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Potato Processing and Storage in Algeria

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Study on Potato processing and post-harvest chain in Algeria

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MPC
Meijer Project Consultancy

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Summary

This report contains the main findings of a study of the potato processing and post-harvest sector in Algeria. Potato processing in Algeria is still a very small economic sector; less than 1% of the total potato production volume is processed into French fries or potato chips.

Potato is Algeria's first vegetable crop both in terms of area and production and is an import staple crop. Both consumption and production have expanded considerably over the last three decades and the sector is still growing fast. Mechanisation is almost absent in the Mediterranean regions. Adequate soil management may accelerate the introduction of potato production machinery.

For further growth of the sector, export of potatoes and potato processing is important. Spunta is by far the most popular variety in Algeria, but for processing other varieties with higher dry matter contents are needed. Another important precondition for the development of the potato processing sector is the organization of production and continuous supply of potatoes according to the standards of the processor. To bridge the gap of insufficient supply of potatoes for processing, they need to be stored for longer periods. Adequate climate control, higher storage temperature and sprouting control are important challenges during the post-harvest period to preserve the desired potato quality for processing.

The report concludes with business opportunities and recommendations for cooperation between Algeria and the Netherlands contributing to the development of the potato sector in general and the potato processing industry in particular.

Keywords: Algeria, Mostaganem, potato, post-harvest, storage, climate control, potato processing, French fries, crisps, seeds and varieties, crop production, machinery & equipment, soil management

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Photo cover: Harvesting potatoes in Ain Défla.

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Preface

This project has been carried out during May - September 2019 and was initiated by the Netherlands Enterprise Agency and The Netherlands Embassy in Algeria as a follow up of Mixed Commission meetings held in 2016 and 2018 between the Netherlands and Algeria. In the framework of these meetings it was agreed to cooperate in developing the Algerian food processing industry. This study on potato processing and the post-harvest chain is to analyse the current situation and to conclude several actions and opportunities for cooperation between Algerian and Netherlands Companies and Institutions to develop the potato chain in Algeria.

A potato mission has been carried out to Algeria from 7 – 14 June 2019. This report describes the main findings of this mission and other information on the potato chain in Algeria. The report analyses the most important elements of the potato chain mainly from the potato processing point of view. Opportunities – both so called quick wins and longer term opportunities – are presented in the report.

We noticed substantial enthusiasm with Algerian and Dutch private companies, institutes and Government organizations to cooperate on the further development of the potato chain. We owe a lot of thanks to all the Algerian and Dutch companies, government institutes, Algerian potato farmers and others for sharing information, ideas and feedback with us.

Ben Meijer
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Summary

A study of the potato processing and post-harvest sector in Algeria has been performed by Ben Meijer (MPC), with assistance of prof. Abdelkader Aissat (Saad Dahlab University) and Khaled Benchaalal (EKN) during May – September 2019. As part of this study a visit was made to Algeria to the regions Algiers, Boumerdes, Ain Défla and Mostaganem. The mission program was organized by the Netherlands Embassy in Algiers and the Ministry of Agriculture. The program consisted of meetings with the Ministry of Agriculture and related institutes, the National and Regional Chambers of Commerce, The National Potato Council, potato processing industries, potato storage companies and potato farmers in the regions mentioned. Unfortunately we could not visit today's largest potato producing region El-Oued.

The agricultural sector is important for the economic diversification in Algeria, one of the goals of the Algerian Government. The agricultural sector contributes to over 13% of Algeria's GDP and employs 10% of the country's workforce. The importance of the potato sector has increased considerably over the last decades. Potato consumption increased from 34 kg/capita/year in 1980 to about 115 kg/capita/year in 2015. Much attention has been given to develop and improve potato production, which of course is an important part of the total potato chain.

How is it that developments in the field of potato storage and processing are lagging behind and what is needed to improve this situation? That is the key question of this study. Although the primary focus of this study is aimed at potato processing and the post-harvest industry, preceding parts of the potato production chain have been taken into account as well, because of their importance with regard to potato quality for processing.

