Scientific Research Publishing

Open Journal of Applied Sciences, 2025, 15(5), 1324-1333
https://www.scirp.org/journal/ojapps
ISSN Online: 2165-3925
ISSN Print: 2165-3917

Enhancement of Tomato Production Using the Tabletop Micro Gardening Technique in Dakar

Amadou Bouye Seydi[1], Toffene Diome[1], Nadina Zuleika Leite[1], Ababacar Sy Diallo[2], Amadou Diouf[3], Pape Mbacké Sembène[1]

[1]Animal Physiology Laboratory, Faculty of Science and Technology, Cheikh Anta Diop University of Dakar FST/UCAD, Dakar, Senegal
[2]Center for Horticultural Development of Cambérène, Dakar, Senegal
[3]National School of Agriculture (ENSA/Thiès), Thiès, Senegal
Email: amadou.seydi@ucad.edu.sn

How to cite this paper: Seydi, A.B., Diome, T., Leite, N.Z., Sy Diallo, A., Diouf, A. and Sembène, P.M. (2025) Enhancement of Tomato Production Using the Tabletop Micro Gardening Technique in Dakar. *Open Journal of Applied Sciences*, **15**, 1324-1333.
https://doi.org/10.4236/ojapps.2025.155092

Received: January 18, 2025
Accepted: May 23, 2025
Published: May 26, 2025

Abstract

Tomato is one of the main agro-industrial crops in the Senegal River Valley (VFS), more precisely in the Saint-Louis region. The departments concerned are Dagana and Podor. Given the production deficit to meet the needs of rural dwellers, the micro-gardening technique was initiated in order to compensate here and there for the few needs of urban dwellers in fresh tomatoes. It is in this context that this study was developed with the aim of supporting the needs of city dwellers. The study was conducted on 21 micro-gardening tables with the Mongal variety repeated 4 times per table on an area of ½ m2 which were selected, after transplanting at a rate of 04 plants per table. The average per table leg gives average values of 634.09 ± 39.09 g for leg 1, for leg 2 we find 608.28 ± 31.47 g, for leg No. 3 an average of 596.09 ± 28.89 g, finally for leg 4 a value of 586.95 ± 38.71 g, The analysis of variance gives (P = 0.564). However, we note a significant difference with (P = <0.001) on all the legs and tables studied.

Keywords

Tomato, Mongolian Variety, Micro Gardening, Table, Dakar

1. Introduction

Processing tomatoes are one of the main horticultural crops in the Senegal River Valley (SV). The first diversification crop introduced in the region, processing tomatoes mobilized approximately 12,000 producers spread across the Dagana

and Podor departments, on the border with Mauritania.

In its heyday, the industrial tomato sector in Senegal generated nearly 3.5 billion CFA francs (5.32 millions euros or 6.33 millions US dollars, as of January 2018) in sales per season, and producers could expect a gross margin of nearly 1,000,000 CFA francs (1520 euros or 1810 USD) per hectare. Tomatoes were among the market garden crops with a high gross margin and were among the crops that could allow producers to modernize their often family-run farms. More importantly, for producers benefiting from a cultivation contract, tomato cultivation made it possible to better negotiate the value of other crops, particularly rice, through an integrated financing system set up by the CNCAS (Crédit Agricole Sénégalais) [1].

But for several years, despite its progress in terms of contractualization and integration, the Senegalese processing tomato industry has faced significant challenges. With a turnover of only 1.5 billion CFA francs in 2016 and a gross margin per producer of nearly 550,000 CFA francs per hectare (836 euros or 996 dollars), interest in this crop has waned, especially as many uncertainties however contract negociations and the commitment of manufacturers to meet processing targets.

Thus, the quantities processed over the last two seasons did not exceed 28,000 metric tons of raw material for a cultivated area of approximately 1400 hectares, while the target was 78,000 mT. National needs, estimated at nearly 20,000 metric tonnes (mT) of concentrates, or the equivalent of 120,000 mT of fresh tomato equivalent, are in fact covered mainly through imports [1].

