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TITLE: A Prospective Study Using Spectrum Software Technology to Estimate Future Needs in the Field of Agriculture for the Year 2035 to Promote Food Security in Algeria.

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Abstract. Food security is closely linked to political independence and the achievement of full sovereignty for nations. Countries that achieve higher levels of food security are often stronger and more independent in their sovereign, political, and economic decisions. This has posed challenges for decision-makers to develop plans, strategies, and programs aimed at achieving self-sufficiency in food, thereby ensuring food security and political independence. This is evident in the 2030 Sustainable Development Agenda, which emphasizes food security and nutrition, with a specific goal to "end hunger, achieve food security, improve nutrition, and promote sustainable agriculture" (Goal 2 of the Sustainable Development Goals and its eight targets). In light of these challenges, our study utilizes Spectrum software technology to estimate future needs in the agricultural sector for the year 2035, with the aim of achieving self-sufficiency.

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Introduction.

The latest estimates from the Food and Agriculture Organization of the United Nations (FAO) indicate that the global hunger figure for 2022 ranges between 691 million and 783 million people. These estimates reveal that since 2015, the increase in the number of undernourished people worldwide has eroded nearly all the progress made during the previous decade. Furthermore, food insecurity increased significantly from 25.3% of the global population in 2019 to 29.6% in 2022. While the prevalence of severe food insecurity globally showed a slight decrease from 11.7% in 2021 to 11.3% in 2022, it remains significantly higher than pre-pandemic levels – equivalent to 180 million additional people compared to 2019.

Indicators focusing on malnutrition present a mixed picture. Although stunting decreased from 26.3% in 2012 to 22.3% in 2022, the rate of decline is not sufficient to meet the global target. In 2022, 6.8% of children under the age of five were affected by wasting, while the prevalence of overweight children, at 5.6%, has stagnated over the past decade, requiring greater efforts to achieve the 2030 target (FAO, 2023).

Algeria is one of the countries that strives, plans, and fights to ensure food security for its citizens. Despite all the efforts made by the state, there remains a challenge in securing food security due to the lack of self-sufficiency in food production, prompting the country to import large quantities of essential goods compared to its domestic production. Hence, we conducted this study using Spectrum software technology in the agricultural sector to estimate future needs and achieve food self-sufficiency in line with the expected population growth by 2035.

1. Concept Definition:

1.1 Definition of Sustainable Development:

Definitions of sustainable development vary depending on the field of study (social, economic, environmental, etc.). Some definitions include:

- Sustainable development was defined by Barbier Edward, who first used the term, as "an economic activity that leads to an improvement in social welfare with the utmost care for available natural resources and minimal harm to the environment" (Al-Farraji, 2021).

- Paget defined sustainable development as "preserving opportunities for future generations with a general notion that justice is intertwined between generations" (Hassoun, Daoui, and Israa, 2015).

- The World Commission on Environment and Development, established by the United Nations to study this issue, provided a definition in 1987 in its report *Our Common Future*, describing sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Egyptian Ministry of Environment, 2024).

- Generally, sustainable development means being fair to future generations, aiming to leave them with a stock of resources equal to or better than what the present generation inherited.

1.2 The 2030 Sustainable Development Agenda and Goal:

The 2030 Sustainable Development Agenda is an action plan adopted unanimously by United Nations member states in 2015 to set the direction for global and national development policies. It also aims to provide new options and opportunities to bridge the gap between human rights and the right to development, forming a comprehensive framework that guides both global and national development efforts.

This global plan includes 17 goals aimed at achieving 169 sustainable development targets. To measure the achievement of these goals and targets, 231 indicators have been identified to assess the degree of implementation of policies and the Sustainable Development Agenda.

- **The second goal of the 2030 Sustainable Development Agenda focuses on food security, which is to "end hunger, achieve food security, improve nutrition, and promote sustainable agriculture" (Lartey, 2015).**

This comprehensive goal revolves around eight specific targets: five of which focus on development outcomes, while three address the means of implementation. The outcome targets cover a broad spectrum, ranging from hunger and malnutrition to agricultural productivity and income for small-scale food producers, sustainability of agricultural practices, and protection of plant and animal genetic resources, thus covering the four dimensions of food security and nutrition (availability, access, utilization, and stability) (FAO, 2016).

