

## The impact of cold storage facilities on the commercial regulation of the Algeria fruit sector: Issues and Challenges

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*Received: 15/10/2025*

*Accepted: 13/03/2026*

*Published: 27/03/2026*

### Abstract:

This study examines the impact of cold storage infrastructure on the competitiveness of fruit producers in Algeria from 2017 to 2025. Drawing on data from ONS and MADR, the research demonstrates how refrigeration regulates market flows and significantly reduces post-harvest losses. The analysis highlights the strategic role of these facilities in stabilizing prices against seasonal fluctuations and improving agricultural income. However, the findings also reveal persistent regional disparities and logistics challenges. Ultimately, integrating the cold chain is identified as a vital lever for modernizing the sector and ensuring national food security.

**Keywords:** Cold storage infrastructure, Market regulation, Price volatility, Fruit sector in Algeria.

**Jel Classification Codes :** Q13, Q18, Q55

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## **1. INTRODUCTION:**

Algerian fruit sector is a major pillar of national food security, rural development, and economic diversification. According to the National Office of Statistics (ONS, Collections statistiques économiques – Indice de la production agricole. , 2024), it accounted for nearly 1.2 million direct agricultural jobs in 2023, while ensuring a significant share of households' fresh produce supply. However, despite this economic and social weight, the value chain remains confronted with pronounced structural constraints: high seasonality in production, postharvest losses that can exceed 30% for certain fruit categories (Peters, 2018), and recurrent price volatility linked to logistical difficulties and market coordination issues (Abebe, 2010). These factors fuel persistent imbalances between supply and demand across seasons, undermining both producer income and consumer purchasing power.

In this context, public and sectoral debates are increasingly presenting cold storage infrastructure as a potential lever for market regulation. these facilities allow for deferred marketing and mitigate seasonal fluctuations in supply through a temporal arbitrage mechanism by extending the shelf life of perishable goods, (Smith. J. & Brown. A, 2022), which is particularly crucial in a climate of increasing variability (Parfitt. J & al, 2010). Although public authorities have intensified their focus on agricultural logistics, notably through the National Agricultural Logistics Development Plan (PNDLA, (2021–2025).), several financial, institutional, and organizational constraints continue to limit the expansion and optimal utilization of such equipment.

Beyond their preservation function, cold storage units are likely to influence marketing schedules, loss levels, and producer revenues stability, aligning with international analyses that emphasize their structural role in regulating agricultural markets (Jedermann. R & al, 2014). Nonetheless, the actual extent of their contribution to the regulation of the Algerian fruit market, as well as the ambivalent effects related to speculative practices and

significant geographical disparities in capacity remain empirically under-documented.

This study aims to analyze the extent **to which cold rooms constitute a structural lever for regulating the Algerian fruit market while maintaining a clear distinction between factual description and structural effects**. The impact study is understood in a structural sense: the objective is to observe how the development of refrigeration capacities, particularly since 2021, modifies market operations by acting on the temporal adjustment of supply and prices, rather than claiming to establish strict causality in an econometric sense.

This study adopts a documentary and analytical approach based on the exploitation of secondary data for the 2017-2025 period. It employs three complementary components: a review of national and international literature, an analysis of public policies specifically the, (PNDLA, (2021–2025).), and the processing of statistical data primarily sourced from the Algeria's National Office of Statistics (**ONS**) and the Ministry of Agriculture and Rural Development (**MADR**). The selected sources include: ONS production and employment series, MADR reports on the fruit sector and national cold storage capacities, cold rooms data from the Ministry of Trade and Export Promotion and the First Biennial Transparency Report (**BTR1**) (Ministère Algérien de l'Environnement, décembre 2024) regarding major logistical platforms. Data were selected based on their relevance to the sector (production, losses, cooling capacities and prices), their institutional reliability, and the ability to establish coherent temporal comparisons.

## **2. Algeria fruit sector: challenges, performance and vulnerabilities:**

### **2.1 Economic, social and food importance:**

Algerian sector occupies a central position within the agricultural sector. According to data from the **Ministry of Agriculture and Rural Development** (MADR, 2023), fruit crops (excluding dates) cover more

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than 450,000 hectares, representing approximately 20% of the national utilized agricultural area (UUAA) devoted to arboriculture. The main cultivated species include citrus fruits, apples, pomegranates, figs, and grapes, in addition to the recent expansion of tropical fruit cultivation in Saharan regions such as Adrar, Béchar, and Ouargla.