The first explanation put forward by the sector's stakeholders is the difficulties producers encounter in complying with technical itineraries and cultivation calendars. Over the last thirty-five years, the average yield of industrial tomatoes has not exceeded the threshold of 23 tonnes per hectare, for an average production of 50,000 tonnes. In addition to these technical difficulties, there are problems of access to credit, linked to producers' indebtedness, the shortage of agricultural equipment and the constraints linked to the collection and transport of tomatoes, all obstacles which limit the development of the sector [1].

Faced with this enormous production deficit and the lack of adequate supply to meet the needs of the national or urban market, and in particular the problems of land grabbing characterized by the appropriation of all or the majority of the land in the capital and certain large cities of the country, farmers have found in soilless cultivation or micro gardening, an alternative to live from their profession and to compensate for the lack of need for fresh tomatoes on the market thanks to the support of government services [2].

In fact, this constitutes an alternative to provide a solution to urban producers, that is to say: micro-gardening. It could be associated with soilless cultivation by developing market gardening production units deployed in the open air, on terraces, in the courtyards of houses, etc. The State of Senegal has initiated a micro-garden program led by the horticulture service, to meet the demand of market gardeners whose lack of land was hampering their work [2].

In the Senegalese capital, the population continues to increase with 18,032,473 [3], limited access to arable land and the lack of drinking water constitute an obstacle to food security. Knowing this, the government is trying to promote soilless cultivation, which is micro-gardening. Today, the tomato is not immune to the deficit in national horticultural production. Senegal imports more than 80,000 tonnes of fresh tomatoes, or 12 billions CFA francs per year, in the form of triple concentrate to supplement national needs, which are around 140,000 tonnes [4]. The race for land seems to be over and increasing production would require increasing yields with the necessary intensification and control of production factors [5]. Tomato production must be supported as a staple food for the Senegalese population; the public authorities are currently considering ways to obtain from manufacturers a commitment to acquire and process the entire harvest, as well as tax measures likely to "protect the national sector" from imported products [1]. Thus, our study is focused on the micro-gardening technique through the production of a table tomato unit.

2. Method and Material

2.1. Technique for Making a Micro Gardening Table Depending on the Material

It's an easy tool to put together since the elements are often within sight and cost little, and they are listed in Table 1 below.

Table 1. Components of the micro gardening table.

Designating elements	Equipment requirements
Wooden frame	Purchased or recovered
Wooden sleeper	Purchased or recovered
Substrate (rice husk + peanut shell)	free
Black polystyrene canvas	Depending on the bin to be done
Micro 1 nutrient solution (1 liter)	Nutrient solution composed of: Magnesium Nitrate 103 g, Mg sulfate 82 g, Cu sulfate 0.12 g, Mn sulfate 0.5 g, Zinc sulfate 0.3 g, Boric acid 1.55 g, Ammonium Molybdate 0.005 g, Iron chelate 4.23 g
Macro 2 nutrient solution (1 liter)	Nutrient solution composed of: Mono ammonium phosphate 34 g, calcium nitrate 208 g, potassium nitrate 110 g
Tip 04	Fix the table
Tip 06	Fix the table
Bedbugs	Fix the canvas
Drains	8 to 12 mm for drainage and purification

Continued

Polystyrene sheet	Spread on the tray before the substrate
Hoe	Wood used to turn the table substrates
Hammer	
Crankshaft	
Graduated set square	

2.2. Methodology and Production Technique

The study is conducted on twenty-one tables. Each table is covered with black cloth, and the substrates (rice husks and peanut shells) are spread out. The Mongal tomato variety, repeated four times per table over an area of 0.5 square meters, was selected and transplanted on January 11, 2023, at a rate of four plants per table.

The substrate consists of one bag of rice husks (25 kg) and three bags of peanut shells (75 kg). These elements are mixed and moistened, with which the table, already covered with a black cloth, is filled. This facilitates the absorption of daylight. The substrate will decompose over a long period of time, turning it over each time during the day with a hoe for 24 or 48 hours at most. The water supply is instantaneous at a rate of 2L per day and per table as well as the supply of fertilizer or nutrient solution made up of 5 ml of micro which is made up of: Magnesium Nitrate 103 g, Mg Sulfate 82 g, Cu Sulfate 0.12 g, Mn Sulfate 0.5 g, Zinc Sulfate 0.3 g, Boric Acid 1.55 g, Ammonium Molybdate 0.005 g, Iron Chelate 4.23 g [6].

And 10 ml of macronutrients consisting of (34 g monoammonium phosphate, 208 g calcium nitrate, 110 g potassium nitrate). The quantities are mixed to obtain a homogeneous nutrient solution.

Watering and fertilizers are applied regularly until the 6th day, and from the 7th day onward, thorough leaching is carried out to drain all traces and nutrient losses.

Regarding crop protection, to prevent any intrusion or attack by parasites or bacteria, the tables are covered with a mosquito net to reduce attacks by phytophagous insects and pests (house rats) and preserve the chances of crop success. Despite these efforts, the leaf miner has entered the crop, causing major damage. To save part of this speculation, the phytosanitary treatment was carried out with "Neem" oil at a rate of 5 mL/L of water and eucalyptus at a rate of 250 g/10L of water.

The products are harvested as soon as they are ripe, according to each table and by speculation. The values found are listed in the form of a table in which we have expressed the cumulative values and averages of the crops, distributed across these three tables.

The values of the results of this study were calculated using Excel 10, and the statistical analyses were performed using Stat 18.SE and Sigma plot 13.0 software.

3. Results

Four feet per table were transplanted on 11/01/2013 (Figure 1 and Figure 2 below). A daily supply of water (2 liters) and fertilizer (10 ml of macro and 5 ml of micro) was carried out until the sixth (06) day. A large amount of water was washed off on the seventh day. The presence of lyriomyza "leaf miner" family of diptera caused some losses on the crop, these are tiny yellowish dots and numerous sinuous galleries on the leaves, these dry out later, so that to compensate for the harvest the phytosanitary control used was the use of neem solution at the concentration of 10 ml in 1000 ml or 1% or 30 ml in 1000 ml or 30% in application following a foliar spray [7]. All the harvests are grouped in Table 2 below according to the mature fruits weighed on a mass scale.

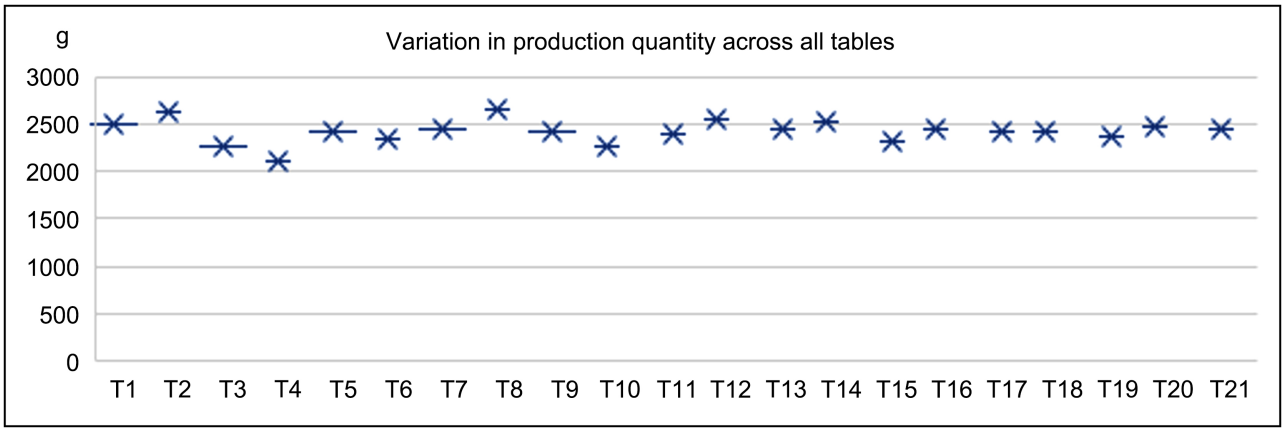
Table 2. Harvest data recorded on all tables and on each plant.