1.3. Food Security:

There are many definitions of food security, including:

- According to the 1996 World Food Summit, food security is defined as a condition where "all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (World Bank Group, 2024).

- Food security refers to the state of achieving local self-sufficiency in food, based on the country's ability to meet the needs of all individuals for food products through local production (Murad, 2010).

- The Food and Agriculture Organization (FAO) defines food security as: "a situation in which all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (Brahim, 2016).

2. Dimensions and Importance of Food Security:

2.1 The Four Main Dimensions of Food Security (World Bank Group, 2024):

To achieve food security goals, all four of the following dimensions must be met simultaneously:

- **Food Availability:** This refers to the "supply side" of food security, determined by food production levels, stock levels, and net trade in food.

- **Physical and Economic Access to Food:** Adequate food supply at the national or international level does not, by itself, guarantee food security at the household level. Concerns about insufficient access to food have led policies to focus more on income, expenditure, markets, and prices to achieve food security goals.

- **Utilization of Food:** Utilization is generally understood as the way the body makes the most of the various nutrients contained in food. Adequate intake of nutrients that provide energy and nourishment is the result of good care, proper feeding practices, food preparation methods, dietary diversity, and food distribution within the household. In addition to good biological utilization of consumed food, this determines individuals' nutritional status.

- **Stability of the Three Dimensions Over Time:** Even if a person has enough food today, they are still considered food insecure if they lack the capacity to access food regularly, putting them at risk of deteriorating nutritional status. Poor weather conditions, political instability, or economic factors (such as unemployment and rising food prices) can affect food security.

2-2 The Importance of Food Security (annajah.net, 2024):

Food security is of great importance because its absence can lead to serious health, economic, and social consequences.

- **Health:** Food security is closely linked to health. People who do not get enough food are more susceptible to diseases such as malnutrition, obesity, heart disease, and diabetes.

- **Economic and Social Development:** Food security contributes to economic and social development. People with food security are more productive and better able to participate in society.

- **Political Stability:** Food insecurity can lead to social and political conflicts. People who lack sufficient food are more likely to engage in violence.

The pursuit of food security and the provision of safe and adequate food for different populations have prompted the World Bank Group and its partners to develop a strategy to achieve this goal by establishing food systems that can provide food for all, everywhere, and every day by improving food security, promoting "nutrition-sensitive agriculture," and enhancing food safety. The World Bank is one of the main financiers of food systems. In the 2022 fiscal year, there were new commitments worth \$9.6 billion from the International Bank for Reconstruction and Development/International Development Association for agriculture and related sectors. Relevant activities include (World Bank Group, 2024):

- Strengthening safety nets to ensure that vulnerable households have access to food and water, along with sufficient funds to purchase essential goods.

- Providing urgent emergency support through fast-disbursing funds from existing projects to address crisis situations.

- Working with countries and development partners to tackle food security challenges through rapid country diagnostic studies, data-based monitoring tools, and partnerships such as the Famine Action Mechanism and the Agricultural Observatory.

- Promoting agricultural systems that use climate-smart methods and produce a more diverse mix of foods to improve food system resilience, increase farm incomes, and provide more nutrient-rich and affordable food.