Potato is Algeria's first vegetable crop both in terms of area and production and it is an import staple crop. Both consumption and production have expanded considerably over the last three decades and the sector is still growing fast. The average area of potatoes in recent years is about 153,000 ha with a total production volume of 4.7 million tons annually, growing up to 5 million tons in the near future. Spunta – an old Dutch variety – is by far the most popular potato variety, according to rough estimates it covers about two-third of total potato production in Algeria. But as Spunta's dry matter content (dmc) in Algeria is rather low (about 17%), this variety is not suitable for processing French fries or potato chips. The processing industry needs other varieties with a higher dmc, preferably 20-22% for French fries and 22-24% for potato chips. The problem is that farmers stick to their preferred varieties like Spunta and they do not seem willing to grow varieties suitable for processing because of several reasons: more difficult to grow, lower yield and less certainty in sales compared to Spunta. Therefore a total chain approach is needed to develop the processing industry, with the processing industry itself in the lead. The traditional production driven potato chain has to be transferred gradually into a market oriented potato production chain. In the case of processing: the processor has to set his standards (variety, dmc, potato sizes, storage conditions, etc.) and he has to organize production and supply for his industry, giving certain guarantees to the farmer concerning price and delivery of his produce. The approach of the potato processing industry as a total chain concept and the organization of production and supply of suitable potatoes is the most important challenge for the future development of this sector. This transition is still a long way to go.

The Mediterranean potato production regions are well-known for their heavy clay soils. The use of field machinery for potato production is almost absent because of many stones and hard clods, making mechanization almost impossible. In general, farmers do not own the land but they rent it for one or a few years. Because of this situation farmers do not invest in the land; soil management focused on the longer run is not a high priority of the farmers. To our opinion, adequate soil management is of great importance to improve potato production in terms of yield and quality. It starts with widening crop rotation, removing the stones, less deep ploughing, applying soil preparation on the right time with adequate machinery. Standardization of working width is very important when introducing machinery.

In Algeria potatoes can be grown almost all year round. Yet storage is needed to bridge periods of less supply. The average storage period is rather short compared to the situation in the Netherlands. In Algeria potatoes are stored for up to 3 months, sometimes longer. The common storage strategy is to cool potatoes as soon as possible and keep the storage temperature at 4 degrees Celsius. Ventilation and climate control (CO₂ and relative humidity) is not applied. Storage temperature is set at 4 degrees to prevent potatoes from sprouting. Sprout inhibitors like CIPC are not applied. Storage of potatoes for a longer period or storage of potatoes which have been harvested under less good conditions may cause high losses following the traditional storage strategy.

Potatoes for processing should be stored at higher temperatures (preferably 7-8 degrees). Lower storage temperatures lead to high levels of reducing sugar content which will give a poor frying color of the French fries and chips. Sprouting control is necessary at these storage temperatures.

The potato sector is supported by the government through different subsidies. Seed potato farmers, which are authorized by the government, receive a subsidy of 6 DA/kg for production of seed potatoes and 0.75 DA/kg/month for the storage of seed potatoes. The Ministry of Agriculture has set up a storage program (SYRPALAC: Système de Régulation des Produits Agricoles à Large Consommation) for ware potatoes to avoid heavily fluctuating potato prices for the consumers. In times of surplus potatoes are stored and in time of scarcity potatoes will be sold. Potato farmers participating this storage program receive a subsidy of DA 1.80/kg/month for storing ware potatoes.

The general policy of both the Ministry of Agriculture and the Potato Council is to develop the potato sector through seed potato production, processing and export. Algeria wants to decrease the imports of seed potatoes and increase local seed potato production in specific areas. The ambition is to export seed potatoes to other African countries. Processing of potatoes is favorable to replace imports of frozen French fries and potato chips on the one hand and to increase the total production volume of potatoes on the other hand. Finally Algeria has the ambition to export potatoes and potato products.

The results of this study are the following opportunities and recommendations.

1. Business opportunities for establishing potato production and supply for processing, expanding existing storage and processing capacity, establishing new potato processing factories and potato stores.
 2. Opportunities for cooperation, leading to business opportunities in future.
 - Demonstration project on soil preparation and potato production in the heavy clay area.
 - Demonstration project on advanced potato storage and climate control for processing.
 - Seminars on potato processing.
 - Training programs and knowledge exchange on all aspects of potato production.
 - Introduction of new varieties suitable for processing.
 - Matching Algerian and Dutch companies on storage, handling and processing.
- It is recommended to develop a *Potato Processing Chain Program*, covering all the aspects mentioned above, to be submitted to the Top Sector Agri & Food or to one of the encouragement programs for international development of the RVO.
3. Actions on Government level: G2G.
 - Continuation of cooperation between NVWA and INPV and others.
 - Assist Algeria to become a full member of UPOV.
 - How can Algerian authorities be involved in processing?
 - Discuss import barriers on technology and machinery.
 - How to professionalize marketing for the processing industry?
 - Assist Algeria to export (seed) potatoes and potato products.

It should be clear that the above mentioned recommendations are based on the findings of our visits in Algiers, Ain Défla and Mostaganem. Unfortunately we could not visit El-Oued. Potato production conditions in the desert area El-Oued are different from the Mediterranean regions. Recommendations for the El-Oued region especially with respect to potato production might be different as well.