Tables	Pied 1	Pied 2	Pied 3	Pied 4	Total récolte
T1	630	620	615	630	2495 ± 7.5 g
T2	720	645	630	625	2620 ± 44.1 g
T3	580	575	570	545	2270 ± 15.5 g
T4	550	520	538	500	2108 ± 21.8 g
T5	607	625	600	600	2432 ± 11.8 g
T6	605	590	580	578	2353 ± 12.4 g
T7	620	605	605	615	2445 ± 7.5 g
T8	680	665	660	655	2660 ± 10.8 g
T9	608	632	590	602	2432 ± 17.6 g
T10	610	580	550	525	2265 ± 36.8 g
T11	622	602	590	580	2394 ± 18 g
T12	678	660	625	590	2553 ± 38.9 g
T13	651	600	600	595	2446 ± 26.4 g
T14	645	630	625	620	2520 ± 10.8 g
T15	672	598	548	510	2328 ± 69.9 g
T16	665	592	605	600	2462 ± 33.4 g
T17	641	601	586	588	2416 ± 25.5 g
T18	617	615	607	595	2434 ± 9.9 g
T19	603	590	587	580	2360 ± 9.6 g
T20	677	608	602	600	2487 ± 36.9 g
T21	635	621	605	593	2454 ± 18.3 g

Figure 1. Tomato table.

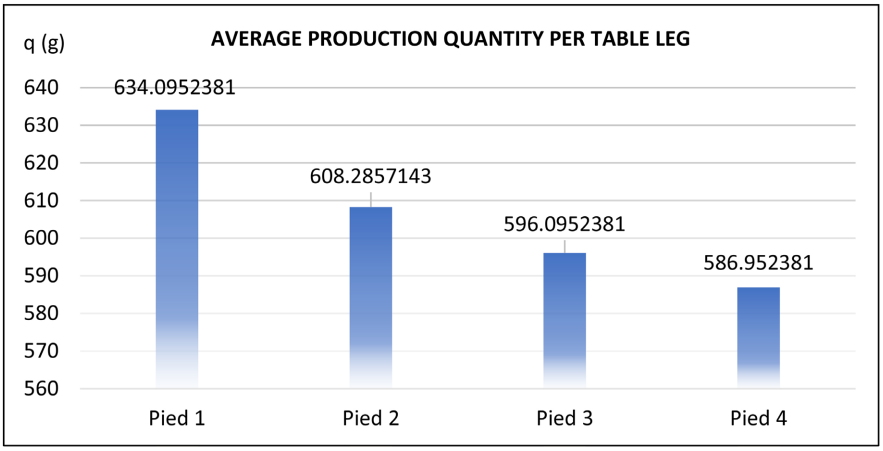
Figure 2. Tomato table legs.

Graph 1 below shows the variation in the quantity of tomatoes harvested during the production of the micro-gardening activity carried out on the 21 tables. It is noted that tables T2 and T8 respectively with 2620 ± 44.1 g and 2660 ± 10.8 g show a much higher yield compared to all the other tables, this increase can be explained by the fact that these two tables the actor had put a larger quantity of water and nutrient solution than compared to the other tables which seem to receive a more or less reasonable quantity of water and nutrient solutions.



Graph 1. Variation in the quantity of production on the tables.