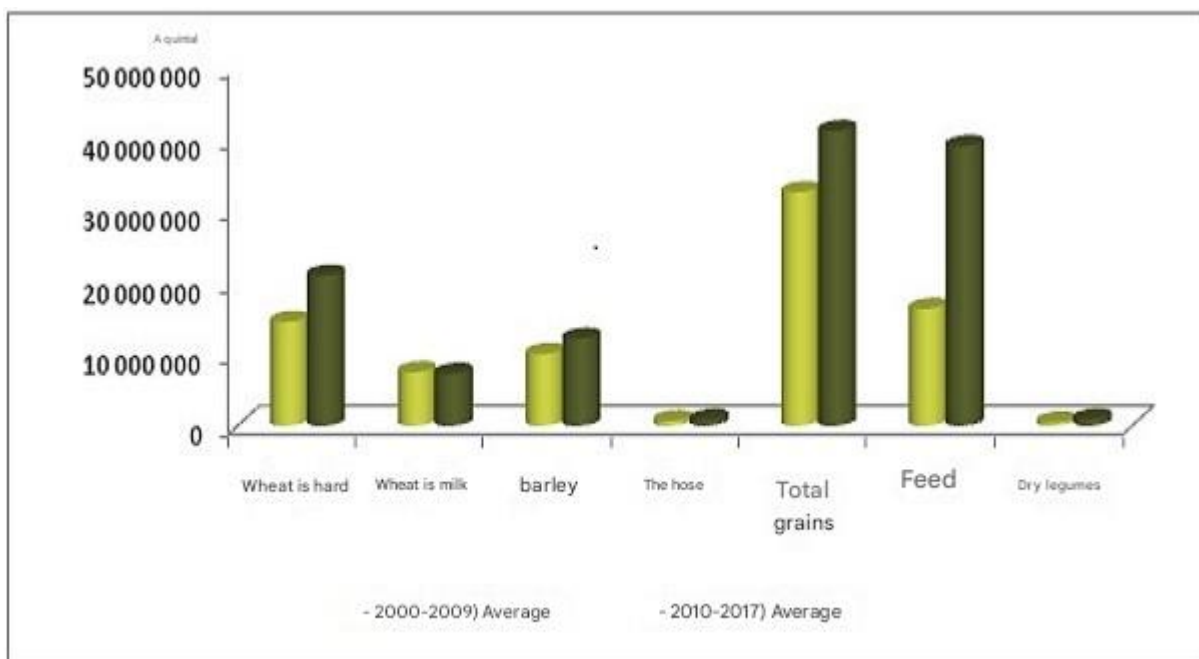
- Improving supply chains to reduce post-harvest food losses, enhance hygiene in food distribution channels, and establish better connections between production and consumption centers.

- Implementing the integrated "One Health" approach to manage risks related to human, animal, and environmental health.

- Supporting investments in research and development to increase the micronutrient content in foods and raw materials.
- Advocating for policy reforms and regulatory changes to enhance the efficiency and integration of local food markets and reduce trade barriers for food commodities.
- Collaborating with the private sector, governments, scientists, and others to strengthen capacities for assessing and managing food safety risks in low- and middle-income countries.
- Supporting long-term global food security programs: The World Bank hosts the Global Agriculture and Food Security Program, a global financing mechanism that pools donor funds to provide additional complementary financing for agricultural development across all aspects of the value chain.

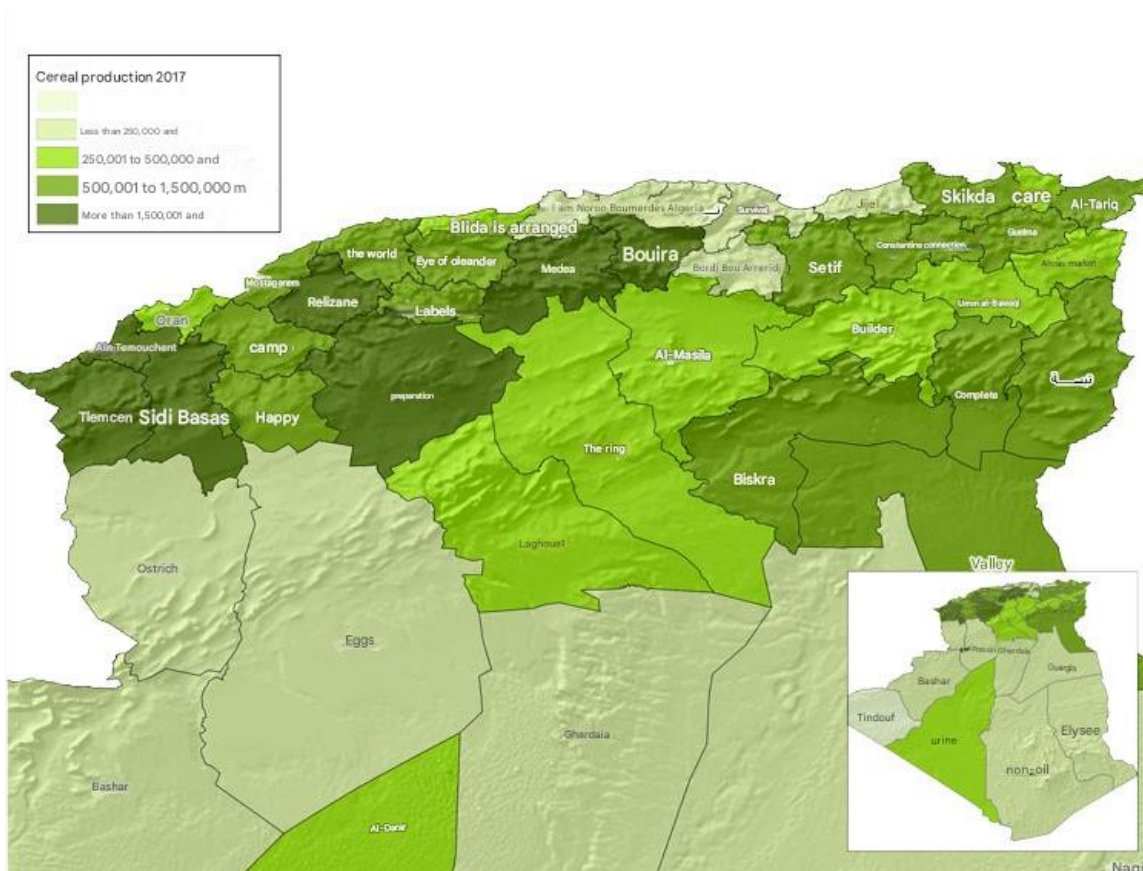
3- Some Statistics and Data from the Algerian Ministry of Agriculture (Algerian Ministry of Agriculture, 2021).

- Cereal products hold a strategic position in both the diet and the national economy. During the periods 2000-2009 and 2010-2017, cereal crops occupied an annual average of 40% of the utilized agricultural area.
- The area planted with cereals during the decade 2000-2009 is estimated at approximately 3,200,930 hectares, with durum wheat and barley occupying most of this area, accounting for about 74% of the total cereal area.
- During the period 2010-2017, the average area reached 3,385,560 hectares, an increase of 6% compared to the previous period (2000-2009).
- The average cereal production during the period 2010-2017 is estimated at about 41.2 million quintals, an increase of 26% compared to the decade 2000-2009, where the average production was estimated at 32.6 million quintals.
- Production mainly consists of durum wheat and barley, which represent 51% and 29% respectively of the total average cereal production during 2010-2017.
- Industrial crops focus on industrial tomatoes and tobacco, with an annual average area of 19,380 hectares during the periods 2000-2009 and 2010-2017. For tobacco, the average area reached 4,850 hectares during the same periods.
- In terms of production, industrial tomato output increased significantly by 136%, due to improved yield, which rose from around 200 kg/hectare during the period 2000-2009 to more than 500 kg/hectare during the period 2010-...



Source: Data from the Algerian Ministry of Agriculture and Rural Development (Algerian Ministry of Agriculture, 2021)

From the figure, we observe that the total production of cereal crops during the period 2010-2017 is higher than in the period 2000-2009, reaching 41 million quintals compared to approximately 35 million quintals during the period 2000-2009. In detail, the production of durum wheat during the period 2010-2017 recorded 23 million quintals, while the production volume of durum wheat for the period 2000-2009 was approximately 17 million quintals. As for other crops such as soft wheat, barley, oats, and dry legumes, the production was relatively similar.



Source: Ministry of Agriculture (Algerian Ministry of Agriculture, 2021).

4- Method and Tools:

We conducted the foresight study using the Spectrum program tool, which is a program that includes several systems, models, and applications used to make demographic projections (such as population size, fertility trends, life expectancy, mortality rates, etc.), extending up to 150 years into the future. The Spectrum program is used to estimate needs across various sectors, such as education, health, and employment, to project future demands and support political planning processes or family planning initiatives.

The first step we undertook was population projection to determine the size of population change for the projection year (2035) starting from the selected base year (2019) using the DEMO model. We then estimated the needs for the projection year (2035) in terms of (cultivated land area, annual consumption of the main crop, and annual production of the main crop) using the

RAPID model (Resources for the Awareness of Population Impacts on Development) within the program.

The RAPID project highlights the social and economic consequences of high fertility rates and rapid population growth in sectors such as labor, education, health, urbanization, and agriculture. This program is used to raise policymakers' awareness of the importance of fertility and population growth as key factors in social and economic development.

The RAPID model contributes to estimating needs in the following areas:

- **Economic field:** It estimates the labor force participation rate for males and females (ages 15-65 and 10-14), the expected Gross Domestic Product (GDP), and the GDP growth rate.