From an economic perspective, the fruit sector makes a substantial contribution to agricultural value added, estimated at over 240 billion dinars in 2022. It provides income for thousands of farmers and serves as a key economic driver in several specialized production areas, notably the Mitidja plain, Kabylie, the High Plateaus, and certain Saharan valleys.

Socially, this sector employs a significant workforce, of approximately 1.2 million direct and seasonal agricultural workers (ONS, Agricultural Production Index, 2024), making it one of the largest sources of employment in rural areas. This workforce includes activities related to cultivation, harvesting, sorting, transportation, and marketing.

Finally, in terms of food and nutrition, fruits constitute an essential source of vitamins, minerals, and dietary fiber for the Algerian population. Average per capita fruit consumption in Algeria is estimated at nearly 90 kg per year according to the (FAO, Developing cold chains for fresh fruit and vegetables in the Middle East and North Africa region., 2023), a relatively high level compared to other Maghreb countries, but subject to strong seasonal and regional variations. However, despite this economic and social importance, the fruit sector remains exposed to strong structural vulnerabilities related to seasonality, postharvest losses and logistical constraints.

## **2.2 Structural constraints: seasonality, postharvest losses, price volatility and logistics:**

Despite its strategic importance, the Algerian fruit sector continues to face structural constraints that limit its economic performance and long-term sustainability.

Fruit production in Algeria is characterized by pronounced seasonality, with harvests concentrated between May and October, followed by periods of relative scarcity. This imbalance between supply and demand results in an overabundance of certain fruits, particularly watermelons, peaches, and plums, during the summer months, often accompanied by sharp price declines, followed by marked increases during the off season.

According to a joint study by the Ministry of Agriculture and Rural Development (MADR) and the FAO (2023), postharvest losses in the fruit sector can reach 25% - 35%, primarily due to inadequate sorting, packaging, and, above all, insufficient cold storage infrastructure. These losses which is predominantly affect fragile fruits, such as apricots, figs, and strawberries, which are highly sensitive to transport delays and adverse weather conditions.

The lack of effective market regulation mechanisms contributes to significant price volatility (A. Garrido & al, 2016). For instance, according to the weekly records of the Directorate of Trade Regulation of the Ministry of Commerce (2024), the price per kilogram of local apples fluctuates between 300 DA during the harvest period and over 600 DA out of season, such instability adversely affects consumer purchasing power and producer profitability.

Lack of adequate logistical infrastructure remains a major limiting factor for the Algerian fruit sector. Most farmers, particularly small and medium-sized producers, do not have access to cold storage facilities, packaging units, or specialized transport networks.

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In 2023, the country had approximately 650 approved cold rooms with a total capacity of 3.2 million m<sup>3</sup>, primarily concentrated in the northern regions, whereas the actual requirements are estimated to exceed 6 million m<sup>3</sup> (Ministère du Commerce et de la Promotion des Exportations, 2024).

### **2.3 Recent data on fruit production, employment, and postharvest losses:**

According to official ONS statistics (2023), the national fresh fruit production (excluding dates) reached nearly 6.8 million tons in 2022. The main productions by species were as follows:

- Citrus : 1.2 million tons
- Apples: 870,000 tons
- Watermelons and melons: 1.5 million tons
- Grapes: 730,000 tons
- Plums, apricots, figs, and others: 2.5 million tons.

These production volumes have moderately grown since 2015; however, this growth remains uneven across regions, largely due to climate change, irrigation challenges, and of agricultural land urbanization.

The ONS (2024) reports that the arboreal subsector employs nearly 1.2 million people, representing more than 35% of the active agricultural workforce. This figure includes seasonal harvesting and transportation jobs.

As previously noted, postharvest losses are estimated to be between 25% and 35%, depending on the species and region, corresponding to an annual loss of approximately 1.5 to 2 million tons of fruit. This situation not only results in substantial food waste but also leads to reduced income for producers and exerts an inflationary effect on prices during off-peak periods (MADR, 2023).

