.

Figure 35



[13] Consumption of fruits and vegetables by types and sources across urban and rural Senegal, Ndeye Fatou Faye et al., Journal of Agribusiness in Developing and Emerging Economies, November 2023

Figure 36

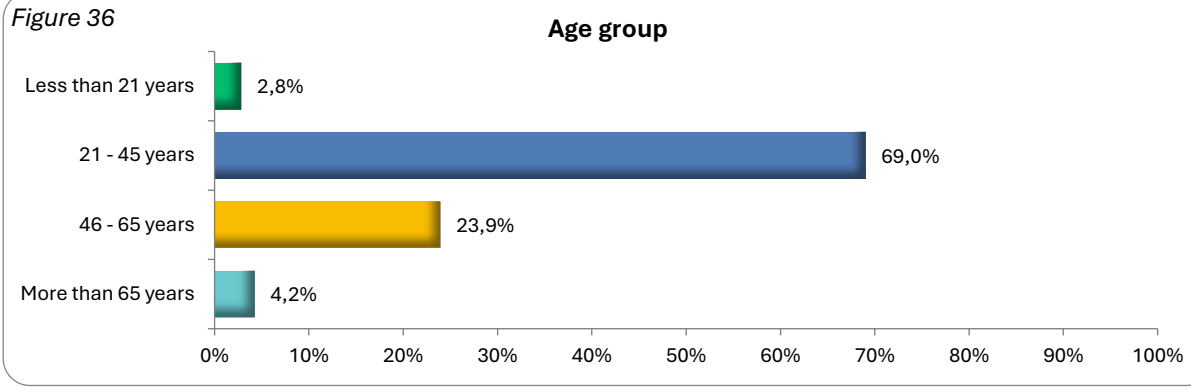
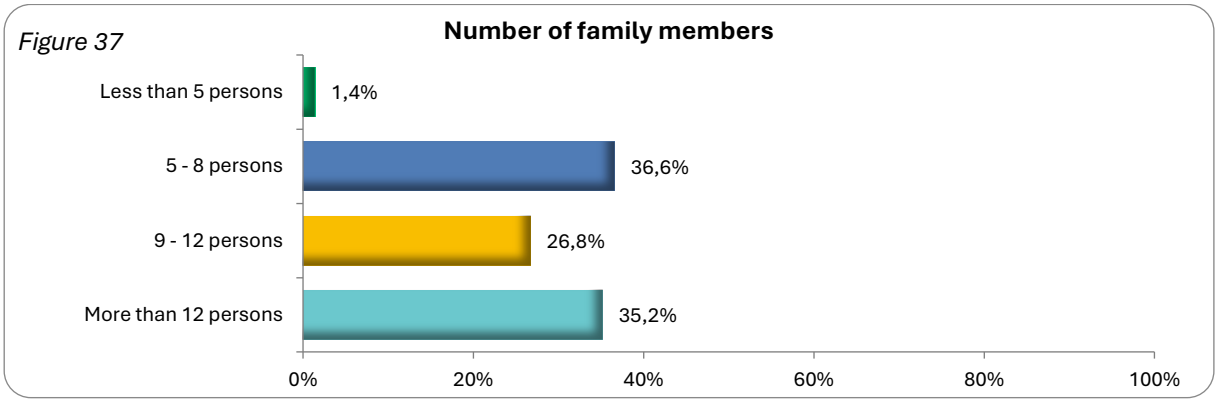