- **Educational field:** It helps estimate the projected number of students in various educational stages, the number of teachers and professors required, and the expenditure on education across different levels.

- **Health field:** The Spectrum program assists in estimating future healthcare needs, including the number of hospitals, health centers, hospital beds, doctors, nurses, and annual healthcare expenditure.

- **Urban field:** It helps estimate the proportion of the population in urban cities, the population in major cities, and the ratio of population to urban housing units and buildings.

- **Agricultural field:** It contributes to estimating the area of agricultural land, production volume of staple crops (main cereals), annual growth in cereal production, and annual cereal consumption.

5- Results and Discussion:

Foresight Study Results for Needs Estimation in the Agricultural Sector in Algeria (2019-2035):

5-1 Estimation of Population Size between 2019 and 2035:

The estimation of population size in Algeria between 2019 and 2035 involves studying the demographic changes expected in the near future. This estimation is based on several factors, such as population growth rates, fertility, mortality, and migration. Analyzing these factors allows for predicting future population trends in Algeria, aiding in informed decision-making in areas such as urban planning, education, health, and resource management. Projections indicate that Algeria will witness an increase in population size, presenting both challenges and opportunities for the government and society in achieving sustainable development.

Table 01: Estimation of Population Size in Algeria between 2019 and 2035.

Table 01: Estimation of Population Size in Algeria between 2019 and 2035

Year	Population
2019	43,113,932
2020	43,838,804
2021	44,569,236
2022	45,287,752
2023	45,975,476
2024	46,634,508
2025	47,266,744
2026	47,873,580
2027	48,459,104
2028	49,023,020
2029	49,569,428
2030	50,101,780
2031	50,622,704
2032	51,135,092
2033	51,642,128
2034	52,147,592
2035	52,649,776

Source: Prepared by researchers based on Spectrum program outputs.

The table provides a clear view of population growth in Algeria during the period 2019-2035, reflecting a continuous increase in population. In the base year (2019), the population was 43,113,932, while in the projection year (2035), it is estimated to reach 52,649,776, with an average annual growth of approximately 596,240 people. With this growth, Algerian society will face challenges in providing adequate services and resources for the increasing population, necessitating the development of sustainable national policies across various economic and social sectors. The data shows that population growth in Algeria follows a steadily rising trend. If this trend continues at the same pace, it will affect various aspects of life in the country, thus requiring

proactive planning and suitable strategies to accommodate this growth and ensure sustainable development.

5-2 Estimation of Cultivated Land Needs in Algeria (2019-2035):

The estimation of cultivated land needs in Algeria between 2019 and 2035 reflects the expected changes in demand for agricultural land due to population growth, urban expansion, and improvements in agricultural production methods. With population increase, the demand for food is expected to rise, necessitating the expansion of cultivated areas or enhancing the efficiency of current land use. Additionally, this challenge will require developing innovative agricultural techniques to adapt to climate changes and enhance agricultural productivity to ensure future food security.

Table 02: Estimation of Increase in Cultivated Land in Algeria during 2019-2035

Projection Year 2019 (Total cultivated land in million hectares: 3.3)

Year	Population	Increase in Cultivated Land (Million Hectares)	Total Cultivated Land (Million Hectares)
2019	43,113,932	0.08	3.38
2020	43,838,804	0.08	3.46
2021	44,569,236	0.08	3.54
2022	45,287,752	0.08	3.62
2023	45,975,476	0.09	3.71
2024	46,634,508	0.09	3.80
2025	47,266,744	0.09	3.89
2026	47,873,580	0.09	3.98
2027	48,459,104	0.09	4.07
2028	49,023,020	0.09	4.16
2029	49,569,428	0.09	4.25
2030	50,101,780	0.10	4.35
2031	50,622,704	0.10	4.45
2032	51,135,092	0.10	4.55
2033	51,642,128	0.10	4.65

Year	Population	Increase in Cultivated Land (Million Hectares)	Total Cultivated Land (Million Hectares)
2034	52,147,592	0.10	4.75
2035	52,649,776	0.10	4.85

Source: Prepared by researchers based on Spectrum program outputs.