### **3. Inventory of cold storage infrastructure in Algeria:**

#### **3.1 Existing infrastructure:**

Given the strong seasonality of fruit production, refrigeration infrastructure plays a central role in smoothing supply and stabilizing prices. In this context, refrigeration infrastructure, particularly cold storage facilities, plays a central role in market regulation. These facilities allow supply to be smoothed over time, stabilize prices, and ensure continuous access to fruit for markets throughout the year (FAO, Developing cold chains for fresh fruit and vegetables in the Middle East and North Africa region., 2023).

According to the First Biennial Transparency Report (BTR1) submitted to the United Nations, the total capacity of refrigeration infrastructure in Algeria is estimated at approximately 383,000 m<sup>3</sup>, refers exclusively to large-scale logistics platforms and regional cooling hubs distributed across about thirty cold storage facilities and logistics cooling platforms nationwide (Ministère Algérien de l'Environnement, décembre 2024). In contrast, the **3.5 million m<sup>3</sup>** capacity cited from the Ministry of Commerce's 2021 census represents the aggregate national capacity, encompassing all storage units, including medium-scale commercial and private facilities. This distinction is crucial for distinguishing between strategic logistical infrastructure and the wider, diffuse storage network.

The government aims to achieve one million m<sup>3</sup> of positive and negative cold storage nationwide. For example, a flagship project (the Adrar Refrigeration Complex) offers 15,000 m<sup>3</sup> of storage, including 12,000 m<sup>3</sup> at positive temperature and 3,000 m<sup>3</sup> at negative temperature, complemented by a 4,000 m<sup>3</sup> unit in Reggane (Algerie-Eco, 2024). These facilities are intended to ensure the conservation of plant and animal products to regulate local markets. They include modular cold rooms, ranging from 500 to 1,500 m<sup>3</sup>, designed to meet regional agricultural needs.

The geographical distribution of cold storage facilities in Algeria reveals a significant structural imbalance, marked by excessive

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concentration in the northern wilayas (Blida, Bouira, Tipaza, and Constantine). This northern concentration marginalizes high-potential agricultural regions in the south and the Highlands, which are essential for national fruit production.

Strategic areas, such as Adrar (the leading producer of Deglet Nour dates), El Oued (watermelon), Tlemcen (plums and cherries), and Batna (apple orchards), remain under-equipped in terms of refrigerated storage capacity. This territorial asymmetry hampers local market regulation: producers in these regions are compelled to transport their harvests over long distances to storage centers in the north, resulting in increased postharvest losses (up to 50% for fragile fruits) and greater dependence on intermediaries.

This logistical deficit restricts the economic development of southern productive basins and intensifies regional disparities, thereby undermining the national objective of fresh fruit self-sufficiency.

This shortfall contributes to significant postharvest losses estimated between 25 and 30% in some sectors (FAO, Food loss and waste in the Near East and North Africa region. , 2021).

To address these challenges, the State has allocated a budget of 100 billion DA for the construction of cold storage facilities, with subsidies covering up to 50% of investment costs and interest-free loans available to operators. A national commission has also been established to restructure and strengthen the network, alongside banking facilities for farmers seeking to invest in the sector (Agence Presse Service (APS), 2024).

### **3.2 The impact of Cold rooms on the regulation of the Fruit Market in Algeria:**

#### **3.2.1 Effects on Availability and Prices:**

**a. Effect on the market availability of fruit:** according to official sources and national media national vegetable production was reported at 156

million quintals (M qtls) in 2023, while citrus production was estimated at approximately 16 M qtls for the 2022/2023 season and around 18 M qtls for 2023/2024 (APS – Algérie Presse Service, 2023). Concurrently, authorities have identified approximately 2,984 cold storage facilities with a total capacity of approximately 3.5 million m<sup>3</sup> (Ministry of Commerce and Export Promotion (Algeria), 2021) and have established a commission and a roadmap to develop a national refrigerated storage network, reflecting a strong political commitment to expand the use of cold storage.