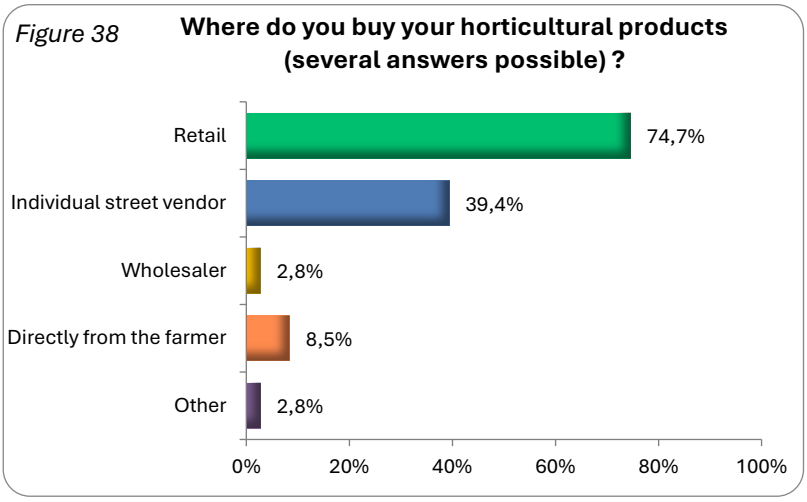
Figure 37



4.3.2 Consumer buying behaviour of horticultural products

Consumers buy their horticultural products primarily from 2 sources, namely the retailer and the individual street vendor. The last type often uses a small handcart to display the products. As noticed before, direct contact between the consumer and the farmer to buy horticultural products is relatively limited.

Figure 38

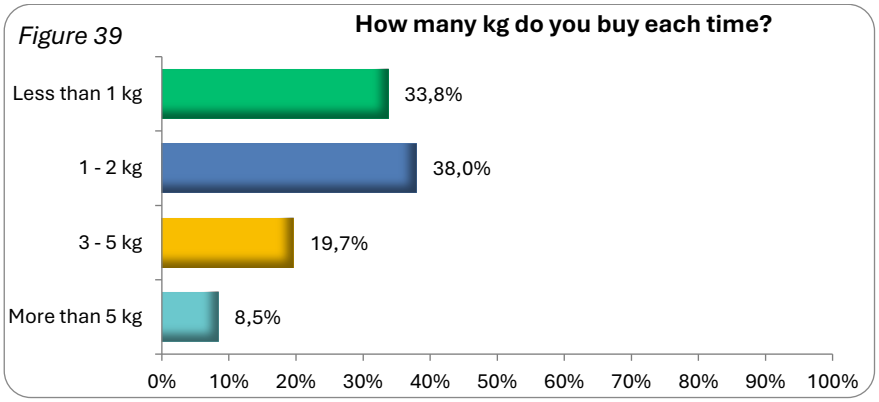


Consumers buy their horticultural products mainly at a retailer or an individual street vendor

Two out of five consumers always go to the same seller. Trust in the quality of the products, knowing the vendor, and good sales prices are reasons why consumers don't switch easily. The most important horticultural products consumers are buying are onions, potatoes, tomatoes, chili peppers, and cabbages. Products that belong to the traditional Senegalese cuisine with dishes like thiéboudieune, yassa chicken or fish, and dibi. Three-quarters of the consumers buy their horticultural products on a daily basis. Their decision to buy a particular product is primarily based on – in order of importance -

size, price and colour. Own observations and asking the seller are the key sources of information about the product's characteristics.

Figure 39



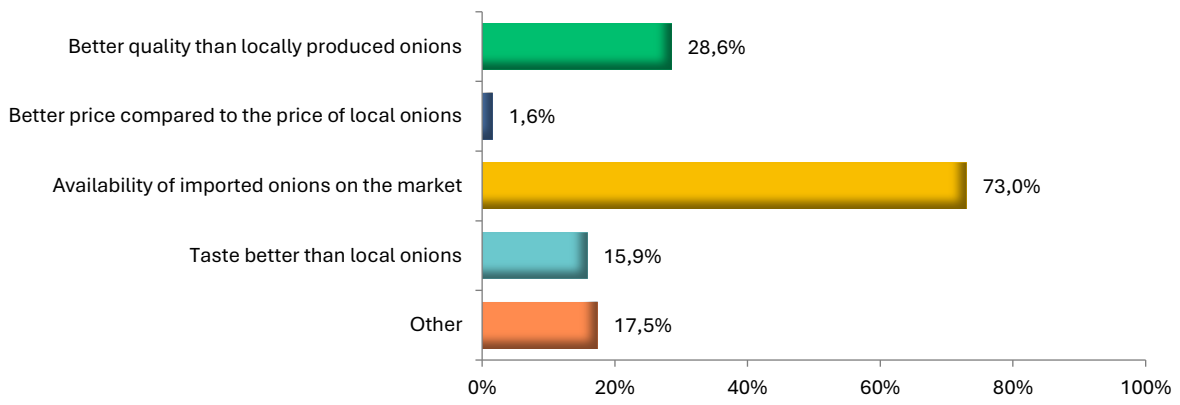
Majority of consumers in region of Thiès buy daily max. 2 kg of horticultural products

Despite the fact that households in the region of Thiès are relatively large, over 70% of the (female) buyers of these households purchase each time no more than 2 kg of horticultural products. And they do this mainly on a daily basis. An important reason for many consumers to buy fresh horticultural products like onions, potatoes or tomatoes on a daily basis is that they do not own a proper refrigerator or other cold storage facility to conserve the products for a longer period of time without degrading the quality. Almost fifty per cent of the consumers can store the products no longer than 3 days.