From Table (02), we observe that the population in Algeria is gradually increasing from 43,113,932 people in 2019 to 52,649,776 people in 2035, resulting in an almost steady annual increase of slightly more than 700,000 people per year.

Meanwhile, the increase in cultivated land was initially steady at 0.08 million hectares annually between 2019 and 2022, estimated at 3.38 million hectares in 2019 and reaching 3.62 million hectares in 2022. After 2023, when it was estimated at 3.71 million hectares, the increase rose to 0.09 million hectares annually, reaching an estimated 4.25 million hectares by 2029. From 2030 onwards, the increase rose to 0.10 million hectares annually, reaching 4.35 million hectares and projected to reach 4.85 million hectares by the forecast year.

These increases resulted in three distinct periods:

- The period from 2019 to 2022: Annual increase steady at 0.08 million hectares.
- The period from 2023 to 2029: Increase rises to 0.09 million hectares.
- The period from 2030 to 2035: Increase reaches 0.10 million hectares annually.

From the table, between 2019 and 2022, although the population increased by approximately 2.1 million, the increase in cultivated land remained steady at 0.08 million hectares. However, between 2023 and 2029, there was a slight increase in cultivated land (0.09 million hectares annually), coinciding with a population rise of approximately 700,000 to 800,000 people annually. By 2030, the increase in cultivated land rose to 0.10 million hectares annually, keeping pace with continuous population growth.

While population growth remains continuous and steady, the increase in cultivated land is accelerating over time. This indicates planning to expand cultivated land over time to meet the growing population’s food and agricultural needs. Expanding agricultural land leads to increased food production, helping the country achieve a better level of food self-sufficiency, provided that there is a necessary focus on improving agricultural productivity through technology or enhanced farming methods to increase the productivity of cultivated land, especially with continued population growth.

5-3 Estimation of Annual Consumption Needs for the Main Crop (Wheat) in Algeria Between 2019 and 2035:

Estimating annual wheat consumption needs in Algeria between 2019 and 2035 is a critical step to ensure food security and meet the expected increasing demand due to population growth and improved living standards.

Wheat is considered one of the essential crops in Algeria, with the population relying on it as a primary source of food.

Accurate estimation of annual wheat needs requires studying current consumption rates and population growth projections, taking into account possible changes in dietary habits and agricultural policies to achieve sustainable self-sufficiency.

Table 03: Estimation of Annual Consumption Volume in Algeria for the Period 2019/2035

Year	Population	Annual Individual Consumption (kg)	Total Consumption (Million Tons)
2019	43,113,932	246	10.61
2020	43,838,804	238	10.44
2021	44,569,236	230	10.26
2022	45,287,752	222	10.07
2023	45,975,476	215	9.86
2024	46,634,508	207	9.64
2025	47,266,744	199	9.39
2026	47,873,580	191	9.14
2027	48,459,104	183	8.87
2028	49,023,020	175	8.58
2029	49,569,428	167	8.29
2030	50,101,780	159	7.98
2031	50,622,704	152	7.67

Year	Population	Annual Individual Consumption (kg)	Total Consumption (Million Tons)
2032	51,135,092	144	7.34
2033	51,642,128	136	7.01
2034	52,147,592	128	6.67
2035	52,649,776	120	6.32

Source: Prepared by researchers based on the outputs of the Spectrum program.

Table (03) presents data related to population, annual individual consumption volume, and total consumption volume (in million tons) in Algeria during the period from 2019 to 2035. The table shows a gradual increase in population from 2019 to 2035. In 2019, the population was 43,113,932, and it continued to grow until reaching 52,649,776 in 2035. This increase reflects an average annual population growth rate of about 1.1% to 1.2%.

The table also shows a gradual decrease in annual individual consumption volume, from 246 kg in 2019 to 120 kg by 2035. This decline can be attributed to several factors, such as improved resource use efficiency, changes in dietary patterns, increased awareness and culture of healthy consumption, combating waste, and economic or environmental factors that may reduce individual consumption.

Moreover, the table highlights that total consumption volume also decreases over the years despite population growth. In 2019, the total consumption volume was approximately 10.61 million tons, while it is expected to decrease to 6.32 million tons by 2035. This suggests that despite population growth, the significant decline in individual consumption has led to a reduction in total consumption volume.