**Table 1:** National fruit production evolution (2017/2021)

| <b>Years</b> | <b>Production (tons)<br/>ONS or<br/>estimation</b> | <b>%<br/>Variation</b> | <b>Lead Source</b>               |
|--------------|----------------------------------------------------|------------------------|----------------------------------|
| <b>2017</b>  | 5 349 084,6                                        | —                      | ONS                              |
| <b>2018</b>  | 5 577 632,5                                        | +4,27 %                | ONS                              |
| <b>2019</b>  | 5 952 695,7                                        | +6,72 %                | ONS                              |
| <b>2020</b>  | 6 049 349,2                                        | +1,62 %                | ONS                              |
| <b>2021</b>  | 5 670 338,8                                        | −6,27 %                | ONS                              |
| <b>2022</b>  | 5 753 000                                          | +1,47 %                | ONS Trend Estimation             |
| <b>2023</b>  | 5 838 000                                          | +1,47 %                | ONS + APS/Radio estimate         |
| <b>2024</b>  | 5 924 000                                          | +1,47 %                | Estimate ONS + Algerian<br>Radio |
| <b>2025</b>  | 6 011 000                                          | <b>1,47</b>            | ONS Trend Estimation             |

**Source:** Developed by the author based on data (ONS, Agricultural Production Index, 2024).

- **2017–2019:** Strong growth (+10.8% over two years), reflecting a favorable production environment, likely supported by good climatic conditions, cultivated area expansion, and efforts to improve yields.
- **2020:** Production peaked at 6.05 million tons, despite a growth slowdown (+1.62%), indicating a potential plateau in productivity gains.

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- **2021:** Significant decline (−6.27%), possibly linked to drought and logistical constraints.
- **2022–2025 (estimates):** Moderate recovery (+1.47% per year, according to the ONS trend), recommended relative stability without a substantial increase.

Inadequate cold chain management accounts for a significant reduction in marketable volume, with losses estimated at **10–13%** of total production (FAO, Food Loss and Waste Database – Estimations des pertes post-récolte. Disponible sur, 2019). Out of a production of 5.7 million tons, this corresponds to 570,000 - 740,000 tons that could potentially be saved through an effective cooling network.

**Before 2021:** Production dynamics primarily depended on cultivation and market conditions, with high sensitivity to climatic shocks.

**After 2021:** The expansion of cold storage capacity has acted as a safety net, to mitigate the effects of poor harvests or seasonal surpluses.

Without cold storage, part of the production had to be sold immediately, resulting in lower prices at harvest time and shortages in the off-season. However, some fruits can be preserved for several months With a strengthened network balancing supply and demand and limiting sudden price fluctuations.

Although fruit production has exhibited an overall stable trend since 2022, the growth of the cold storage network likely plays a structuring role in stabilizing availability and securing producers' incomes.

However, the 2023–2025 estimates, require confirmation through up-to-date ONS surveys to fully assess the impact of refrigerated storage on postharvest losses reduction and fruit sector competitiveness.

Between 2022 and 2025, the impact of investments in cold storage facilities could be explained as follows:

- The stabilization of the estimated production volumes despite the climatic risks,
- Improved availability during the off-season,

**b. Effect on price stability:** Cold storage facilities are a powerful tool for regulating supply and reducing seasonal price fluctuations (Gebresenbet, 212). As argued by (Hudson.D, 2007), storage acts as a temporal arbitrage mechanism that smooths price volatility by redistributing product availability from peak harvest to scarcity periods. However, in the absence of effective control mechanisms, they can also serve as a lever for speculation, as evidenced by targeted price increases for apples and dates. The actions of the Ministry through censuses, control campaigns, and sanctions are essential to ensure that this infrastructure operates in the public interest rather than serving special interests.

In December 2022, the Ministry of Commerce announced a program to establish regular and random cold storage facilities monitoring, including the creation of regional surveillance units (APS, 2022). The objective was to monitor stock levels, detect speculative behavior, and assess its impact on fruit and vegetable prices. This system forms part of a broader policy aimed at ensuring price stability.

According to *El Watan* (Constantine, 2024), controversial practices were observed in the field: a market representative reported that dates were being hoarded to artificially inflate prices (*El Watan, Hausse des prix des fruits et des légumes à Constantine : vers une stratégie étatique globale.*, 2024).

Similarly, the Consumer Protection Association has denounced sharp price increases, particularly for apples, citing storage in cold rooms orchestrated to delay sales and exert upward pressure on prices (Algérie360,

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flambée des prix des fruits et légumes, l'APOCE appelle à les réguler., 2023).

Although the official price list sets the reference price for local apples at approximately DZD 485/kg, some markets have reported prices of up to DZD 900/kg for apples stored in cold rooms (Algérie360, 900 DA/kg : après la banane, le prix de la pomme locale flambe en Algérie., 2025). This substantial discrepancy between the administered price and the actual market price raises consumer concerns, highlighting market tensions and storage practices that may contribute to speculative behavior.

### **3.2.2. Impact on Food Quality and Safety:**

#### **a. Contribution of cold rooms to quality standards compliance:**

The Preservation of the quality of fruits and vegetables is a central concern for Algerian agriculture. Cold storage facilities play a key role in extending shelf life, reducing postharvest losses, and ensuring better compliance with sanitary standards. They also contribute to market regulation by mitigating seasonality effects and ensuring more regular product availability.

Thus, the following analysis is based on two complementary dimensions: technical mechanisms for preserving and maintaining product quality and the infrastructures and regulatory systems implemented by public authorities.

**a.1 Preservation and compliance with quality standards:** Cold storage facilities play an essential role in maintaining the sanitary and organoleptic quality of fruits and vegetables. They slow maturation, limit enzymatic degradation, and reduce microbial development by maintaining a controlled temperature, typically between 1°C and 6°C.

This regulation helps ensure optimal quality and better compliance with food safety standards (Africhill., 2023).

Furthermore, controlling relative humidity (ideally between 85% and 90%) and providing adequate ventilation prevent drying, wilting, or the appearance of mold (Intarcon, 2023). These technical parameters promote the preservation of the products organoleptic properties, particularly their texture, taste, and appearance, which are essential criteria in assessing compliance with market standards.

**a.2. Infrastructure and regulation:** Beyond technical aspects, cold rooms are part of a national market regulation strategy.

The Ministry of Commerce has repeatedly emphasized the importance of developing a national cold storage facilities network to stabilize supply, combat speculation, and ensure optimal agricultural production utilization, thereby contributing to the marketing of quality products (El Watan, Pour renforcer les capacités de stockage des produits agricoles : cap sur la réalisation de chambres froides., 2024).

furthermore, the authorities have reinforced the monitoring and inspection of these infrastructures to ensure that stored foodstuffs comply with regulatory requirements and do not undergo hidden deterioration. These measures include random inspections, sanctions in cases of fraud, and the establishment of regional monitoring units, constituting a governance tool to ensure market compliance and transparency (Vitamedz, 2015).

**a.3 Effect of Technical Innovations on Off-Season Supply:** A technical study indicates that innovations such as cold storage facilities and greenhouses have reduced the rigidity of seasonality in fruits and vegetables (Haichour.M, 2018). Consequently, they have promoted a more regular supply throughout the year, although higher off-season prices often accompany this increased availability.

### **3.2.3 Impact on Business Strategies:**

In Algeria, the development of the cold chain has become a key lever for reducing agricultural losses and stabilizing markets. Recent government initiatives reflect a strong commitment to strengthening food security through integrated policies and appropriate regulatory mechanisms. Beyond its technical function, this logistical development drives a transformation of commercial strategies and reshapes competitive relationships among agricultural market actors.

**a. Commercial strategy adaptation:** The integration of cold storage facilities has profoundly altered the commercial practices of Algerian producers and distributors. Traditionally, farmers were compelled to rapidly sell their crops during peak production periods, resulting in falling prices and postharvest losses of up to 10–13% of total production (Banque mondiale, 2022).

With the expansion of refrigeration infrastructure, estimated at 2,984 cold storage facilities with a total capacity of 3.5 million m<sup>3</sup> in 2021 (Ministère de l'Agriculture et du Développement Rural (MADR), Rapport sur les capacités nationales de stockage frigorifique., 2021), producers can now defer market entry and better manage seasonality. This enables them to sell at more favorable times, thereby reducing income volatility.

For instance, according to estimates from MADR reports and the national press (APS., 2023), the more regular availability of certain fruits (apples, citrus fruits, and dates) contributed to an average 15% - 20% increase in off season sales prices, thereby enhancing producers' profit margins.

**b. Effects on market participants' competitiveness:** Cold storage facilities also affect the competitive structure of the agricultural market. Actors equipped with modern preservation systems gain a clear comparative advantage, as they can:

- To ensure continuous product availability,
- To guarantee superior quality (texture, taste, appearance in compliance with standards),
- To meet the increasing demands of mass distribution channels and export markets.

According to (FAO, Food and Agriculture Organization. (2020). The state of agricultural commodity markets: Agricultural value chains and cold chain logistics., 2020), in horticultural sectors of developing countries, access to the cold chain increases farms' market share by 10% to 20% compared with those without it.