Figure 40

Although Senegal produces over 400 000 tons of onions each year, ninety per cent of the consumers buy imported onions. As onions are the most essential ingredient in Senegalese dishes, consumers want to be able to buy them all year round. Local produced onions are only available for six or seven months of the year. For the other five months the Senegalese consumer turns to imported onions. This is for three-quarters of the consumers the main reason to buy imported onions. Price, taste or quality of imported onions compared to local varieties are much less important reasons to buy them.

Figure 41


What are the main reasons you buy imported onions (multiple answers possible)?
Better quality than locally produced onions
28,6%
Better price compared to the price of local onions
1,6%
Availability of imported onions on the market
73,0%
Taste better than local onions
15,9%
Other
17,5%
0%
20%
40%
60%
80%
100%

5. Conclusions

The horticultural supply chain in the region of Thiès, which is the main focus of this market study, is one of the critical drivers of the regional economy. Approximately 110 000 households in the region of Thiès are active in agriculture, of which ten per cent in market gardening and seven per cent in arboriculture. These households provide (paid) employment to thousands of family and non-family members and are essential in providing food security. But not only the producers, also the traders of horticultural products provide a key role in the supply chain by connecting local supply with local demand. In doing so they provide much needed paid jobs as well.

The climatological circumstances in the region of Thiès provide a good opportunity for growing a wide variety of horticultural crops like onions, potatoes, tomatoes, cabbages, and carrots. The region accounts for about one-third of national horticultural production. Despite this apparent success the potential in production of the region could be much higher. Average yield of an important crop like onion is less than 10 tons, which is about one-third of the national level. There are several reasons for this opportunity gap.

Almost no farmer in the region of Thiès does crop rotation. They do only one (onion) harvest each year. For onions the main sowing season starts in November/December. Harvesting is done during the import freeze on onions, which runs from January to August/early September, protecting the local farmer against massive imports coming mainly from the Netherlands and Morocco. Despite these protective measures local farmers are struggling to meet ends needs. The majority are small scale farmers with less than five hectares, having relatively low yields due to phytosanitary problems and the overuse of mineral fertilizers depleting the soil of the farm plot. But the overarching problem for the farmers in the region of Thiès is the lack of proper storage facilities. As most farmers harvest at the same time and in general have no possibility to store their crops, their bargaining position on the sales price vis-à-vis the buyers (bana-bana, coaxer, wholesaler, retailer) is relatively weak. At the end of the day they must accept the low market prices offered to them or lose their harvest to rotting.

The most important buyer for the horticultural farmers in the region of Thiès are bana-banas. Bana-banas are itinerant traders buying the crops at the edge of the farm field and transport it to the local market where they sell the crops either to wholesalers or retailers. Direct contact between farmer and individual end consumer is very limited. Traders buy from farmers primarily in bulk, 25 kg or 50 kg mesh bags. The majority of traders buy horticultural products, especially onions, on a daily basis as they don't have a storage room. Instead, the onions are often placed on a pallet in the hot sun during the day, during transportation, and at the market stalls. As a result, the onions are ill-protected against the hot climate in Senegal. Therefore, most traders can only store their onions for less than a month before the quality deteriorates. The traders who own a storage room can store their onions between one and three months. However, under suitable conditions, onions can be stored for a far longer period of time. The improper storage results from a lack of knowledge and funding. Traders are primarily reliant on their own financial resources to fund their business activities. However, their own finances are usually limited, which prevents them from making the necessary investments such as investing in a storage room.

Despite the lack of storage facilities, traders are more than satisfied with locally produced horticultural crops like onions, but the fact that they are not available all year round traders also need to buy imported onions to satisfy local consumer demand. For collecting information about market supply

and prices, traders use word of mouth as their main source and to a lesser account the mobile phone. TV, newspapers, radio and internet are hardly used as an informational source.

Consumers in Senegal eat on average 80 kg of fresh fruit and vegetables per person each year. With 32 kg onions are the most consumed vegetables, followed by potatoes and tomatoes. As most consumers don't have a refrigerator or other type of proper (cold) storage at home, they buy fresh horticultural products on a daily basis and in relatively small quantities. Most consumers buy no more than 2 kg each day at the local market. Mainly they buy at a retailer or street vendor. Women are the main buyers within a household. Their key sources of information on product prices and quality is through own observation and asking the seller. Besides buying locally produced horticultural crops like onions, their lack of all year round availability lead consumers to buy imported onions as well. In addition, one-quarter of the consumers in the region of Thiès appreciate the quality of imported onions more than that of local produced onions. Higher quality means in this case the opportunity to store the imported onion for a longer period of time.

6. Recommendations

One of the main objective of the Plan Senegal Emergent (PSE) is gaining food sovereignty or self-sufficiency by 2035. In brief this means that local food demand is fully covered by local food production. The reason behind food self-sufficiency is to be no longer dependent on expensive food imports, and promoting local food production – instead- create much needed jobs and income for many households across Senegal. To achieve this ambition, the Senegalese government implemented over the last decade the Program to Accelerate the Rate of Senegalese Agriculture (PRACAS), the Agricultural Program for Food Sovereignty (PASAD) and the National Food Sovereignty Strategy. Significant progress has been made in cereal production, covering more than 85% of domestic needs in 2022. For horticulture, despite an increase of seventeen per cent in domestic production since 2016, national needs for important crops like onions and potatoes are only covered for 7 to 9 months of the year.[14] The remaining months must be covered by imports.

To solve the problem of expensive imports of horticultural products, the Senegalese government is especially looking at improving storage infrastructure. Senegal loses 25% of its harvests annually due to insufficient storage infrastructure.[15] Strengthening storage capacities would help increase available production, diversify the range of products marketed, improve marketing conditions and stabilize the prices of food products.[16] To achieve this effect, the Senegalese government selected the following actions: (i) standardization and certification of storage infrastructures (ii) promotion of research and development on new construction and storage materials (iii) the development of a Warehouse Receipt System[17] ; (iv) strengthening goods transport infrastructure accessible to production areas, and (v) development of infrastructure suitable for marketing.[18]

Farmers in the region of Thiès, more specifically the Kayar area where the Impact Cluster project is implemented, are also suffering from a lack of a proper functioning storage infrastructure. Without solving this issue, increasing the quality and quantity of onion production in the area will not automatically lead to a sustainable improvement in farmers' income. At the same time, in general, individual farmers in the area have too small a plot of land to be able to invest in a good storage facility. Therefore, they must work together to either invest collectively in a (cold) storage room or become as a collective an interesting client for an owner of a storage room.

Due to the fact there is not much experiences among farmers in the area with a cold storage room (mechanically//naturally ventilated), constructing such a storage room as a demonstration facility of what is achievable taking local circumstances into consideration and being an integral part of the Impact Cluster project in the Kayar area, would be surely desirable. Such a demo cold storage room should have at least a 50 tons capacity for the storage of onions and, if possible, another horticultural product as well. The products supplied to this storage room should come from a group of 30 – 40 farmers from the Kayar area who are involved in the Impact Cluster project.

[14] Plan Sénégal Émergent (PSE) Plan d'Actions Prioritaires 3 : 2024-2028, Décembre 2023

[15] For some horticultural products, like tomatoes, this percentage is even higher.

[16] Ibid. 14

[17] Warehouse receipt financing systems (WRS) are financial arrangements which allow farmers to store their agricultural production in a certified warehouse in exchange for a warehousing receipt that can serve as a collateral for receiving credit in a formal financial institution (bank or micro-finance institution) (*Source: World Bank*).

[18] Ibid. 14

In addition to strengthening the horticultural supply chain by constructing a demo cold storage room, investing in better packaging, product labelling and transporting of horticultural products from the farm to the market would reduce post-harvest losses and increase the income of farmers and traders. Different types of packaging, for example smaller bags of 2.5 or 5 kg, could provide the farmer the opportunity to sell more directly to consumers as they demand these smaller quantities on a daily basis. Also for wholesalers and retailers, different types of bags with informative labelling would provide the opportunity to create added value for individual end consumers instead of selling in bulk in plastic crates with no product information whatsoever. Better stacking of the horticultural products and protecting them against direct sunlight would reduce product losses and improve quality.