The contradiction between population growth and declining individual and collective consumption can be attributed to increased awareness among the population, who have become more conscious about consumption and waste reduction; government policies aimed at improving resource use efficiency or changing consumption patterns; and economic or environmental factors that have led to reduced spending or consumption overall.

If current trends continue, individual consumption by 2035 is expected to be 51.2% lower than in 2019 (from 246 kg to 120 kg). On the other hand, the population will have increased by approximately 22% over the same period.

We conclude that the decline in individual consumption represents both a challenge and an opportunity. The challenge lies in adapting to changing consumption patterns, while the opportunity is that this decline may help reduce pressure on natural resources, ensure self-sufficiency in this commodity, and provide the possibility of export in case of surplus. Meanwhile, population growth indicates the necessity of having sustainable policies to address this increase, especially regarding food supply and other resources.

5-4 Estimating the Annual Production Needs of the Main Crop (Wheat) Between 2019 and 2035 in Algeria:

Estimating the annual production needs of wheat in Algeria between 2019 and 2035 is an important step to secure local consumption requirements and reduce dependence on imports. This estimation involves studying factors affecting wheat production, such as cultivated area, agricultural productivity, and climate changes. With the growing population and increasing demand for wheat, enhancing local production becomes a priority to ensure supply stability and achieve food security in the future.

Table 04: Estimation of Annual Production Volume of the Main Crop (Wheat) Between 2019 and 2035

Year	Population	Production Volume (Million Tons)
2019	43,113,932	3.2
2020	43,838,804	3.23
2021	44,569,236	3.43
2022	45,287,752	3.63
2023	45,975,476	3.85
2024	46,634,508	4.1
2025	47,266,744	4.32
2026	47,873,580	4.58

Year	Population	Production Volume (Million Tons)
2027	48,459,104	4.86
2028	49,023,020	5.15
2029	49,569,428	5.46
2030	50,101,780	5.79
2031	50,622,704	6.13
2032	51,135,092	6.50
2033	51,642,128	6.89
2034	52,147,592	7.31
2035	52,649,776	7.75

Source: Prepared by researchers based on the outputs of the Spectrum program.

The table includes data showing the estimated annual wheat production in Algeria from 2019 to 2035, along with the population size for each year. From the table, we observe that in 2019, wheat production was 3.2 million tons. By 2035, it is expected to reach 7.75 million tons, indicating a gradual growth in annual wheat production with an almost constant annual increase rate. The increase in production between 2019 and 2035 is approximately 4.55 million tons, with an annual growth rate of 0.284 million tons per year. Meanwhile, the population in the base year 2019 was 43.1 million and is projected to reach 52.6 million by 2035, with an annual population growth rate of approximately 0.596 million people.

The table shows that annual wheat production increases proportionally with population growth. This suggests the presence of agricultural policies aimed at meeting the increasing demand for wheat as the population grows. In 2019, the per capita wheat production was 0.074 tons per person, and by 2035, it is expected to reach 0.147 tons per person. This reflects a significant improvement in per capita wheat production over the years, indicating advancements in agricultural efficiency or an expansion in the area cultivated with wheat.

The table demonstrates that the annual production growth rate appears to align with population growth, even surpassing it in some years. This suggests that the country may achieve self-sufficiency in wheat or even be able to export in the future. The more than doubling of production over 16 years (from 3.2 to 7.75 million tons) indicates the use of advanced agricultural

technologies, an increase in cultivated land, or improved water management and other resources necessary for agricultural production.

Given this upward trend in production, future challenges may lie in efficiently managing natural resources such as water and agricultural land. The growing population will increase the demand for food, but the sustainable growth in wheat production indicates that effective developmental plans are in place to address these challenges. The table reflects an optimistic outlook for wheat production growth in line with population growth, suggesting that the country is investing in the agricultural sector and striving to improve productivity to meet rising food demands, with promising prospects for increasing per capita production in the coming years.

Conclusion

The issue of food security is not only an urgent necessity to ensure the survival of nations and peoples, but also a fundamental pillar for achieving independence and national sovereignty. Food security is essential for the stability of societies and the maintenance of social peace. Therefore, ensuring adequate and sustainable food for both current and future generations require integrated efforts across all economic, environmental, and social sectors.