In Algeria, MADR findings corroborated this trend: The growing demand from urban markets and organized distribution channels (supermarkets, modernized wholesale markets) benefits producers equipped with cold storage facilities.

Consequently, the relative market share of operators using cold storage facilities has increased at the expense of traditional producers. Several sectors experienced consolidation around better-equipped actors Between 2018 and 2023:

- Citrus fruits: maintenance of permanent availability outside the harvest season
- Apples: Cold storage enabling marketing over 8 to 10 months
- Dates: export value enhanced due to compliance with quality standards.

consequently, the use of cold storage facilities is no longer merely a logistical tool but a lever of structural competitiveness that reshapes the hierarchy of market actors.

#### **4. CONCLUSION:**

In Algeria, the fruit sector constitutes a strategic pillar of the agricultural economy and a critical component of food security. It spans

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over 450,000 hectares and contributes approximately 240 billion dinars to agricultural value added, employing nearly 1.2 million workers. However, the sector remains vulnerable due to pronounced production seasonality, postharvest losses ranging from 25% to 35%, and significant price volatility.

Cold storage facilities are emerging as a central regulatory tool. They extend the shelf life of fruits, reduce waste, enhance compliance with quality standards, and improve food safety. Their economic functions are evident, encompassing price stabilization, inventory management, supply chain optimization, and of farm income protection.

Despite public initiatives between 2021 and 2025—including subsidies, interest-free loans, and the creation of a national commission—the available cold storage capacity remains insufficient. In 2021, Algeria had approximately 2,984 cold rooms with a total capacity of 3.5 million m<sup>3</sup>, whereas national needs exceed 6 million m<sup>3</sup> (Ministry of Agriculture and Rural Development; Ministry of Trade). The distribution is highly uneven: it is concentrated in northern regions and marginalizes the Highlands and the South, exacerbating postharvest losses (up to 50% for fragile fruits).

The impact of cold rooms can be examined across three dimensions:

- **Availability and prices:** Cold rooms improve supply regularity and mitigate seasonal price fluctuations. However, speculative practices such as deliberate stock retention to maintain high prices (e.g., apples reaching 900 DA/kg in 2025) have been reported.
- **Food quality and safety:** Through temperature and humidity control, cold storage ensures compliance with health standards, reduces losses, and facilitates product recovery.
- **Commercial strategies:** Cold rooms enable producers to delay marketing, achieve higher off-season profitability (+15–20% for certain fruits), and gain a competitive advantage over market participants with refrigeration capacity.

Consequently, cold storage facilities are not merely technical infrastructures but strategic instruments that reinforce market regulation and competitiveness.

This study highlights that cold rooms are a key link in Algeria's agricultural logistics chain. They help reduce postharvest losses, ensure continuous fruit availability, stabilize prices, and maintain the quality of marketable products. Additionally, they support the adaptation of commercial strategies and enhance competitiveness of producers.

Nonetheless, their effectiveness is limited by insufficient capacity (3.5 million m<sup>3</sup> versus over 6 million m<sup>3</sup> needed), uneven geographic distribution, and speculative practices. These factors reduce their overall contribution to market regulation.

Public authorities have undertaken substantial efforts—including investments, subsidies, interest-free loans, and logistics platform projects—demonstrating a commitment to structuring an integrated national cold storage network. If successful, these initiatives could transform the fruit sector into a more competitive and sustainable industry capable of addressing food security and market imbalances.

Several priority actions are recommended to strengthen the strategic role of cold storage in regulating the Algerian fruit market:

- **To address territorial imbalances:** Direct new investments toward under-equipped but high-potential production areas in the Highlands and South (Adrar, El Oued, Batna, and Tlemcen) to reduce postharvest losses and regional disparities.
- **Regulate speculative practices:** Regular stock monitoring in cold rooms is Implemented to prevent artificial retention that drives price spikes.
- **Modernize and maintain infrastructure:** Rehabilitate obsolete equipment and enhance energy reliability, particularly in rural areas affected by power outages.
- **Promote cooperation among actors:** Encourage small producers to pool resources for collective access to refrigeration infrastructure, thereby increasing bargaining power and reducing intermediary dependence.

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- **Targeted financial incentives:** Grants covering up to 50% of costs and interest-free loans are offered, prioritizing sectors most affected by postharvest losses, such as apples, citrus fruits, and fragile fruits.

### 5. BIBLIOGRAPHIE LIST :

#### 1. books :

- Garrido. A and all, B. R.-O. (2016). *Agricultural markets instability: Revisiting the recent food crises*. London: Routledge.
- Gebresenbet.G (2012). *Logistics and supply chains in agriculture and food*. CABI Publishing.
- Hudson. D, (2007). *Agricultural markets and prices*. Blackwell Publishing. (États-Unis).

#### 2. Journal Articles :

- Abebe, G. K. (2010). Market coordination and post-harvest loss in fruit supply chains. *Journal of Chain and Network Science*, 10(1), 1-18.
- Gebresenbet, G. &. (212). *Logistics and supply chains in agriculture and food*. CABI Publishing, 139-145.
- Haichour. M, (2018). *Innovations techniques et évolution de la production agricole en Algérie : le cas des serres et des chambres froides*. Cinq Continents, 8(18), 103–117.
- Jedermann, R. et al. (2014). *Reducing food losses by intelligent food quality monitoring*. *Journal of Food Engineering*, 118(1), 147-161.
- Johnston, B. F. & Mellor, J. W. (1961). *The role of agriculture in economic development*. *American Economic Review*, 42-47.
- Parfitt, J. et al. (2010). *Food waste within food supply chains: Quantification and potential for change to 2050*. *Philosophical Transactions of the Royal Society B*, 365(1554), 3065-3081.
- Peters, H. E. (2018). *Food waste reduction through improved refrigeration: A case study*. *International Journal of Food Science & Technology*, 53(10), 2450-2460.

- Reardon, T. & Timmer, C. P. (2012). *The economics of the food system revolution*. Annual Review of Resource Economics, 238-242.
- Smith, J. & Brown, A. (2022). *Refrigeration technology and cold storage*. Journal of Food Engineering, 130, 45-58.

## **2. Online institutional reports :**

- Algerian Investment Promotion Agency (AAPI). (2023). *Bilan des projets d'infrastructure logistique et frigorifique en agriculture*. Alger: AAPI.
- FAO. (2019). *Food Loss and Waste Database – Estimations des pertes post-récolte*. Rome: FAO. <https://www.fao.org/food-loss-and-food-waste/en/>
- FAO. (2020). *The state of agricultural commodity markets: Agricultural value chains and cold chain logistics*. Rome: FAO.
- FAO. (2021). *Food loss and waste in the Near East and North Africa region*. Rome: FAO.
- FAO. (2023). *Developing cold chains for fresh fruit and vegetables in the Middle East and North Africa region*. Rome: FAO. <https://www.fao.org/3/cc6105en/cc6105en.pdf>
- FAO. (2023). *Developing cold chains for fresh fruit and vegetables in the Middle East and North Africa region*. Rome: FAO.
- Intergovernmental Panel on Climate Change (IPCC). (2022). *Climate Change 2022: Impacts, adaptation, and vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the IPCC*. Cambridge: Cambridge University Press. <https://doi.org/10.1>
- MADR. (2023). *Statistiques agricoles et filière fruitière*. Alger: Ministère de l'Agriculture et du Développement Rural.
- Ministère Algérien de l'Environnement. (2024, décembre). *Premier rapport biennal de transparence (BTR1)*. Alger: Ministère de l'Environnement.

## **The Impact of Cold Storage Facilities on the Commercial Regulation of Fruit in Algeria: Issues and Challenges**

---

- Ministère de l'Agriculture et du Développement Rural (MADR). (2021). Rapport sur les capacités nationales de stockage frigorifique. Alger.
- Ministère de l'Agriculture et du Développement Rural (MADR). (2022). Rapport annuel sur la production et la régulation du marché agricole. Alger.
- Ministère du Commerce et de la Promotion des Exportations. (2024). Recensement national des chambres froides et capacités de stockage frigorifique. Alger.
- Ministry of Commerce and Export Promotion (Algeria). (2021). Recensement national des chambres froides et capacités de stockage frigorifique. Alger.
- ONS. (2024). Collections statistiques économiques – Indice de la production agricole (N°241/2024). Alger: Office National des Statistiques.
- PNDLA. (2021–2025). Plan stratégique pour le développement logistique agricole. Alger: Ministère de l'Agriculture.
- World bank. (2022). *Food loss and waste in the Middle East and North Africa*. Washington, DC: World Bank Group.