Graph 2 shows the average variation in the quantity of production harvested per table foot, we can clearly see the strong trend of the feet in the first position, in other words the feet number 1, the equality of the variance test with ANOVA gives a value (P = 0.564) with Feet 1, N = 21, (634.09 ± 39.09), Feet 2, N = 21 (608.28 ± 31.47), Feet 3, N = 21, (596.09 ± 28.89), Feet 4, N = 21 (586.95 ± 38.71). We note a statistically significant difference; with (P = <0.001) on all the feet studied.



Graph 2. Average number of products harvested per table leg.

The overall average per harvest table gives an average value of 2425.4 ± 20.45 g for the entire harvest, which is not negligible. From this perspective, the analysis of the situation of tomato production in micro-gardening deserves special attention because efforts are needed in relation to the work of [8] which states that irrigated industrial tomato cultivation currently represents approximately 1400 ha in the Senegal River Valley. Despite an apparently favorable institutional and technical environment, production remains irregular and insufficient to satisfy the capacities of the two processing plants, and the national market estimates 10,000 tons of concentrate. Farmers' cultivation practices have proven to be very variable compared to management recommendations. The average yield was 18.2 t/ha with a potential exceeding 50 t/ha. [8]. However, there is a statistically significant difference with P = <0.001.

3. Discussions

Despite these rather low results given the small dimension used, these values found show signs of hope to promote further to balance the needs of city dwellers in the city in particular. All the tables studied, we actually note a clear difference at the level of the No. 1 feet of the tables. This could be explained by the fact that the operator, when applying the nutrient solutions using the watering can, pours more quantity at the first jet than more on the other feet of the table, hence the yield on foot 1 is much more significant than compared to the cultivation feet of the table. This results in a statistical difference with (P = <0.001). However, even

if the analysis of the principal components was not carried out, these results show the similarity with the work of [8] clearly showing that the cumulative weight of the harvest produced is not distinct enough except for tables No. 2 with 2620 ± 44.1 g and table No. 8 with 2660 ± 10.8 g where there is a slight increase in the harvest weight. Through these results, this reassures the approach aimed at promoting this production of fresh tomatoes with the so-called [8] assertion the success and proliferation of micro-gardens in Dakar over the last 18 years, according to ACRA, sales of vegetables from micro-horticulture represent barely 5% of all vegetables consumed in Dakar. A greater potential for production and consumption is nevertheless very real, especially with a willingness of political leaders to support the sector.

This precarious situation facing the micro-gardening sector has led to the identification of technical, organizational, and commercial strategies that can ensure the sustainability of horticultural operations. The production system analyzed requires significant investments (equipment and expertise) for the installation and equipment necessary for the operation of market gardening, especially fresh tomatoes. This will highlight certain aspects to be considered in the design of the system, the organization, and the support of producers. [9].

Furthermore, it should be noted that there is a strong demand in Senegal and West Africa for processed tomato products, which is still very limited and cannot be met by local production. This particularly concerns the demand for double tomato concentrate, which is very high locally and regionally. This demand is not met by local production due to structural problems and insufficient competitiveness vis-à-vis imports [10].

These results obtained from these production trials in micro-gardening or in soilless cultivation on the other hand, must encourage state authorities to put the means to compensate for the deficit and the poor yields of industrial tomato production because as his reported comments support [11]. The first explanation put forward by the actors of the sector themselves is due to the difficulties encountered by producers in complying with technical itineraries and cultivation calendars. Over the last thirty-five years, the average yield of industrial tomatoes has not exceeded the threshold of 23 tonnes per hectare, for an average production of 50,000 tonnes. Today it would be very relevant to draw up a table listing all the species likely to attack soilless crops in order to minimize attacks by parasites or bacteria capable of harming crops, in other words to implement a preventive control technique as recommended by [12]. However, these works are more or less honorary because they share the same points of view as the work of Dasylva *et al.* which states that these micro-farms contribute to urban sanitation using household waste for soil fertilization. The production sold contributes significantly to the livelihoods of households [13].

4. Conclusion

Through this study, given the results obtained, it allows us to offer a range of av-

enues to further outline in order to relaunch our tomato industry in the agricultural sector, which has so far struggled to take off to compete with industrial tomato producing countries. Micro gardening offers several alternatives to the production of market garden crops in general and also contributes to the protection and beautification of the city by recovering useless objects destined for abandonment using recycled materials such as vehicle tires, plastic cans, peanut plates which serve as support. Its investment is inexpensive, which is beneficial for the urban population [7]. Moreover, the micro garden offers excellent potential for strengthening resilience in the context of various realities which require political commitments. At the level of immigration, this sector could help immigrant families earn income and have access to a variety of cheap vegetables for their food, then allows populations affected by disasters or exposed to socio-political conflicts to benefit from diversified vegetables and local production nearby. Regarding the environment, it promotes the absorption of carbon dioxide with less transport and conservation. On the nutritional level, it provides a varied range of vitamins, mineral salts and vegetable proteins to compensate for the nutritional deficit in poor neighborhoods of the city. The FAO is available to share its experience in this area and to enter into partnership for the promotion of micro gardening [14].

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Branthôme, F.-X. (2018) Sénégal: Une filière en grande difficulté. Tomato News. https://www.tomatonews.com/fr/senegal-une-filiere-en-grande-difficulte_2_252.html

[2] Rassoul, E. (2017) Agriculture hors sol ou micro jardin. https://www.senegal-export.com/actualites/l-agriculture-hors-sol-ou-micro.html

[3] Agence Nationale de la Statistique et de la Démographie (ANSD) du Sénégal (2023) ANSD 2023 population du Sénégal Données de population.

[4] Aurélie Fontaine et Vincent Défait (2017) À Dakar, les micro-jardins font la difference. https://medium.com/@Spore_Magazine_54746/%C3%A0-dakar-les-micro-jardins-font-la-diff%C3%A9rence-9d00da430e38

[5] Robbiati, G., *et al.* (2013) Exploitation horticole avec irrigation goutte à goutte dans le bassin arachidier. Programme d'appui au programme national d'investissement de l'agriculture au Sénégal. Papsen Novembre 2013 Rapport N°6.

[6] FAO (2010) Manuel micro-Jardins du Senegal.

[7] RADHORT-Publications (2012) Techniques de production de semences de tomate au Sénégal.

[8] Aminata DIENE (2013) Le Micro-jardinage au Senegal: Voie de développement. https://www.seneplus.com/article/le-micro-jardinage-au-senegal-voie-de-d%C3%A9veloppement

[9] Diop, B.G. (2025) N° 16434. Journal hebdommadaire le soleil page 5 du jeudi 13 Mars. (Tomate: Filiére en zone rouge p4 à p6). https://lesoleil.sn/

[10] Joël, H. and Hélène, D.-B. (2000) La tomate d'industrie au Sénégal: Performance de la production et enjeux pour la filière. Cirad-Agritrop. https://agritrop.cirad.fr/476061/

[11] Dasylva, M., Ndour, N., Sambou, B. and Toussaint Soulard, C. (2018) Les micro-exploitations agricoles de plantes aromatiques et médicinales: Élément marquant de l'agriculture urbaine à Ziguinchor, Sénégal. *Cahiers Agricultures*, **27**, Article 25004. https://doi.org/10.1051/cagri/2018011

[12] Beniest, J., *et al.* (1987) Guide pratique du maraichage au Sénégal. Centre pour le développement de l'horticulture au Sénégal.

[13] COLEACP (2021) Profil de marché sur la tomate transformée au Sénégal.

[14] Diaw, C.L. (2018) L'Expérience du micro jardin au Sénégal: Expansion vers d'autres pays d'Afrique de l'ouest. https://fr.slideshare.net/slideshow/briefing-de-bruxelles-50-coumbaly-diaw-lexprience-du-microjardinage-en-afrique-de-louest/93543987