Achieving food security is linked to the availability of comprehensive policies and strategies that take into account the challenges facing the agricultural sector, such as the scarcity of natural resources, degradation of agricultural lands, climate change, population growth, and rural-urban migration. Hence, countries must develop strategic plans that enhance the contribution of agricultural and industrial sectors to food production by expanding investments in modern agricultural technologies and providing incentives for farmers and young people to engage in this vital field.

Governments must encourage more individuals, especially young people, to participate in agriculture and livestock farming by offering financial, technical, and legislative support. Additionally, plans should be put in place to combat desertification and reduce urban sprawl that threatens agricultural lands. This can be achieved through afforestation campaigns, better urban planning, protecting agricultural lands from encroachments, and optimizing water resource usage by adopting modern irrigation techniques such as drip irrigation and desalination, as well as considering the privatization of water management by assigning it to specialized companies for more efficient distribution.

At the same time, countries need to develop a more diverse and sustainable agricultural system that focuses on producing crops reliant on artificial irrigation rather than rain-fed agriculture, which has become unreliable due to climate change. There should also be plans to

reduce dependence on industrial crops used for biofuel production, such as corn and sugarcane, and instead prioritize food crops that directly contribute to self-sufficiency.

Addressing rural-urban migration is also essential, as it leads to labor shortages in agricultural areas and increases urban population pressures. This can be mitigated by improving living conditions in rural areas and providing essential services to encourage residents to stay and contribute to agriculture. Moreover, it is important to promote healthier eating habits to reduce excessive consumption of bread and processed foods, which increases the demand for grain imports and exacerbates food shortages.

Another crucial aspect of food security strategies is combating food waste. Millions of tons of edible food are wasted annually, especially in developed countries, while millions suffer from hunger in developing nations. Tackling this issue requires raising awareness about the importance of responsible consumption and ensuring a fair redistribution of food resources.

In conclusion, achieving food security is a collective endeavor that requires coordinated efforts between governments, farmers, businesses, and civil society to build a sustainable food system that meets the needs of the present while safeguarding the rights of future generations.

References:

1. Food and Agriculture Organization. (2023). *Tracking progress on food and agriculture-related SDG indicators 2023*. Retrieved on 07/04/2024, from <https://openknowledge.fao.org/server/api/core/bitstreams/e1ede2f4-b6e9-4b2a-a327-950c51c9a83f/content/index.html>
2. Ali Jassim Hamoud Kanas Al-Faraji. (01/28/2021). *General definitions of sustainable development*. Retrieved on 07/04/2024, from Al-Murja Electronic Reference for Informatics: <https://mail.almerja.com/more.php?idm=145918>
3. Hassoun Abdullah, Saleh Daoui Mahdi, Abdulrahman Khudair Israa. *Sustainable Development: Concept, Elements, and Dimensions*. Deli Journal, Issue 67, p. 341.
4. Egyptian Ministry of Environment. (2024). *Sustainable Development*. Retrieved on 07/06/2024, from Ministry of Environment: <https://www.eea.gov.eg/Topics/86/35/Details>
5. Ana Lartey. (2015). *United Nations Chronicle*. Retrieved on 07/06/2024, from United Nations: <https://www.un.org/ar/chronicle/article/20258>

6. Food and Agriculture Organization of the United Nations. (2016). *Monitoring Food Security and Nutrition in Support of the 2030 Sustainable Development Agenda: Current Situation and Future Prospects*. Rome. Retrieved on 07/06/2024, from United Nations: <https://www.un.org/ar/chronicle/article/20258>
7. World Bank Group. (2024). *Food Security Update*. Retrieved on 07/08/2024, from World Bank Group: <https://www.albankaldawli.org/ar/topic/agriculture/brief/food-security-update/what-is-food-security>
8. Nasser Mourad. *Food Security Policies in Developing Countries – The Case of Algeria*. *New Economy Journal*, Vol. 5, Issue 1, p. 45.
9. Belkala Brahim. *The Reality of Arab Food Security during the Period (2000-2014) and the Requirements for its Achievement*. *North African Economics*, Vol. 12, Issue 15, p. 710.
10. Annajah.net. *Food Security: Its Concept, Importance, Types, and Constraints*. Retrieved on 07/11/2024, from <https://annajah.net>
11. Algerian Ministry of Agriculture. (2021). *Agricultural Statistics*. Retrieved on 07/08/2024, from Ministry of Agriculture: <https://madr.gov.dz>



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