1 Introduction

1.1 General context

Algeria wants to diversify its economy which currently is heavily dependent on the export of oil and gas. The Algerian agricultural sector has great potential to contribute to economic diversification in Algeria, given that it contributes to over 13% of Algeria's GDP and employs 10% of the country's workforce. The importance of the potato sector has increased considerably over the last decades. According to various sources, potato consumption was estimated about 34 kg/capita/year in 1980 and would be around 115 kg/capita/year in 2015, making this product an important part of the national dish. Algerian authorities as well as the potato sector recognize that the current absence of sound post-harvest handling, storage/packaging and processing industry hampers further development of the potato value chain.

In the framework of the Mixed Commission meetings held in 2016 and 2018 between the Netherlands and Algeria, it was agreed to cooperate in developing the Algerian food processing industry (including storage and agricultural logistics). This was again discussed in October 2018 between the Algerian Minister of Agriculture and DG Marjolijn Sonnema of LNV during the latter's visit to Algeria on the occasion of SimaSipsa2018. The Algerian Minister of Agriculture indicated that with respect to the potato processing industry and value chain development, Mostaganem is identified as focus area.

1.2 Problem analysis

Algeria is one of the largest potato producing countries of Africa in terms of hectares and production volume. Moreover, Algeria is the number one importer of high quality Dutch seed potatoes outside the EU. The annual import of Dutch seed potatoes is about 80,000 tons, which is about 10% of the total export of Dutch seed potatoes. Given this specific situation, it is incomprehensible that the potato post-harvest and processing chain in Algeria lacks far behind compared to other African countries like Zimbabwe, Kenya, Ethiopia, Tanzania. This is the key question of this study. How is it that developments in the field of potato storage and processing are lagging behind and what is needed to improve this situation? Finding answers will hopefully lead to concrete suggestions and recommendations for a sound development of the potato post-harvest and processing chain in Algeria.

Potato is Algeria's first vegetable crop both in terms of area and production and is an import staple crop. Both consumption and production have expanded considerably over the last three decades and the sector is still growing fast. Most of the Algerian potato production is consumed domestically and Algeria is more or less self-sufficient in its potato production.

The current potato production is concentrated in the following regions: Mostaganem/Mascara, Aïn Défla, Boumerdes/Bouira and El-Oued. Algerian authorities have identified Mostaganem as a focus region for cooperation with the Netherlands.

In Algeria, potatoes are produced in large quantities of relatively good quality. The Algerian potato-market is characterized by periods of overproduction and scarcity and large price volatility. Main reason for this problem is the lack of (cooled) storage capacity in the potato producing areas of Algeria.

The post-harvest handling, storage, sorting and packaging in the value-chain are underdeveloped. The potato processing industry is virtually absent: there are very few French fries producing enterprises like ALITECH¹ (35 km south from Algiers) and FRITOP (south-east from Algiers) and 15 – 20 small enterprises for crisps. SNAX (30 km south from Algiers) is the biggest crisps producing enterprise in Algeria. Consequently, less than 1% of Algeria's potato production is processed.

¹ ALITECH is probably the first enterprise to produce French fries in Algeria.

It is a well-known fact that processing of French fries and crisps sets high demands to the quality of the potatoes. To mention a few: shape and color and the absence of external damages, dry matter and sugar content. To meet the desired quality standards for fries and crisps processing, suitable potato varieties are needed in the first place. Furthermore it requires excellent crop management, production and harvesting techniques. Even if potato quality at harvest time is good, inadequate packaging, transport and climate control during storage may still deteriorate potato quality in such an extent that the product is no longer suitable for processing. Obviously the development of a sound potato processing sector in Algeria has many challenges.

The current absence of a strong and reliable post-harvest sector and lack of potato processing industry has thus far hampered investment, production and distribution activities. This lack also means that there are opportunities for economic development and job creation, that have not been taken yet. Algerian authorities have expressed their ambition to develop the post-harvest value chain in the potato sector. Development of the potato processing industry has the potential to add value to the chain, stabilize prices and to contribute to a growth in employment.

With over 80,000 tonnes annually, Algeria is the largest importer of Dutch seed potatoes outside the EU for more than 30 years. Furthermore, the Netherlands are the largest supplier of the Algerian seed potato market. Most of the imported seed potatoes are unloaded in the port of Mostaganem.

Since potato processing requires different potato varieties than currently produced in Algeria, it is likely that primary potato producers in Algeria need support in the introduction of new varieties (knowledge transfer, field trials etc.). Dutch potato companies have a long and successful history of developing many new potato varieties which are suitable for processing.

This study examines how the post-harvest and processing parts of the value chain can be developed, strengthened and professionalized. It contributes to the development of potato processing and thus valorisation of the potato value chain. