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FEASIBILITY STUDY

Market-Led Horticulture in Jubaland – Somalia

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Executive Summary

This feasibility study assesses the potential for market-led horticultural development in Jubaland, Somalia, with a specific focus on the establishment of an NLA-linked commercial pilot plot near Kismayo.

The study finds that there is a clear and immediate market opportunity for local horticultural production. Kismayo has established demand for fresh vegetables, while a significant share of current supply is imported from Kenya. The main opportunity for local production therefore lies not in creating new demand, but in supplying an existing market more reliably in terms of volume, quality, freshness, and timing. Crops such as tomato, onion, sweet pepper, and cucumber stand out as particularly relevant for this opportunity.

At the same time, the market system remains only partly developed. Aggregation, storage, cooling, and transport infrastructure are limited, and market access often depends on informal and relationship-based channels. Even so, the market is active, and buyers place clear value on availability and freshness. This means that producers who can organize reliable production and delivery have a realistic basis for market entry. Seasonal fluctuations further strengthen this opportunity, especially when imported supply becomes more expensive or less consistent.

From a production perspective, horticulture in Jubaland is technically feasible, particularly in the irrigated riverine areas along the Juba River. The agro-climatic conditions offer potential for irrigated production, but they are also demanding. High temperatures, low and variable rainfall, and chronic heat stress mean that successful horticulture depends on careful management of irrigation, crop timing, and production systems. In practice, this favours a combination of improved open-field production, shade-net structures, and selected greenhouse cultivation for higher-value crops.

Soil and water conditions require active management, but do not prevent horticultural development. The study finds that irrigation water from the Juba River is generally suitable for crop production, provided that filtration, maintenance, and basic water treatment are applied. Soils across the sampled sites are characterised by high pH, low phosphorus, low nitrogen, and limited organic matter, indicating that structured soil improvement and nutrient management will be necessary. These constraints are manageable, but they do require deliberate technical planning from the outset.

Current horticultural production practices in Jubaland are still evolving. Smallholder production dominates, and irrigation methods, seed use, crop protection, and technical support systems are not yet strong enough to ensure consistent market-oriented supply at scale. This creates clear room for improvement. Better irrigation practices, improved seed, stronger crop management, and more structured technical support could significantly improve productivity and consistency.

The study concludes that the proposed NLA commercial pilot plot is feasible and well positioned as a first commercial model. The selected site near the research centre offers a suitable basis because of its layout, water access, relative shelter, proximity to the research centre, and comparatively better soil characteristics than the alternative site. At the same time, successful implementation will depend on

putting the full operational system in place from the start, including irrigation infrastructure, soil improvement, filtration, crop protection, fencing, nursery capacity, and post-harvest handling.

The proposed production model combines greenhouse and shade-net/open-field production and is designed first and foremost as a commercially oriented horticultural model for the Kismayo market. Its primary aim is to organize local vegetable production in a commercially relevant way that can generate income for NLA. Training, demonstration, and wider farmer learning are important additional functions in a later stage, but they are intended to be built around a commercially functioning production system.

To support this commercial logic, an indicative business projection was developed and submitted alongside this report. Based on the proposed crop calendar and scenario analysis, the projection suggests that the model has clear revenue-generating potential under conservative, base, and optimistic assumptions. These figures should be interpreted as indicative planning estimates rather than fixed forecasts, but they strengthen the conclusion that the proposed plot can serve as a realistic commercial starting point.

Overall, the study concludes that market-led horticultural development in Jubaland is promising, and that the proposed NLA plot offers a practical and well-positioned starting point. The conditions for success are present, but they depend on treating the plot as a complete commercial system from the outset, in which production, technical management, input supply, and market linkage are developed together rather than separately.

1. Introduction

1.1 Background and context

Jubaland is widely regarded as one of Somalia's most important agricultural regions, mainly because of the presence of the Juba River, relatively fertile production areas, and the strategic role of Kismayo as a commercial and logistical hub. Agriculture plays a central role in livelihoods and in the wider Somali economy, and several stakeholders consulted for this study identified the Juba Valley corridor, particularly Lower and Middle Juba, as an area with comparatively strong potential for irrigated agriculture and horticultural development.

At the same time, the agricultural sector in Jubaland faces structural constraints that limit both productivity and the development of more reliable market-oriented production systems. These include climatic shocks such as droughts and floods, weak irrigation and transport infrastructure, limited access to quality inputs, insufficient extension and technical support services, and underdeveloped market and post-harvest systems. As a result, agricultural potential in the region is only partly utilized, and there is still a significant gap between the sector's potential and its current performance.

Within this broader agricultural context, horticulture presents a potentially important opportunity. Fruits and vegetables can contribute to food availability, dietary diversity, income generation, and local economic activity, particularly in and around urban markets such as Kismayo. There are also indications that part of the demand for fresh produce is currently met through imports, suggesting opportunities for local production if supply can be improved in terms of reliability, quality, and market fit. At the same time, horticultural production is generally more sensitive than staple crop production to water access, production management, input quality, post-harvest handling, and market timing. This means that any effort to promote horticultural development needs to be based on a realistic understanding of both opportunities and constraints.

A further reason for undertaking this study is the interest in developing an NLA-linked horticultural plot near Kismayo as a commercially oriented pilot. The intention is not only to create a site for commercial, training, and practical learning, but also to establish a working production model for the local market that can show what is commercially viable under the conditions of the NLA site. In addition, the horticultural plot is envisioned as a sustainable source of income for NLA, contributing to the organization's long-term financial stability and self-reliance. In this context, it is important to assess whether the surrounding market, production, and operational environment is sufficiently favourable, which crops and production systems are most suitable, and what conditions need to be in place for such a plot to function effectively.

Against this background, the feasibility study was commissioned to provide an evidence-based assessment of the potential for market-led horticultural development in Jubaland. The study is intended to assess not only whether opportunities exist, but also whether these opportunities are technically feasible, commercially relevant, and operationally realistic. In doing so, it aims to provide a practical basis for decision-making on future investments in the horticultural sector, including the establishment of an NLA-linked commercial pilot plot that can supply the local market while generating practical lessons for future scaling and farmer training.

1.2 Objectives, scope and key questions

The objective of this feasibility study is to assess the potential for market-led horticultural development in Jubaland, Somalia, by examining whether horticultural production can be technically feasible, commercially relevant, and operationally realistic under local conditions. The study is also intended to inform practical decision-making on possible next steps for investment and implementation, including the potential development of an NLA-linked commercial plot near Kismayo.

In line with the agreed study scope, the assessment is structured around three interrelated components: (i) market and value chain analysis, (ii) production systems feasibility, and (iii) feasibility of an NLA-linked plot. Together, these components are intended to provide a practical basis for assessing not only whether horticultural opportunities exist, but also what would be required to translate them into realistic interventions or investments.

The study is guided by the following key questions:

Market and value chain analysis

- What vegetables are currently supplied to Kismayo and surrounding markets, and from where, including imports and domestic flows?
- Who are the main market actors, and what are the main trading routes?
- What do buyers require in terms of quality, volumes, consistency, and pricing?
- How do prices move across seasons, and how volatile are they?
- Where could local production compete, and what are the main market risks?

Production systems feasibility

- What are the agro-climatic conditions and seasons relevant for horticulture in the target areas?
- What are the soil and water conditions for production?
- What are the main production risks, including pests and diseases, and what is feasible in terms of integrated pest management?
- What high-quality inputs and services are available locally or can be imported, and what availability constraints affect reliable production?
- Which production models are feasible in the region, ranging from improved open-field systems to low- or mid-tech protected cultivation?

NLA-linked commercial plot feasibility

- What is the site-specific soil and water quality?
- Which crops and production systems are most appropriate for the plot, based on market demand and feasibility findings?
- What agronomic knowledge and technical capacity is available in the region to make the plot operationally feasible?

- What would a realistic layout and production calendar look like?
- How can produce be stored, and how does the logistical system around NLA function?
- Under what conditions could the plot produce marketable crops, considering the broader market findings?

Together, these questions provide the analytical basis for assessing whether, where, and under what conditions market-led horticultural development can be advanced in Jubaland.

1.3 Report structure

This report is structured as follows. Chapter 2 sets out the methodology and assessment framework applied in the study, including the main data collection methods, stakeholder consultations, and the key criteria used to assess feasibility. Chapter 3 presents the market and value chain analysis, focusing on demand, supply structures, market actors, buyer requirements, and opportunities for local horticultural production. Chapter 4 examines production and operational feasibility, including agro-climatic conditions, soil and water suitability, production constraints, input and service availability, and the broader operational environment for horticultural development. Chapter 5 translates these findings into the specific context of the proposed NLA-linked commercial plot, assessing its practical relevance, feasibility, and implementation requirements. Chapter 6 concludes the report by summarizing the main findings and presenting recommendations for future action. Additional supporting information is provided in the annexes.

2. Methodology and assessment framework

2.1 Study approach and methods

This feasibility study applied a mixed-methods approach combining desk-based analysis, stakeholder consultation, and field-based assessment. The study was designed to assess horticultural feasibility from multiple angles, recognizing that market potential, production conditions, and operational realities are closely interlinked and cannot be assessed in isolation.

The overall approach followed the three main components set out in the study scope: market and value chain analysis, production systems feasibility, and feasibility of an NLA-linked commercial plot. The study therefore combined different methods in sequence. First, a desk review was undertaken to establish the broader context and identify key themes for investigation. Second, stakeholder interviews were used to gather practical insights, validate emerging assumptions, and identify issues requiring further follow-up. Third, a field mission was conducted to verify selected findings on the ground, observe current market and production conditions, and assess the practical relevance of a possible commercial plot. The study also incorporated technical assessment of site conditions, including soil and irrigation water sampling, to support the analysis of production suitability and commercial plot feasibility.

The study was intended not only to collect information, but also to assess feasibility in a practical and decision-oriented manner. For that reason, evidence from different sources was considered together rather than separately. Market information was interpreted alongside technical and operational considerations, while observations from the field were used to test and refine findings from interviews and desk research. This made it possible to assess not only whether opportunities exist in theory, but also whether they appear realistic under local conditions.

2.2 Data collection and stakeholder consultation

As mentioned in section 2.1, data for this study was collected through three main channels: desk research, interviews with relevant stakeholders, and a field mission in Jubaland. Together, these sources provided the evidence base for the feasibility assessment.

The desk research component involved a structured and thematic review of available literature to establish the broader context for horticultural development in Jubaland, Somalia. The process began by identifying key focus areas aligned with the study objectives, including agro-climatic conditions, soil and water resources, market systems, input availability, and institutional support. Relevant sources were then identified through targeted online searches and a review of publications from reputable development and research institutions, including the Food and Agriculture Organization (FAO), World Bank, FEWS NET, and Food Security and Nutrition Analysis Unit (FSNAU), as well as reports from implementing partners such as GIZ and other NGOs active in the region.

Interviews were conducted with a range of stakeholders relevant to the study questions, including representatives from the Federal Ministry of Agriculture, the Jubaland Ministry of Agriculture, development actors, and other technical or sector experts with experience in agriculture, irrigation, extension, market systems, and horticultural development in Somalia. These consultations provided insights into production patterns, irrigation practices, extension systems, market opportunities, investment constraints, and the broader enabling environment for horticultural development.

The field mission in Jubaland complemented the desk research and interviews with direct observations from the study area. During the visit, the team reviewed local market conditions, visited farms and a small processing initiative, assessed the proposed NLA commercial plot site, and discussed practical opportunities and constraints with local actors. The field mission also included soil and irrigation water sampling to support the assessment of production suitability and crop selection for the commercial plot. Soil testing was carried out using two complementary approaches: conventional laboratory analysis of soil samples and satellite-based soil assessment.

2.3 Feasibility assessment framework

The study does not only describe the current situation of horticulture in Jubaland, but also assesses whether market-led horticultural development is feasible under local conditions. To do so, findings from the desk research, stakeholder consultations, and field mission were assessed against three practical feasibility criteria. Table 1 below summarizes the criteria used and the main aspects considered under each.

Table 1: Summary of Assessment Criteria and Key Considerations

Feasibility criterion	Description	Assessment parameters
Market potential and competitiveness	The extent to which a crop or value chain shows clear demand and realistic commercial potential, and whether local production in Jubaland could compete within the current supply system.	• Demand patterns • Supply gaps • Pricing • Product quality • Market access constraints
Technical and environmental suitability	The extent to which a crop or production model is agronomically suitable under local conditions.	• Agro-climatic conditions • Seasonality • Soil suitability • Water availability and quality • Pest and disease risks
Operational feasibility	The extent to which production and marketing are practical under current conditions.	• Access to inputs • Extension and technical support • Labor • Infrastructure and logistics • Post-harvest handling • Security

Together, these criteria provide the analytical basis for assessing feasibility across the three main components of the study: market and value chain opportunities, production and operational feasibility, and the feasibility of an NLA-linked commercial plot. Rather than treating these dimensions separately, the framework allows them to be considered in an integrated way. This is important because horticultural opportunities that appear attractive from a market perspective may still face major technical or operational constraints, while technically feasible production options may not be commercially attractive.

2.4 Limitations of the study

This study has a number of limitations that should be considered when interpreting the findings. First, reliable quantitative data on production, markets, and trade in Jubaland is limited. The analysis therefore draws mainly on interviews, field observations, and available background documents. This provides a strong practical basis for the assessment, but some findings remain indicative.

Second, the study focuses primarily on Kismayo and the surrounding areas most relevant to the proposed intervention. Field visits in this area included traders in Istanbul Market and Kismayo town, three farms in Luglow, a tomato processing facility in Goobweyn, and production areas along the Juba River. The findings should therefore be understood mainly in relation to this target geography, rather than as a definitive assessment of all parts of Jubaland.

Third, horticultural production systems in Jubaland are still relatively underdeveloped and vary considerably between locations and producers. As a result, findings from one site or production setting cannot automatically be generalized to other areas.

Overall, the study provides a solid basis for decision-making, while also showing the importance of considering local variation and using caution where evidence is based on limited existing data.

3. Market and value chain opportunities

3.1 Market demand and supply structure

The findings of this study indicate that Kismayo already has clear and established demand for fresh produce, but that this demand is not yet met consistently through local production. In practical terms, this means that the main market opportunity for horticulture in Jubaland is not the creation of new demand, but the ability of local production to supply an existing market more reliably in terms of volume, quality, and continuity.

The field mission confirmed that Kismayo functions as an important consumption market for fresh produce. Vegetables such as tomatoes, potatoes, and onions were widely observed in the market, but much of this produce was reported to come from Kenya, often transported by boat. At the same time, local production was present but more limited in range and consistency. Onions were the most commonly observed locally available vegetable, while tomatoes and green capsicum appeared in smaller quantities. Leafy vegetables were largely absent, which appears linked to their perishability and the absence of cooling and post-harvest handling systems. Overall, the field visit suggests that effective demand is already there, but that local production is not yet supplying the market consistently enough.

The interviews broadly confirm this picture. Bashir Yusuf identified onion and tomato as the main horticultural crops currently grown in Jubaland and noted strong demand for banana and mango alongside the main staple crops maize and sorghum. He also pointed out that imported produce can have an advantage when it is perceived as higher quality than local products. Maalim similarly described Kismayo as part of a wider trade system linking local production to regional and export markets, and referred to crops such as tomatoes, onions, and lemons as relevant products in the Juba Valley and Gedo. Together, these interviews suggest that the market already absorbs a range of fresh produce, but that local vegetables do not yet supply it as strongly or as consistently as they could.

Amina Osman adds an important qualification to this market picture. She emphasized that Jubaland is currently stronger as a fruit-producing area than as a vegetable-producing one. In her view, vegetable production does take place, but it is generally smaller in scale and more oriented toward household consumption and local markets such as Kismayo, rather than larger commercial systems. Fruits such as mango, coconut, lime, grapefruit, and banana have a stronger position in the wider horticultural landscape of the region. This suggests that, within horticulture, the immediate market opportunity for vegetables lies mainly in strengthening local supply to Kismayo, while fruits may represent a broader commercial opportunity in the wider Jubaland context.

This broader picture is also consistent with the literature reviewed for the study, which highlights the Juba basin as one of Somalia's main agricultural zones and points to the need for stronger market systems, value chains, and supporting services around production. In other words, both demand and production potential are present, but the local supply base is not yet strong enough to meet market demand consistently[1][2].

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[1] World Bank. Somalia Food Systems Resilience Project (P177816): First Implementation Support Mission Aide Memoire. 2023.

[2] World Bank. Somalia Food Systems Resilience Project (P177816): Second Implementation Support Mission Aide Memoire. 2025.

Taken together, the evidence points to a clear conclusion: Kismayo already offers a real market for fresh produce, but current supply still depends partly on imports because local production does not yet meet demand consistently. For the purposes of this feasibility study, that makes local market supply and import substitution the most relevant starting point for horticultural development in Jubaland.

3.2 Market actors, channels and buyer requirements

The Kismayo fresh produce market is active, but the channels through which produce moves are still developing. Produce reaches the market through a network of farmers, aggregators, transporters, traders, retailers, and final buyers. These linkages are present, but not yet highly structured, which means that market access often depends on informal relationships and practical arrangements rather than on well-organized value chains.

The interviews suggest that the connection between producers and markets remains one of the main constraints in the system. Bashir Yusuf noted that there are not enough transport companies, aggregators, or traders linking farmers to buyers, and that farmers and cooperatives often have limited access to market information. Maalim described a similar structure, explaining that produce from farmers typically moves through aggregators and middlemen before reaching traders and urban markets in Kismayo. Together, these interviews show that market channels do exist, but that they could be strengthened further to support more reliable commercial linkages.

The field mission supports this picture. It found that many vegetables sold in Kismayo are imported from Kenya, often by boat, with aggregators organizing bulk transport. At the same time, local market systems appeared strongly relationship-based and relatively informal. Traders often worked through trusted resale arrangements, which suggests that market exchange is active, but still depends heavily on personal networks and practical coordination between actors.

The market also includes several different buyer segments. Based on the field visit, demand comes not only from households and market retailers, but also from hotels, military bases, and small processors. This means that the Kismayo market is broader than a simple retail market and offers more than one possible entry point for local horticultural production.

In terms of buyer requirements, the evidence suggests that availability, freshness, and acceptable quality are more important than highly formal specifications. Bashir Yusuf noted that imported produce can have an advantage when it is perceived as higher quality than local crops. This indicates that buyers are sensitive to visible quality and consistency, even in a market that remains relatively informal. At the same time, the continued purchase of imported vegetables despite long transport routes suggests that buyers are willing to purchase produce that meets a practical standard of quality and is available when needed.

Osman adds an important structural point to this. She emphasized that horticultural development is influenced not only by production issues, but also by the limited availability of storage, cold chain, aggregation, processing, and quality support systems. This suggests that stronger local horticultural supply will depend not only on growing the right crops, but also on improving the systems that connect production to buyers.

Overall, the evidence suggests that Kismayo already has functioning market actors and channels, but that these are still evolving and are not yet strongly supported by infrastructure and services. For local horticultural development, this means that success will depend not only on crop production, but also on how effectively producers can connect to aggregators, traders, and buyers, and whether they can supply produce with the level of freshness, quality, and consistency that the market expects.

3.3 Seasonality, price dynamics and market gaps

The evidence collected for this study suggests that the main market opportunity in Kismayo is not simply the presence of demand, but the fact that supply is not stable throughout the year. Seasonality, transport conditions, and limited post-harvest systems affect when produce reaches the market and in what condition. For local horticultural development, this is important because the strongest opportunities are likely to arise where producers can supply fresh produce more reliably at times when the market is less well served.

A first point is that market supply in Jubaland is closely linked to seasonal production conditions. Agriculture in Somalia is shaped by the Gu and Deyr rainy seasons, with dry periods in between. FAO SWALIM[4] describes the year as divided into Jilaal, Gu, Hagaa, and Deyr, with Gu as the main rainy season and Deyr as the secondary rainy season. These seasonal patterns influence planting, water availability, and the timing of harvests, and therefore also affect the seasonal flow of produce into markets. In a context where irrigation is essential for horticulture, seasonal changes in rainfall and water availability continue to shape supply even where production is not fully rainfed.

The interviews confirm that prices and market conditions vary across the year. Bashir Yusuf described the market as unstable and noted that prices can be high at some times and low at others, with prices often increasing during Ramadan. This indicates that timing matters. Maalim also pointed out that products move across the Somalia–Kenya corridor depending on prices and demand, which suggests that local prices are influenced not only by local harvests, but also by cross-border trade conditions.

Broader monitoring data supports the view that Kismayo and Lower Juba are exposed to seasonal price pressure. Somalia's Joint Monitoring Report for December 2024 identified Lower Juba and Kismayo among the areas with heightened food and nutrition security risk alerts, including alerts linked to food prices and fuel prices[3]. While this report is not specific to horticultural crops, it does show that Kismayo operates in a market environment where price movements are influenced by wider pressures such as transport costs and supply conditions. This is highly relevant for horticulture, as vegetables are especially sensitive to delays, losses, and cost increases along the chain.

The field mission adds an important practical dimension to this. It confirmed that many vegetables sold in Kismayo are imported from Kenya, often by boat, while local production remains limited in range, quantity, and consistency. This means that the market is already compensating for local supply gaps through imports. The most relevant gaps therefore appear not to be the total absence of produce, but

[3] Somalia Joint Monitoring Report. Update on Food and Nutrition Security Crisis Risks, December 2024 – Report #2. Mogadishu, 2024.
[4] FAO-SWALIM (Food and Agriculture Organization), Water Resources of Somalia (Technical Report No. W-11), 2007.

the lack of reliable local supply, especially for fresh and more perishable vegetables.

These market gaps also differ by product type. Some crops are mainly supplied through imports, while others are produced locally but not yet consistently enough to supply the market. Highly perishable crops remain more constrained by limited cooling, storage, and handling systems. The limited presence of leafy vegetables in the market is a clear example of this, as their availability seems to be constrained less by demand than by the difficulty of handling and preserving them under current conditions. Osman's observation that vegetable production in Jubaland is still largely oriented toward household use and local market supply, rather than larger commercial systems, fits this picture and suggests that the main gap is not demand itself, but the ability to respond to that demand in a consistent and commercially organized way.

Overall, the evidence points to three main areas of opportunity: import substitution for vegetables already demanded in the market, stronger local supply of crops that are currently available only inconsistently, and better-timed local production during periods when imported supply becomes more expensive or less reliable. This suggests that seasonality and market timing will be important in determining which crops are commercially attractive.

For the purposes of this study, the main implication is that market-led horticultural development in Jubaland should not be assessed only in terms of annual demand, but in terms of when supply gaps occur, which products are most affected, and whether local producers can use irrigation, crop planning, and better market timing to respond to those gaps. In other words, the opportunity lies not only in producing locally, but in producing at the right time and in a way that fits the specific weaknesses of the current supply structure.

3.4 Crop prioritization and operational feasibility

As mentioned in previous section, the strongest immediate market opportunity for horticulture in Jubaland appears to lie in supplying the local Kismayo market with products that are already consumed in significant quantities, but for which supply is not yet consistently met by local production. In practical terms, this points first to vegetables that are currently imported or only available in limited quantities locally, and second to crops that are both marketable and realistic to produce within the area. The purpose of this subsection is therefore not to make a final agronomic recommendation, but to identify which crops appear most promising from a market perspective at this stage.

A first conclusion is that tomatoes, onions, and other commonly consumed vegetables show clear market relevance. During the field visit, tomatoes, potatoes, and onions were widely present in the Kismayo market, with much of the supply reported to come from Kenya. This suggests that these products already have an established market and that local production could potentially compete if it can deliver sufficient freshness, quality, and consistency. Onions were the most common locally available crop observed during the visit, while tomatoes and green capsicum were present in smaller quantities. This points to an existing vegetable market in which some crops are already familiar to traders and consumers, but where local supply remains limited.

The interviews support this picture. Bashir Yusuf identified onion and tomato as the main horticultural crops currently grown in Jubaland and noted clear demand for them in the local market. Maalim similarly referred to onions, tomatoes, lemons, and other horticultural products as important crops in the Juba Valley and Gedo, while also pointing to increasing relevance of crops such as capsicum, watermelon, and lettuce. Together, these interviews suggest that the market already recognizes several vegetable crops and that the main issue is less whether the crops are marketable, and more whether they can be supplied at the right quality and time.

The interviews also suggest that fruit crops should not be overlooked. Osman emphasized that Jubaland is currently stronger as a fruit-producing area than as a vegetable-producing one, and identified mango, grapefruit, coconut, lime, and banana as key crops in Middle and Lower Juba. From a broader market perspective, this suggests that the region already has comparative strength in horticulture beyond vegetables. However, for the purposes of the proposed NLA-linked commercial plot, the most immediate opportunity may still lie in vegetables for the local market, because these products offer a clearer link to import substitution, shorter production cycles, and more visible commercial value for training and proof of concept. Fruit crops may still be relevant in a broader long-term strategy, especially where they already fit existing production systems and market channels.

The field trip findings support a cautious but practical market prioritisation. The high-level conclusion from the visit was that horticultural development in Jubaland is promising, driven by strong unmet demand and clear room for import substitution, but that the NLA plot should first focus on the local market and establish a viable business model before exploring processing or export opportunities. Preliminary thinking from the field team suggested greenhouse crops such as tomatoes, sweet peppers, cucumbers, and possibly melons as promising options, while for open-field production crops such as cabbage may be suitable during cooler periods. These suggestions are consistent with the market evidence collected during the study, though they still need to be confirmed against technical suitability and the economics of production.

Based on the market findings, crop prioritisation at this stage can be summarized in three broad groups. The first group consists of priority vegetables for local market supply and import substitution, especially tomato, onion, sweet pepper, cucumber, and cabbage. These crops combine clear market demand with good potential for stronger and more consistent local supply. The second group consists of secondary or opportunity crops, including sweet melon, green capsicum, lettuce, spinach, carrot, and potato. These crops also appear relevant for the local market, but their commercial potential is somewhat more dependent on factors such as perishability, handling, consistency of supply, or stronger evidence of demand. The third group consists of broader horticultural opportunities, particularly lime and lemon, which show strong commercial potential in the wider Jubaland context, including possible trade opportunities, but are less central to the immediate local vegetable market focus.

Table 2: Crop Prioritisation by Market Segment and Commercial Potential

Crop	Market attractiveness	Main rationale
Tomato	*High*	Strong demand in Kismayo, visible imports, and clear opportunity for stronger local supply.
Onion	*High*	Established local demand and strong market familiarity, with relevance for both local production and import substitution.

Crop	Market attractiveness	Main rationale
Sweet pepper	*High*	Attractive higher-value vegetables with room for stronger and more consistent local supply.
Cucumber	*High*	Promising for local fresh market supply and identified as a crop with clear market potential.
Cabbage	*Medium–High*	Positive market potential, especially for local market supply and relatively broad consumer familiarity.
Sweet melon	*Medium–High*	Positive market potential and relevant as a higher-value crop for local supply.
Green capsicum	*Medium–High*	Relevant for the fresh market and likely attractive where quality and consistency can be improved.
Lettuce	*Medium*	Some market potential, but more constrained by perishability and handling requirements.
Spinach	*Medium*	Likely demand exists, but perishability and limited cooling should be addressed.
Carrot	*Medium*	Relevant as a local market vegetable, though current evidence of market strength not proven yet, demand is expected.
Potato	*Medium*	Present in the Kismayo market and relevant for local consumption, though its role in local horticultural production appears less prominent than some other vegetables.
Lemons	*High*	Strong broader commercial potential, including trade potential, and already recognized as an important fruit crop in the region.

Overall, the market evidence suggests that crop prioritisation should remain closely tied to the logic of local market entry, import substitution, and commercially viable supply. The strongest candidates are crops that are already well known in the Kismayo market, that can replace part of the current imported supply, and that can be marketed within the current level of infrastructure and buyer expectations. The next step is therefore to assess these market-priority crops against the technical and operational realities discussed in Chapter 4, before narrowing them further for the proposed NLA plot.

4. Production and operational feasibility

4.1 Agro-climatic conditions

Jubaland offers potential for horticulture, especially in irrigated riverine zones along the Juba River, but production conditions are also marked by clear climatic stresses that need to be taken into account in crop and production system selection. The region falls within Somalia's predominantly arid to semi-arid climatic zone, with high temperatures, low and variable rainfall, and a strong dependence on seasonal patterns and water access. In practice, this means that horticultural production is possible, but not without careful management of water, heat, and seasonal risk.

As mentioned before, Somalia has distinct production seasons. FAO-SWALIM mentions that a key feature of the agro-climatic context is the division of the year into two rainy seasons and two dry seasons. The Gu season (April to June) is the main rainy season and is generally the most important period for planting and crop establishment. The Deyr season (October to December) provides a second, shorter rainfall window and can support an additional cropping period. These are followed by the dry seasons of Hagaa (July to September) and Jilaal (December to March), during which rainfall declines and water stress becomes more pronounced[5]. This seasonal pattern has direct implications for production planning, irrigation demand, crop choice, and the timing of market supply.

An important distinction within Jubaland is the difference between riverine and non-riverine production areas. Along the Juba River, surface water makes irrigated production possible and creates much stronger potential for horticulture than in inland, rainfed areas. Riverine areas therefore offer the most realistic conditions for more intensive and market-oriented horticultural production. By contrast, inland areas remain more exposed to rainfall variability and are less suitable for reliable horticultural production unless additional water access or water-harvesting measures are available.

A particularly important constraint in Jubaland is chronic heat stress, especially during the Jilaal season, which is considered one of the hottest periods of the year. During this period, temperatures can rise above 30–35°C, while many vegetable crops perform best at lower temperatures, roughly in the range of 18–28°C. Under such conditions, heat stress can directly reduce crop performance through flower abortion, lower fruit set, faster evapotranspiration, and more rapid drying of the soil. This means that heat management should be treated as an important part of horticultural planning in the area, particularly for sensitive vegetable crops.

The interviews confirmed that climate variability is one of the main constraints affecting agriculture in Jubaland. Ahmednoor Abdi described droughts, floods, and unreliable seasons as some of the most important environmental challenges affecting agricultural production in the region. He noted that although the land is fertile, production is repeatedly affected by these shocks, especially in Lower Juba, Middle Juba, and Gedo. Maalim similarly identified climate variability as one of the largest constraints for the sector, emphasizing that rainfall has become less reliable and droughts more frequent. Osman also referred to increasing heat, falling river levels, and very dry soils as major constraints, even in areas with access to water. Together, these interviews suggest that horticultural potential in Jubaland is real, but that it exists within a production environment increasingly shaped by climatic uncertainty.

The field mission supports this picture. Observations from the visit suggest that water availability and irrigation access are central to crop performance, while high temperatures and dry conditions place clear stress on production systems. These conditions are particularly relevant for horticultural crops, which are generally more sensitive than staple crops to heat stress, irregular watering, and fluctuations in growing conditions.

At the same time, the agro-climatic environment creates different types of production risk across the year. Flooding was repeatedly mentioned as a challenge in riverine areas, especially in parts of Lower Juba, including around Kismayo and Jamame. In contrast, drought and prolonged dry conditions reduce production reliability and place greater pressure on irrigation systems and water management. High temperatures further increase evapotranspiration, which means that even in irrigated areas, water needs can be substantial and irrigation systems must be managed efficiently to avoid crop stress and unnecessary water loss.

Overall, the agro-climatic conditions in Jubaland can be described as favourable in principle for irrigated horticulture in the riverine zone but demanding in practice. The main implication is that horticultural development should focus on crops and production systems that are suited not only to market demand, but also to the realities of seasonal rainfall, chronic heat, and irrigation dependence in the Kismayo and Juba River environment.

4.2 Soil, water, and irrigation conditions

The main production areas relevant to this study are located in the riverine zone around the Juba River, which is the primary source of water for agricultural production in Jubaland, especially for horticulture and other irrigated crops. Osman explained that most horticultural production in Jubaland depends on irrigation and that river-based systems remain central to crop production in practice. In terms of irrigation practice, findings point to flood and furrow irrigation as the dominant systems currently in use. More modern systems such as drip and sprinkler irrigation are present, but appear to be limited to a smaller number of larger farms or project sites.

To assess actual conditions at the NLA site and surrounding area, irrigation water was sampled from the Juba River and soil samples were collected from four locations: the NLA Tank Area (Field 1), NLA Research Area (Field 2) ,the Juba River soil sample (Field 3), and the Horn Agro partner farm (Field 4). All samples were analysed by Crop Nutrition Laboratory Services (CropNuts, April 2026). Satellite-based soil organic carbon mapping was also carried out across the NLA plot and the wider Juba River corridor to provide additional spatial context. The findings from each of these sources are discussed below.

4.2.1 Irrigation water quality

The analysis of irrigation water from the Juba River indicates that it is generally suitable for horticultural production in Jubaland, but that a number of parameters require active management to ensure reliable and efficient use. A summary of the key results is presented in Annex 2.1.

The interpretation of the water analysis is based on reference thresholds used by Crop Nutrition Laboratory Services (CropNuts), which apply irrigation water quality guidelines developed by the Food and Agriculture Organization (FAO) as a basis for assessing agricultural suitability.

The overall water quality can be considered acceptable. The pH (8.06) and electrical conductivity (0.72 mS/cm) fall within suitable ranges, while nutrient levels are low to moderate. In practice, this means that crop nutrition will need to be supplied primarily through fertilizers rather than through the irrigation water itself.

At the same time, some parameters require attention over the longer term. Calcium (66 ppm) and sodium (64 ppm) are slightly elevated, and bicarbonate levels are relatively high (121 ppm compared to a recommended maximum of approximately 90 ppm). These conditions can gradually increase soil pH and reduce nutrient availability, affecting crop performance if not managed.

Sulphur (41.5 ppm) and sulphate (124 ppm) levels are also elevated compared to recommended thresholds. However, at the observed concentrations, these are not expected to create immediate constraints for horticultural production, although they should be monitored over time as part of overall water quality management.

The main operational constraint is the very high turbidity of the water (approximately 96 NTU compared to a recommended maximum of 10 NTU), reflecting a high load of suspended particles. This is consistent with the location in the lower reaches and delta zone of the Juba River, where sediment levels are typically higher. Without treatment, these particles can clog irrigation systems, particularly drip irrigation, leading to uneven water distribution. In addition, high water hardness (225 ppm $CaCO_3$) increases the risk of mineral deposits in irrigation equipment.

These findings indicate that the use of Juba River water is feasible, but requires appropriate irrigation management. Filtration is essential to remove suspended solids, while regular system maintenance is needed to prevent clogging. Where drip irrigation is applied, basic water treatment such as acidification may be required to manage bicarbonate levels and reduce scaling.

More broadly, as irrigation water across the region is largely sourced from the Juba River, similar water quality characteristics can be expected across the riverine production areas of Jubaland. While local variation may occur, the overall pattern is likely to be representative.

In the context of this feasibility study, the main implication is that water availability is not a limiting factor for horticultural development in Jubaland. On the contrary, the presence of a consistent and permanent water source in the Juba River represents a strong comparative advantage for irrigated production in the region. Horticulture is therefore technically feasible, provided that irrigation systems are properly designed and managed to address the identified constraints.

4.2.2 Soil conditions

The soil analysis results from the four sampled plots provide a useful indication of the broader soil conditions relevant for horticultural development in the Jubaland study area. While conditions vary between locations, the results reveal a number of common patterns that are important for horticultural production and soil management. This section therefore focuses on the overall soil picture across the sampled sites, while the site-specific implications for the NLA commercial plot are discussed separately in Chapter 5. The guideline ranges used for interpretation are based on average suitability thresholds across horticultural crops; for crop-specific recommendations, these should be refined further. The full laboratory soil test results generated by CropNuts are presented in Annex 2.2.

A first and important finding is that soil pH is consistently high across the sampled sites. Based on the overall results, the average pH is around 8.47, which is well above the range generally considered suitable for most horticultural crops. Most vegetable crops perform best in slightly acidic to neutral soils, and nutrient availability declines under strongly alkaline conditions. In practical terms, this means that high pH is likely to be one of the main underlying soil constraints for horticulture in the study area.

This suggests that pH correction should be treated as a priority by farmers and the Ministry of Agriculture. Where irrigation systems are in place, acidification of irrigation water can be used to reduce alkalinity and help manage pH-related problems. Sulfuric acid and phosphoric acid are both relevant options for this purpose, provided that application is carefully managed and regularly monitored. In addition, incorporation of organic matter, including compost or manure, can help improve soil structure, biological activity, and nutrient buffering, while also supporting gradual improvement of soil condition over time.

A second broad finding concerns the three primary macronutrients: nitrogen (N), phosphorus (P), and potassium (K). The results indicate that phosphorus is consistently low across the sampled plots. This is a significant limitation for horticulture, because phosphorus is essential for root development, early crop establishment, and overall crop vigour. Under alkaline conditions, phosphorus availability is reduced further, which means that low phosphorus and high pH reinforce each other as constraints. This suggests that phosphorus correction should form part of any soil improvement programme, both through direct phosphorus application and through longer-term measures such as compost development and organic matter incorporation.

Nitrogen also appears low across the sampled sites. This points to generally low soil fertility and limited organic matter turnover in the production environment. In practical terms, this means that horticultural production will require active nitrogen management rather than relying on inherent soil fertility. Organic matter addition, compost incorporation, mulching, and crop residue management are all relevant measures to improve nitrogen supply and broader soil function over time.

By contrast, potassium appears to be within an acceptable range in the sampled sites. Based on the current results, potassium does not emerge as one of the primary limiting nutrients for horticultural establishment. This suggests that soil improvement efforts should focus more strongly on pH correction, phosphorus, nitrogen, and organic matter than on potassium at this stage.

A third set of findings concerns the secondary nutrients, particularly calcium, magnesium, and sulphur. Calcium varies between locations but is generally within range or on the higher end. Magnesium also varies between sites and should therefore be assessed in relation to individual field conditions rather than treated as a uniform area-wide issue. Sulphur appears to be adequate across the sampled sites and does not currently emerge as a priority deficiency constraint.

The results also point to a broader issue with micronutrient availability. Iron, zinc, and copper appear generally low, while boron appears high. For iron, zinc, and copper, the high soil pH is likely to be a major part of the explanation, since alkaline conditions reduce the availability of several micronutrients to plants even when they are present in the soil. This means that part of the micronutrient constraint may be linked to pH management rather than to micronutrient supply alone. Boron should be treated more cautiously: where levels are already high, this should be monitored closely during crop selection and fertilization planning, because boron can move from sufficiency into toxicity more easily than many other micronutrients.

Overall, the soil results across the four sampled sites suggest that the main area-wide soil constraints for horticultural development in Jubaland are high pH, low phosphorus, low nitrogen, and low organic matter, with additional variation in magnesium and micronutrients between locations. Potassium and sulphur do not currently appear to be the main limiting factors. This means that preparing land for horticulture in the study area will require a structured soil improvement approach focused first on pH management, phosphorus correction, and organic matter building, supported by crop-specific nutrient management once production begins.

In addition to the chemical soil analysis, a pathology screen was conducted to assess the presence of important soil-borne pathogens relevant for horticultural production in the Jubaland study area. The results show that soil suitability in the area is not only a matter of fertility, pH, and irrigation conditions, but also of plant health risks that may affect crop establishment and performance. The pathology results indicate that soil-borne disease pressure is present across the study area. In particular, Pythium spp. was detected in multiple sampled soils. Pythium is associated with damping-off, root rot, and seedling collapse, especially under moist, poorly drained, or over-irrigated conditions. This is particularly relevant for horticultural systems that depend on nursery production and transplanting, as young seedlings are most vulnerable during the establishment phase. From a practical perspective, these results do not prevent horticultural development, but they do imply that nursery hygiene, drainage, irrigation control, and preventive disease management need to be built into production systems from the outset. In particular, seedling production, propagation areas, and soil handling practices will require close attention if disease risks are to be kept under control. More broadly, the pathology findings reinforce the conclusion that commercially viable horticulture in Jubaland will depend not only on access to land and water, but also on disciplined technical management of crop health.

4.3 Current production practices and agronomic constraints

Current production practices in Jubaland are shaped by a distinction between riverine and inland farming systems. Along the Juba River, farming is more oriented toward crop production and offers stronger conditions for irrigated and market-oriented agriculture. Inland areas are more closely linked to agro-pastoral and rainfed production systems. At the same time, the interviews suggest that much of agricultural production in Jubaland is carried out by smallholder farmers, especially in the Juba River corridor. Bashir Yusuf described agriculture in Jubaland as mainly based on smallholder farming around the Juba River, while Maalim distinguished between the more commercial riverine systems and the more subsistence-oriented inland systems. This distinction is important because the production practices most relevant to horticulture are concentrated mainly in the riverine zone.

The crops currently produced reflect both food security needs and local market demand. Staple crop production is centred on maize and sorghum, while horticultural production includes crops such as onion, tomato, cabbage, cucumber, sweet pepper, chili, and a range of fruit crops. However, the interviews suggest that vegetable production is generally still limited in scale and mainly oriented toward household use or supply to nearby markets rather than larger commercial systems. Osman noted that vegetables in Jubaland are typically produced on a smaller scale, while fruit production plays a stronger role in the wider horticultural landscape of the region.

The fieldwork undertaken as part of this study supports this general picture. Local production was observed, but it appeared limited in range, quality, and consistency compared to imported produce available in Kismayo. On-farm observations also suggested that production practices remain relatively basic in many settings. Irrigation was observed through flooding and trenches, while more intensive systems such as drip irrigation and greenhouse production were present only in limited cases. This indicates that more intensive horticultural production models are being introduced in some places but are not yet widely established.

A number of agronomic constraints emerged from the interviews and field observations. One is the way irrigation is currently applied in practice. As discussed in the previous section, irrigation methods observed during the fieldwork did not always appear to support efficient water use or even water distribution. This is relevant at farm level because it affects root-zone moisture, crop performance, and the practical management of horticultural crops. Concerning the chronic heat stress that was mentioned in 4.1, it is important to mention that crop performance does not only depend on irrigation availability, but also on how well production systems manage heat stress at field level. Measures such as mulching, soil moisture conservation, and careful adjustment of planting calendars are important in improving crop performance under local conditions.

The way irrigation is currently applied in practice has direct implications for crop performance at farm level. Flood and furrow irrigation, the dominant methods observed in the study area, tend to distribute water unevenly across a field, which can lead to variation in plant performance, affect fruit set and yield, and increase the risk of waterlogging in lower-lying areas. Repeated flood irrigation can also cause surface crusting over time, reducing water infiltration and creating less favourable conditions for root development. For fertilizer efficiency, broadcast or furrow-applied nutrients risk being moved away from the root zone before the crop can take them up, which is a particularly significant concern given the low phosphorus and nitrogen levels identified across the study sites. These limitations reinforce the case for drip irrigation at the NLA plot, where more precise water and nutrient delivery can support more consistent crop performance and make better use of the fertilizer inputs required to correct the soil conditions.

A second agronomic constraint relates to crop management and plant health. During the fieldwork, several pest-related issues were directly observed on farms, including the presence of whiteflies on vegetable crops - an indication of both pest pressure and potential viral disease risks. At the same time, crop-protection practices appeared limited or inconsistently applied, suggesting gaps in access to extension services, appropriate inputs, or regular monitoring routines. Although wildlife-related crop damage (e.g. monkeys) was not seen within the production fields during the visit, stakeholders noted that they may become a risk once cultivation expands, which would require close monitoring and preventive measures to avoid crop disturbance. While these observations do not yet provide a full pest and disease profile, they clearly show that pest pressure, potential wildlife-related risks, and uneven crop-management practices are relevant constraints that will need attention to improve productivity and consistency.

A third agronomic issue concerns seed use and crop performance at farm level. Field observations and interviews suggest that farmers often reuse seed over multiple seasons. This may affect uniformity, vigor, and overall crop performance, depending on the crop and the source of seed. At this stage, the study can identify seed reuse as a current production practice, but the practical implications for different crops should be specified more clearly in the agronomic interpretation.

The practical implications of seed reuse vary by crop type. For open-pollinated (OP) varieties of crops such as tomato, onion, cabbage, and pepper, seed saving is agronomically feasible in principle, but repeated reuse over multiple seasons tends to result in reduced vigour, lower germination rates, and increasing variability in plant uniformity, fruit size, and maturity - all of which matter for market-oriented production where consistency is important.

The situation is more problematic for hybrid (F1) varieties, which are the commercial standard for crops like tomato, cucumber, sweet pepper, and melon. When farmers save and replant seed from F1 plants, the resulting crop segregates genetically and the performance advantages of the original hybrid - uniformity, yield, disease resistance - are largely lost. For **onion** specifically, seed reuse carries additional risk because onion is cross-pollinating and seed quality degrades relatively quickly under warm storage conditions, making poor germination and uneven stands a common result.

For Jubaland, usage of certified, high-quality seed can strongly improve the quality and consistency of produce, particularly for greenhouse crops where F1 hybrid seed is the appropriate commercial choice. Demonstrating the yield and quality difference between certified hybrid seed and farmer-saved seed can itself be one of the most practical and visible training lessons for the lead farmers, this can be supported by extension services coming from the Jubaland Ministry of Agriculture.

More broadly, the fieldwork suggests that current horticultural production practices are still developing and that results depend heavily on farmer management, irrigation control, and practical crop management. This means that agronomic performance is shaped not only by environmental conditions, but also by how crops are managed in the field on a day-to-day basis. Current production practices in Jubaland point to a system with clear horticultural activity, but one that is still largely based on small-scale production and relatively simple on-farm systems. The main agronomic constraints identified at this stage relate to irrigation practice, seed use, crop management and pest pressure.

4.4 Input, service, and institutional support environment

The study indicates that the support environment for horticulture in Jubaland is present, but still developing. This applies both to the availability of production inputs and to the systems that support farmers through advice, training, and coordination. Interviews suggest that horticultural development is influenced not only by on-farm conditions, but also by whether farmers can access suitable seed, fertilizers, irrigation equipment, and practical technical support.

Access to quality inputs remains uneven. Osman noted that many vegetable seeds are imported, while some farmers continue to rely on locally saved seed. Bashir Yusuf similarly pointed to the need for better access to certified seed. Field observations also suggest that fertilizers, irrigation materials, and crop protection products are not always readily available or consistently used. This means that inputs are present in the system, but not yet available in a way that fully supports more intensive horticultural production. Extension and advisory support also remain limited. Osman explained that the former public extension system weakened significantly and that much of the current support is still provided through NGOs, development partners, and project-based activities. At the same time, she noted that the Ministry of Agriculture is rebuilding this system through new policy and district-level extension structures. Bashir Yusuf also stated that stronger farmer support systems and more trained staff are needed. Maalim referred to extension workers in some districts and to ongoing investment in research and extension facilities. Together, these interviews suggest that advisory support is available to some extent, but not yet at the level needed for broader horticultural intensification.

Development partners currently play an important role in this environment. Osman referred to farmer field schools, commercial plots, extension centers, and broader initiatives supported through projects such as FSRP and SBQA. Ahmednoor Abdi also mentioned the role of organizations such as WFP, LLGC, local organizations, and the Ministry of Agriculture. This suggests that farmer support in Jubaland currently depends on a mix of public institutions and project-based actors.

The interviews also point to a potential role for private-sector actors. Bashir Yusuf emphasized the need for stronger private involvement in input supply and market development, while Maalim referred to opportunities for local and foreign investment. For this study, that is relevant because any future horticultural intervention, including the proposed commercial plot, is likely to depend on practical collaboration between public actors, development partners, and private suppliers or service providers.

Overall, the findings suggest that the input, service, and institutional environment in Jubaland offers a base to build on, but still requires strengthening if horticultural production is to become more reliable and market-oriented. For horticultural development in Jubaland, these findings mean that input planning and technical support cannot be treated as background conditions that will be available when needed. Certified seed, fertilizers, and irrigation materials are not consistently available locally and will often need to be sourced from outside the region. Extension support remains uneven and largely dependent on project-based activities, which means that producers without access to NGO or development partner programs have limited technical guidance. Any intervention aiming to strengthen horticultural production will therefore need to build in practical input supply arrangements and technical support from the outset, and should look for opportunities to work alongside the public extension structures currently being rebuilt by the Ministry of Agriculture.

4.5 Post-harvest, logistics, and operational constraints

Post-harvest handling, transport, and day-to-day logistics emerged as some of the main constraints affecting horticultural development in Jubaland. The study suggests that these constraints do not only affect the movement of produce after harvest, but also shape what crops are realistic to grow, how far they can be marketed, and whether local production can compete with imported supply.
A consistent finding across interviews and field observations is that post-harvest systems remain limited. During the field mission, storage, cooling, packaging, and handling infrastructure were largely absent, and this was identified as a major bottleneck for perishable crops. The limited presence of leafy vegetables in the Kismayo market was one practical indication of this, as their short shelf life makes them especially difficult to handle without cooling or rapid distribution. Osman similarly emphasized the lack of storage, cold chain, processing, and aggregation facilities as a major constraint to horticultural development.

Transport and market logistics are also important constraints. Bashir Yusuf identified roads, transport, and market linkages as some of the main barriers in the sector, explaining that farmers often struggle to move produce to market and that the link between producers and buyers remains limited. Maalim also referred to weak roads, storage, and transport systems as important barriers affecting agricultural markets. These findings suggest that the challenge is not only production itself, but also the ability to move produce efficiently and in good condition from farm to buyer.

The fieldwork showed that security strongly affects these logistics. During the field trip, checkpoints and inspections were identified as a major challenge for transport, making movement slow, costly, and inefficient. Produce may need to be unloaded and reloaded repeatedly during transport, which is particularly problematic for fresh vegetables. The field notes also indicate that many vegetables entering Kismayo are imported from Kenya by boat, partly because this is seen as more practical than road transport. This means that operational feasibility for horticulture in Jubaland is closely tied to how produce, inputs, and people can move in practice.

These constraints also affect value addition. During the field mission, a small tomato paste operation run by a group of mostly women was visited. This showed that local processing and entrepreneurship do exist, but also that scale remains limited and expansion is constrained by transport and market access. The same applies more broadly to aggregation and market distribution: opportunities are present, but the surrounding logistical environment limits how far they can currently develop.

Overall, the findings suggest that post-harvest handling, logistics, and operational conditions are not secondary issues, but part of the core feasibility of horticultural development in Jubaland. Any intervention aiming to strengthen local production will also need to consider how produce is handled after harvest, how it reaches buyers, and which operational constraints may limit reliability and scale.

4.6 Feasible production models

The findings of this study suggest that horticultural development in Jubaland is most likely to be feasible through production models that are adapted to the local market, the riverine production environment, and the current level of technical and operational capacity. The study does not point to a single model that fits all situations. Rather, it suggests that different production models may be appropriate for different crops and purposes, depending on water access, management capacity, investment level, and the intended market outlet.

A first and most immediate model is improved open-field production under irrigation. This appears to be the most common and most accessible production model in the study area, particularly along the Juba River. It fits the current structure of smallholder and riverine farming and does not require the high investment levels associated with protected cultivation. At the same time, the fieldwork and interviews suggest that current open-field production could be strengthened significantly through improved irrigation design, better crop management, more suitable seed, and more consistent technical support. For crops aimed at the local market, this model is likely to remain an important entry point.

A second model is small-scale protected production, including greenhouse, shade net house and tunnels or similar controlled systems for selected high-value crops. This model was mentioned in both interviews and field observations as an emerging practice in Jubaland. Ahmednoor Abdi referred to greenhouse farming as one of the more promising climate-smart practices currently being introduced, and Osman also noted that greenhouse and hydroponic production is increasing in Somalia for some crops. The field trip findings likewise identified greenhouse crops such as tomato, sweet pepper, cucumber, and possibly melon as potentially promising for the NLA plot. However, this model is also more demanding in terms of technical management, irrigation reliability, input quality, and day-to-day supervision. It therefore appears more suitable as a targeted model for commercial, training, and selected commercial crops than as a broad first-line model for all producers.

A third model is commercial-based production linked to farmer training and practical learning. This model is particularly relevant in the context of the proposed NLA-linked plot. Several interviewees emphasized the need for practical farmer learning, and stronger extension support. Osman specifically suggested that activities should focus not only on showing crops, but on comparing improved varieties and demonstrating good agricultural practices under real conditions. In this sense, the demonstration model is not only a production model, but also a learning model in which production, training, and proof of concept are combined. This appears especially relevant in a context where technical knowledge and advisory support are still developing.

The findings also suggest that large-scale commercial horticulture may be possible in selected locations, particularly near Kismayo and along the Juba River, but that this would require stronger conditions than are currently present in most of the study area. Ahmednoor Abdi pointed to areas near Kismayo and the Juba River as suitable for larger-scale investment because of water access, fertile land, security, and market access. At the same time, the wider findings on irrigation performance, input access, extension capacity, logistics, and post-harvest handling suggest that such models would depend on stronger operational systems, reliable technical support, and a clearer business case than currently exists for most smallholder-oriented settings. For this reason, larger-scale commercial production may be better understood as a medium-term possibility rather than the most immediate model for the current intervention.

At this stage, the study suggests that the most feasible production models for the target area are likely to be those that combine practicality with gradual upgrading. In other words, the strongest options appear to be improved irrigated open-field production for crops suited to the local market, combined where relevant with small-scale protected production for selected high-value vegetables. For the NLA-linked plot, a hybrid model may be the most realistic: one that allows practical demonstration of improved open-field practices while also testing a limited protected production component for crops with higher market potential.

5. Feasibility of an NLA-linked commercial plot

5.1 Purpose and role of the commercial plot

Based on the findings from Chapters 3 and 4, the proposed NLA-linked commercial plot is intended to function as a commercial pilot plot for market-led horticultural production in Jubaland. Its primary purpose is to establish a practical and commercially viable production model that can supply the local market in Kismayo and generate sustainable income for NLA. In this sense, the plot is not primarily conceived as a demonstration or training site, but as a working production model operating under real market conditions at the NLA site.

The first objective is therefore to establish a functioning proof model for commercially oriented horticultural production. This means showing that vegetables can be produced reliably, at sufficient quality, and in a way that fits the market conditions of Kismayo. The emphasis in the first phase should be on building a model that works in practice: combining suitable crops, appropriate technology, and sound operational management in a way that creates a realistic income-generating activity for NLA.

At the same time, the plot can create a basis for practical learning and demonstration once the production model is functioning well. In that sense, training and knowledge transfer are relevant supporting functions, but they should be built around a commercially operating model rather than treated as the starting point. This distinction is important because the credibility and longer-term value of the plot will depend first on whether it can function as a reliable commercial production system.

The proposed plot should therefore be understood as a commercial pilot with broader demonstration value, not the other way around. Once the model is functioning successfully in practice and supplying the local market consistently, it can be gradually built out and used as a basis for broader outreach, additional market opportunities, and possible replication elsewhere.

5.2 Site-specific suitability and constraints

The fieldwork undertaken as part of this study identified a preferred location for the NLA commercial plot. Two potential sites were reviewed, and one was selected based on a combination of practical considerations, including relatively flat terrain, better shelter from wind, access to water, proximity to the research centre, soil analysis results and overall security. The selected site is large enough to accommodate at least two greenhouses as well as open-field production and possible future expansion. This provides a workable physical basis for the proposed plot concept.

A key strength of the selected site is that it appears suitable for establishing a combined production setup with both protected and open-field cultivation. The flat terrain is positive for plot layout, irrigation design, and practical management. The relative shelter from wind is also relevant, particularly for greenhouse placement and for reducing stress on young crops. In addition, proximity to the research centre supports the role of the site as a commercial pilot linked to training and learning, as it makes the plot more accessible for supervision, demonstrations, and engagement with the lead farmers.

Access to water was another important reason for selecting the site. This makes the location suitable in principle for irrigated horticultural production, but the practical implications still depend on the quality of the water source as summarized in Annex 2.1, the design of the irrigation system, and the reliability of water access over time. During the technical review, it was also noted that the available water is muddy, which is consistent with the irrigation water analysis. The results highlight several specific constraints that need to be addressed in the irrigation design. In particular, the very high turbidity (approximately 96 NTU) indicates a high load of suspended particles, which creates a direct risk of clogging in drip irrigation systems if no adequate filtration is applied. In addition, elevated bicarbonate levels (121 ppm) and high water hardness (225 ppm $CaCO_3$) increase the likelihood of mineral deposits forming in pipes, valves, and emitters over time, which may reduce system efficiency. While pH (8.06) and salinity (EC: 0.72 mS/cm) fall within acceptable ranges, the slightly elevated calcium and sodium levels may gradually influence soil conditions under continuous use. Taken together, these factors do not prevent the use of irrigation at the site, but they do imply that a properly designed system, including filtration, regular maintenance, and basic water management measures, is required to ensure reliable and consistent crop production.

The site also presents a number of constraints that should be addressed in the plot design. One is pest pressure. In terms of specific pest management measures, the three pests identified each require a somewhat different approach. Whiteflies are best managed through yellow sticky traps for early detection, insect-proof netting on greenhouse openings, and where necessary the application of contact insecticides such as pyrethroids. Thrips are more difficult to control once established, as they tend to hide inside flowers and young leaves. Fine insect netting with a mesh size of 50 mesh or smaller is the most effective preventive measure for greenhouse production, combined with regular scouting using blue sticky traps and spinosad-based products for treatment where needed. Cutworms primarily affect young transplants at the stem base and are best addressed by keeping the plot free of weeds and crop debris, using cutworm collars around transplants, and applying soil drenches with recommended crop protection products before planting where pressure is high. Across all three pests, prevention and early detection are more effective and less costly than reactive treatment, and regular crop monitoring should therefore be treated as a routine management task at the NLA plot.

Furthermore, the selected site appears to be the most suitable site for the proposed NLA plot in terms of soil organic carbon levels. Comparison of the candidate sites using the Spatialise satellite-based soil analysis shows that, of the two plots considered for the NLA site, the site near the research center is generally richer and more consistent in carbon content, this can be seen in Figure 1 and Figure 2 below, where Figure 2 shows the site near the research centre. This is a positive indicator, as higher soil organic carbon is typically associated with better soil structure, moisture retention, and overall soil health. This is also supported by the CropNuts laboratory results, which show higher percentages of organic matter for site 2.

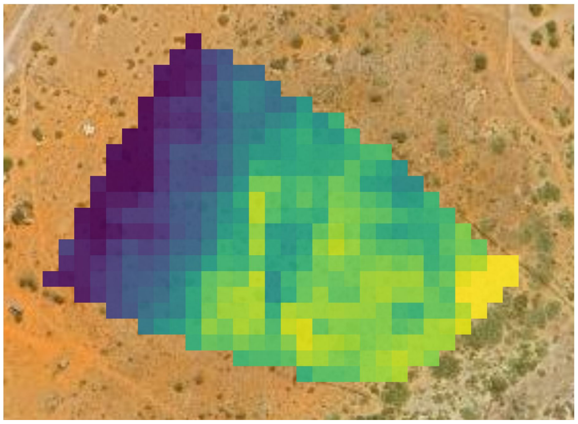

Figure 1: Spatialise Soil analysis site 1

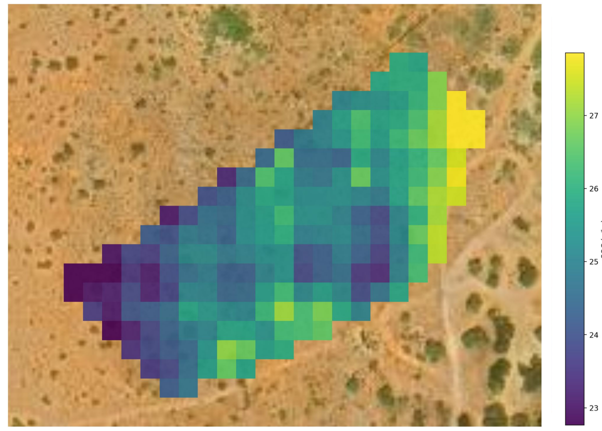

Figure 2: Spatialise soil analysis site 2 (selected site)

At the same time, the broader soil constraints identified for the Jubaland study area also apply to site 2 and will need to be addressed in the plot design and soil management approach. In particular, the high pH, low phosphorus, and low nitrogen levels identified across the sampled sites remain relevant for this field as well. In addition, iron levels are on the lower side and may require corrective measures depending on the crop mix and final fertilization strategy. This means that while site 2 is the preferred site from a relative soil quality perspective, it will still require active soil improvement and nutrient management to support commercially viable horticultural production. The exact values of the CropNuts soil analysis for both NLA fields can be found in Annex 2.2.

A further site-specific consideration is the outcome of the soil pathology screening. The selected NLA site tested positive for Pythium spp., which is relevant because this pathogen can cause damping-off, root rot, and seedling collapse, especially during nursery production and early crop establishment. In addition, the sampled Juba River soil tested positive for Fusarium spp. and Alternaria spp. This means that while the selected site remains suitable overall, plant health risks need to be taken into account in site preparation, nursery management, and any decision to use outside soil sources within the plot.

Overall, the selected NLA site appears suitable as the basis for a commercial pilot plot, particularly because of its layout, water access, relative shelter, and proximity to the research centre. At the same time, its final suitability depends on how well the design responds to the specific constraints of the site, especially in relation to irrigation, pest management, fencing, and the technical implications of the soil and water conditions.

5.3 Suitable crops and production model for the plot

The proposed production model for the NLA plot combines two greenhouses with an open-field production area. This setup is intended to establish a commercially viable horticultural plot for the local Kismayo market, while allowing the production model to be refined over time based on practical results. The current crop selection reflects this approach. It combines crops that are already relevant to the Kismayo market with crops that can help NLA build a broader and more resilient production base. Several of the selected crops, such as tomato, onion, cucumber, sweet pepper, cabbage, and melon, are already present in the market or were identified during the study as crops with strong local potential.

In addition, the proposed model assumes the use of hybrid seeds, which offer several advantages over traditional open-pollinated varieties. Hybrid seeds typically provide higher yields, greater uniformity, improved disease resistance, and better adaptability to stress conditions such as heat or variable water availability. These characteristics are particularly important in the Jubaland context, where production risks and environmental variability are high. By combining greenhouse and shade-net/open-field production with the use of improved hybrid varieties, the plot can begin supplying the local market reliably while gradually identifying which crops and production approaches perform best under NLA conditions.

The production model is intended to use crop rotation and phased adjustment rather than fixed long-term specialization from the outset. This approach supports commercial viability by spreading risk, maintaining flexibility, and allowing the production system to improve over time. In this way, the plot can build a functioning market-oriented model while also generating practical lessons on crop performance, management requirements, and market response.

Table 3: Proposed Crops and Production Systems

Production system	Proposed Crops
Greenhouse production	Cucumber, sweet pepper, tomato, sweet melon, lettuce
Open field/ shade nets	Spinach, potato, onion, cabbage, tomato, carrot, green capsicum, cucumber, coriander

A key part of this model is the combination of protected and open-field production. The greenhouse component is intended to focus on crops with relatively strong market potential and higher commercial value. Crops such as cucumber, tomato, and green capsicum fit well within this logic, while lettuce and sweet melon can help assess whether more sensitive or niche crops can also be produced successfully under protected conditions. The open-field component allows NLA to produce a broader crop mix for the local market while also assessing which crops are most suitable under simpler and more accessible production conditions. At the same time, fully exposed open-field production is likely to face significant heat stress under Kismayo conditions, particularly during the hotter periods of the year. For that reason, the model should not be understood as relying only on completely unprotected field production. The use of shade-net structures can provide an important intermediate production system between greenhouse cultivation and fully exposed open field. Shade nets can help reduce heat stress, lower evapotranspiration, limit crop damage, and create more favourable growing conditions for crops that may not perform well under full exposure but do not require full greenhouse protection. In this way, shade-net production can strengthen the commercial viability of the broader crop mix while also offering a more practical and lower-cost protected system for part of the plot.

Tomato deserves particular attention within this model, because it is relevant both for the fresh market and for possible future processing, especially tomato paste. The plot could therefore also be used to compare tomato varieties not only for fresh market performance, but also for processing suitability. This would make the tomato component commercially relevant from the outset while also informing later decisions on value addition. Coriander may also be included as a short-cycle supporting crop for the local market. It was identified during the feedback discussions as a potentially attractive high-value crop in Kismayo, with the advantage of relatively rapid turnover. Given the limited and somewhat uncertain price information currently available, it is best treated as a commercially promising crop to be further validated during the first production cycles.

Overall, the proposed production model can best be described as a commercial pilot with phased improvement: combining protected and open-field production and focusing on crops with local market potential. The objective is to establish a working and commercially relevant horticultural model for the NLA site, while refining crop selection and production practices over time based on practical experience. A crop calendar has been developed and is included in the business projection analysis accompanying this report. It provides a first practical proposal for Year 1, based on a selection of the crops identified in this section and focusing on those that are currently considered most realistic under the proposed production model. Not every crop identified in this section is therefore included in the Year 1 calendar. The crop calendar should be understood as a working planning tool that can be adjusted over time as practical considerations, implementation constraints, and early production experience become clearer.

5.4 Proposed commercial plot set-up and operational requirements

The proposed NLA commercial pilot plot is designed as a practical production set-up that combines crop production with the supporting infrastructure needed to operate reliably under local conditions. In addition to the two greenhouses and open-field area described in the previous section, the plot will require a number of complementary elements to make the model workable in practice. These relate mainly to soil and water management, irrigation, crop protection, nursery management, post-harvest handling, transport, and site protection.

5.4.1 Soil and water management

A first requirement for the plot is a site-specific water and soil management strategy. Although the site was identified as the preferred option based on its relatively better soil organic carbon levels compared to the other candidate site, it still reflects the broader soil constraints found across the sampled sites in Jubaland. In particular, pH values are high, while phosphorus and nitrogen are low and iron is on the lower side. A first priority within this is to manage irrigation water quality. Water in the holding tank should be treated through acid injection, using sulphuric acid or phosphoric acid, in order to reduce alkalinity and support a more suitable root-zone environment over time. Follow-up sampling and laboratory analysis should be used to monitor whether this treatment is achieving the intended effect and to guide any further adjustment. A second priority is to improve soil fertility and organic matter levels. This can be done through the addition of livestock manure or through the development and use of locally produced compost. A further practical measure is to consider blending soil from the Juba River area with soil from the NLA plot, where technically feasible, in order to improve growing conditions in the production beds. In addition, the low phosphorus and nitrogen levels indicate that nutrient correction will need to form part of the establishment strategy for the plot. Taken together, these measures should form part of the establishment phase of the plot rather than being introduced later, as they are necessary to create more suitable conditions for commercially viable horticultural production.

Furthermore, the pathology results imply that preventive plant health management should be included in the set-up of the plot from the outset. In practice, this means working with clean propagation media, disinfected trays and tools, good drainage, careful irrigation management, and strong nursery hygiene to reduce the risk of Pythium during seedling establishment. Overwatering and poorly drained conditions should be avoided, and collapsed seedlings should be removed promptly. In addition, any use of Juba

River soil in production beds should be approached with caution, as this may introduce additional disease risks. Where outside soil is used, this should only be done under controlled conditions and with appropriate preventive measures in place.

A further central component of the proposed set-up is a robust and practical drip irrigation system. The intention is to use an irrigation set-up that is simple enough to operate reliably in the local context, while still supporting consistent crop performance in both greenhouse and shade-net/open-field production. Because the available water is muddy, the system will require filtration. This is confirmed by the irrigation water analysis, which indicates very high turbidity levels and a high load of suspended particles. As a result, a multi-stage filtration system, such as sand or disc filters, should be treated as a core requirement to prevent clogging of emitters and ensure even water distribution.

In addition, the irrigation system should include a flushing plan to clean the lines regularly, as both suspended solids and mineral deposits may accumulate over time. The water analysis also indicates elevated bicarbonate levels and high water hardness, which increase the risk of scaling in pipes, valves, and emitters. To manage this, water treatment measures should be included where feasible, particularly acidification using nitric acid or phosphoric acid to reduce alkalinity and limit mineral build-up in the system. Taken together, these requirements imply that the irrigation set-up should include not only driplines, but also the supporting infrastructure and management protocols needed for filtration, regular maintenance, and water treatment. Given the technical nature of these requirements, staff training will be essential to ensure that the system is operated and maintained correctly.

5.4.2 Crop management

Crop protection is another core operational requirement. The current technical direction indicates that the plot will need to work with insect nets and practical crop protection measures for thrips, cutworms, and whiteflies. These issues are relevant for both greenhouse and shade-net/open-field production and should be considered from the start of implementation. In this sense, crop protection should not be treated as a later adjustment, but as part of the basic plot design and management approach.
The plot will also require fencing and site security. This is particularly important because the area was previously a monkey sanctuary, which means that crop damage by monkeys is a realistic operational risk. Fencing should therefore be treated as part of the essential infrastructure of the plot rather than as an optional measure.

5.4.3 Operational management

A further operational requirement is the establishment of a propagation unit or nursery. The current concept includes a nursery with peat moss as the growing medium for seedling production. This is important because the plot is intended to work with a relatively broad crop mix, and seedling quality will be an important factor in overall crop performance. The nursery should therefore be considered a core part of the production set-up, especially for greenhouse vegetables and other crops that depend on strong transplant establishment. Post-harvest handling also needs to be built into the plot concept. The review process highlighted the need for a cold chain solution at the NLA plot, especially if the plot is expected to supply perishable vegetables to the Kismayo market in a commercially viable way. This does not necessarily mean a large or advanced cold chain system from the start, but it does mean that cooling or cold storage should be considered part of the operational set-up.

Transport and logistics are closely linked to this. The current concept includes the need for both a refrigerated vehicle and a covered vehicle. A refrigerated option is relevant for preserving quality of more perishable produce, while covered transport is also important because of dust conditions in the area. These requirements suggest that moving produce from the plot to market should be planned as part of the commercial model, not treated as an afterthought. Input logistics are another practical requirement. Based on the study findings and internal review, the preferred route for importing seeds, greenhouse materials, irrigation components, and other production inputs is by boat, as road transport is considered less feasible from a security perspective. This means that establishment and operation of the plot will depend partly on forward planning of input needs, lead times, and delivery routes.

Taken together, these elements show that the proposed NLA plot is not just a cropped area, but a small integrated production system. Its commercial viability will depend not only on crop performance, but also on whether these operational requirements are put in place from the outset. The practical design of the plot therefore needs to combine production infrastructure with soil and water management, protection, nursery capacity, post-harvest handling, and transport arrangements. Because the proposed model requires a relatively high level of technical knowledge and well-managed inputs, successful implementation will also depend on continued technical support and guidance. Holland GreenTech can contribute to this by supporting both the delivery of relevant technologies and inputs and the technical accompaniment needed during the establishment phase and initial production cycles.

5.5 Indicative business projections

To complement the technical and market assessment, an indicative business projection was developed for the proposed NLA commercial pilot plot. The purpose of this projection is to provide an initial estimate of the revenue-generating potential of the proposed production model under different assumptions. At this stage, the analysis focuses on the revenue side of the business case and is intended to illustrate the likely commercial range of the model rather than to provide a full profitability assessment. A more detailed version of the underlying calculations is provided in the accompanying business projection analysis, which is submitted together with this report.

The projection is based on the annual crop calendar developed for the NLA plot. For each crop, expected output is estimated using the planned cultivated area, the number of production cycles per year, the expected yield per square metre, and the proportion of production expected to be saleable. Revenue is then calculated by applying indicative market prices to this saleable output. Yield assumptions are based on expert evaluation of likely crop performance under the proposed production systems and local conditions at the NLA site. Price assumptions are based on observations from the Kismayo market, complemented where necessary by benchmark reference prices used to establish a realistic planning range. These assumptions, and the crop-level calculations built on them, are set out in more detail in the accompanying business projection analysis.

To reflect uncertainty, the business projection is presented through three scenarios: a conservative scenario, a base scenario, and an optimistic scenario. The base scenario reflects the most realistic expected case under the proposed production model. The conservative scenario applies lower yields, slightly lower prices, and lower saleable output to reflect a situation in which crop performance and market realization are below expectation. The optimistic scenario applies stronger yields, slightly better prices, and higher saleable output to reflect a situation in which crop performance and market realization are stronger than expected. The detailed scenario assumptions and crop-level scenario outputs are included in the business projection analysis accompanying this report.

The base scenario follows the current crop calendar and production layout of the proposed NLA plot, including greenhouse production and shade-net/open-field production. In addition, coriander is included as a short-cycle supporting crop for the local market. The business projection reflects the planned crop model while also incorporating a small number of practical assumptions needed to translate the crop calendar into annual output and revenue. The full crop-level breakdown can be found in the accompanying projection analysis.

Scenario	Interpretation	Total projected revenue Year 1
Conservative	Lower-bound estimate with lower yields, lower prices, and slightly lower saleable output	$ 46,781
Base	Most realistic expected outcome under the proposed production model	$ 68,393
Optimistic	Upper-bound estimate with stronger yields, better prices, and higher saleable output	$ 81,364

The scenario analysis suggests that the proposed crop model has clear revenue-generating potential if the plot can be operated successfully under the proposed commercial set-up. At the same time, these figures should be interpreted as indicative planning estimates rather than fixed forecasts. Actual results will depend on crop performance, irrigation and crop protection management, market access, and the consistency with which the production model is implemented. This should be read together with the accompanying business projection analysis, which provides the assumptions and scenario logic behind the summary figures presented here.

At this stage, the analysis does not yet include a full cost structure and therefore does not provide a complete profitability model. This reflects the fact that investment and operating costs are still subject to further refinement. The current projection should therefore be understood as a first commercial estimate of the revenue potential of the proposed NLA plot. If needed, this can be developed further in a later phase through a more detailed cost and margin analysis building on the structure already provided in the accompanying business projection analysis.

5.6 Risks and considerations

The proposed NLA plot is feasible as a commercial pilot, but its success will depend on a number of implementation and business conditions beyond the technical set-up itself.

A first risk concerns market performance. While the Kismayo market offers clear demand for fresh produce, the plot will still need to establish reliable buyer relationships and demonstrate that it can compete with imported produce on freshness, quality, and consistency. Commercial viability will therefore depend not only on production success, but also on actual market uptake and price realization.

A second and very important risk concerns input supply and logistics. The plot depends on timely access to seeds, greenhouse materials, irrigation components, nursery inputs, and crop protection products. Since road transport is constrained by security concerns, input supply will rely heavily on boat transport. This creates clear exposure to delays, procurement bottlenecks, and supply chain disruption, which could affect both establishment and ongoing production.

A third risk concerns operational management capacity. The proposed model combines greenhouse production, open-field production, crop rotation, nursery management, irrigation, post-harvest handling, and farmer training. This creates a system that is commercially promising, but also management-intensive. The plot will only function well if responsibilities are clearly assigned and day-to-day operations are supervised consistently.

A fourth consideration is the need to maintain commercial focus. The plot has an important role in farmer training and demonstration, but its primary purpose is to establish a working income-generating production model for NLA. If training and demonstration activities are not aligned carefully with commercial operations, there is a risk that the plot becomes more educational than commercially viable.

6. Conclusions and recommendations

6.1 Main conclusions

The findings of this study indicate that market-led horticultural development in Jubaland is a realistic opportunity, but one that depends on a set of conditions that are not yet fully in place. Across the three components of the study, market and value chain conditions, production and operational feasibility, and the proposed NLA commercial plot, a consistent picture emerges. The potential is present, the market exists, and the site is suitable, but realising that potential requires coordinated action across production, input systems, and market access.

On the market side, the evidence shows that Kismayo has established demand for fresh vegetables, with a significant share of supply currently met through imports from Kenya. The primary opportunity for local production therefore lies in supplying an existing market more reliably, rather than in creating new demand. Market channels are active but remain informal and only partially supported by infrastructure and services. Buyers place strong emphasis on availability and freshness, which means that producers who can supply consistently and at the right time have a realistic basis for competing. Seasonal fluctuations further reinforce the importance of timing, particularly during periods when imported supply becomes less reliable or more expensive.

On the production side, the agro-climatic conditions in the Juba River corridor are broadly suitable for irrigated horticulture, particularly during the Hagaa season. The main constraints are agronomic and operational rather than climatic. Soil conditions across the study area are characterised by high pH, low phosphorus and nitrogen levels, and limited organic matter, indicating a structural constraint that requires systematic correction. Irrigation water from the Juba River is suitable for use, but requires filtration and active management to ensure reliable performance. Current production practices, including flood irrigation and seed reuse, limit productivity and consistency. Pest pressure from whiteflies, thrips, and cutworms further highlights the need for structured crop management and regular monitoring.

On the operational side, post-harvest handling, transport, and logistics remain key constraints. Limited cold storage, weak aggregation systems, and security-related transport challenges affect both the reliability and cost of supplying the market. These constraints influence not only how produce reaches buyers, but also which crops can be grown and at what scale. Horticultural development in Jubaland therefore depends on integrating production with a realistic and well-managed logistical system from the outset.

With respect to the proposed NLA commercial plot, the study concludes that the selected site provides a suitable basis for a commercially oriented pilot. Its physical characteristics, including flat terrain, access to water, relative shelter, and proximity to the research centre, support its suitability. The proposed combination of greenhouse and shade-net/open-field production aligns well with both market demand and local production conditions. The selected crop mix, including tomato, cucumber, sweet pepper, onion, cabbage, and melon, reflects crops already present in the Kismayo market and offers clear potential for import substitution.

At the same time, the viability of the plot depends on establishing the full operational system from the outset. This includes appropriate irrigation infrastructure with filtration and water management, soil improvement measures, fencing, basic cold chain capacity, reliable input supply, and strong day-to-day management. The involvement of ten lead farmers adds value in terms of training and knowledge transfer, but requires clear coordination to ensure that commercial production and learning activities reinforce each other.

The feasibility of the NLA commercial plot is further strengthened by the institutional position of NLA. Its proximity to the Kismayo market, access to land and water, and mandate in training and capacity building provide a strong foundation for a model that combines commercial production with practical learning.

From a market perspective, the model is aligned with an existing supply gap, while the combination of greenhouse and shade-net/open-field production allows for both higher-value crops and more stable volume production. Preliminary assumptions indicate that, under proper management, the model has the potential to generate stable revenue for NLA.

Taken together, the study concludes that the conditions for market-led horticulture in Jubaland are present but not yet mature. The proposed NLA commercial plot provides a practical and well-positioned starting point, combining a solid technical basis with a clear pathway toward commercial operation. Its success will depend on treating it as a complete operational system from the outset, ensuring that production, input supply, and market access are effectively integrated rather than developed incrementally.

6.2 Recommendations and next steps

The recommendations below follow directly from the findings of the study and are intended to provide a practical basis for next steps by NLA and its partners.

The most immediate recommendation is to proceed with the establishment of the NLA commercial plot on the basis of the site and production model identified in this study. The site is suitable and the market opportunity is real. Proceeding should, however, be conditional on putting the full operational infrastructure in place before planting begins rather than progressively. Irrigation filtration, fencing, nursery set-up, basic cold storage, and transport arrangements should be treated as foundational requirements, not as later additions.

Before any planting takes place, a structured soil improvement programme should be implemented at the NLA site. This should include acidification to begin correcting the very high soil pH, pre-planting compost incorporation to raise organic matter and improve soil structure, and a phosphorus correction programme in line with the laboratory recommendations. The irrigation filtration system should be installed and tested before the drip system is brought into operation, and water acidification should be established as a routine management practice from the start. These steps are prerequisites for productive crop establishment and cannot be deferred without affecting the performance of the first production cycle.

The production model should be based on certified hybrid seed from the outset. Seed reuse is widespread in the area and significantly limits crop performance, particularly for tomato, cucumber, and sweet pepper. Using certified hybrid seed at the NLA plot will improve yield, uniformity, and marketability, and will also serve as one of the most practical and visible demonstration points for the lead farmers. Given that seeds and other inputs will need to be imported by boat, procurement planning and lead times should be built into the operational calendar well ahead of each planting cycle.

Production planning should be aligned with market timing and seasonal conditions from the start. The crop calendar developed as part of this study provides a starting framework, but it should be refined based on direct market feedback and actual plot performance over time. The Hagaa season, from July to September, is the most agronomically favourable period and should anchor the first production cycle where possible.

The training and demonstration function of the plot will require a clear operational structure if it is to work alongside commercial production rather than compete with it. The roles and learning objectives for the lead farmers should be defined before the plot is established, and demonstration activities should be designed to generate lessons that are practical and transferable to smallholder settings. Key topics include the value of drip irrigation over flood methods, the performance difference between certified hybrid seed and saved seed, structured crop monitoring for pest management, and the importance of soil preparation.

In addition, clear management and governance arrangements should be established for the operation of the plot. This includes defining day-to-day management responsibilities, technical supervision, and decision-making structures within NLA, as well as clarifying the role of partners where relevant. Given the operational complexity of the model, consistent supervision and accountability will be essential to ensure performance and continuity. The commercial viability of the plot should be supported through basic financial planning and performance monitoring from the outset. This includes tracking production costs, yields, sales volumes, and revenues per crop cycle, in order to assess performance and inform operational adjustments.

Finally, the study recommends that the NLA plot be managed as a phased model in which the first objective is to establish a functioning and commercially viable production system for the local Kismayo market. Value addition and expanded outreach to smallholder farmers are relevant longer-term opportunities, but they should only be pursued once the core production and market model is working reliably in practice. The conditions for horticultural development in Jubaland are still developing, and moving toward more complex objectives before the foundation is solid risks undermining the viability of the model as a whole.

7. Annexes

Annex 1: Interview list

Name	Sector	Date
Mahamud Hirsi	Agronomy Expert- (MOAI-Jubaland)	5-04-2026
Yussuf Maalim	Federal Ministry of Agriculture	5-04-2026
Abdi Inshar	Agronomy Expert- (MOAI-Jubaland)	6-04-2026
Abdullahi Ali	Agronomy Expert- (MOAI-Jubaland)	6-04-2026
Ahmednoor Abdi	Program Manager- Social Environmental Agency (SEA)	7-04-2026
Sadik Hussein Ugas	Agricultural Expert, Program manager NGO (ALight)	7-04-2026
Amina Osman	Director of Extension and Research, Federal MOAI- Federal	7-04-2026
Nasra Haajir	Local Aggregator	10-04-2026
Suldan Mukhtar	Export Specialist	10-04-2026
Shiine Horn Agro	Importer (Seeds and Fertilizers)	11-04-26

Annex 2: Laboratory tests results

A.2.1 Water Analysis results

Table A1: Key irrigation water quality parameters, NLA site, April 2026

Parameter	Unit	Result	Guide maximum	Assessment
pH		8.06	8.40	Within range
Electrical Conductivity	mS/cm	0.72	< 1.50	Within range

Calcium	ppm	66.4	< 60.0	Marginally elevated
Sodium	ppm	63.7	< 60.0	Marginally elevated
Sulphur	ppm	41.5	< 27.0	Elevated
Sulphate	ppm	124	< 81.0	Elevated
Bicarbonate	ppm	121	< 91.0	Elevated
SAR		1.84	< 10.0	Within range
Hardness (CaCO3)	ppm	225	< 60.0	Very high
Turbidity	NTU	96.5	< 10.0	Very high

A.2.2 Soil Analysis results

Table A2: Soil analysis results by field, NLA site and surrounding area, April 2026

Parameter	Unit	NLA Tank Area (Field 1)	NLA Research Centre (Field 2)	Juba River Area (Field 3)	Horn Agro (Field 4)	Optimal range*
pH (H2O)		8.27	8.47	8.68	8.77	5.50 - 7.00
EC (Salts)	uS/cm	131	118	153	129	< 800
Phosphorus (Olsen)	ppm	7.87	8.08	2.66	1.51	20 - 50
Potassium	ppm	455	601	891	572	220 - 734
Calcium	ppm	1160	1890	3820	2500	2260 - 2820
Magnesium	ppm	117	188	704	460	226 - 361
Total Nitrogen	%	0.099	0.13	0.10	0.069	0.20 - 0.50
Organic Carbon	%	1.30	1.94	1.47	0.92	2.00 – 5.00
Organic Matter	%	2.23	3.34	2.53	1.57	3.00 – 8.00
CEC	meq/100g	8.35	13.2	28.8	18.8	15 - 30
Boron	ppm	2.95	3.45	1.93	2.40	0.80 - 2.00
Copper	ppm	1.02	0.80	6.00	2.19	1.50 - 10.0
Zinc	ppm	2.02	2.70	0.82	0.67	2.00 - 20.0

Parameter	Unit	NLA Tank Area (Field 1)	NLA Research Centre (Field 2)	Juba River Area (Field 3)	Horn Agro (Field 4)	Optimal range*
Sodium (ESP)	%	1.92	2.21	2.64	2.81	0.00 – 5.00
Ca:Mg Ratio		5.92	6.05	3.25	3.26	4.00 – 7.00

*The optimal ranges presented in Table A2 are based on general agronomic reference values for soil fertility, comparable to those used for cover crops or mixed cropping systems. These ranges provide an indication of overall soil suitability rather than crop-specific requirements. Soil management and fertilization recommendations should be tailored to the specific crop intended to be grown in each plot.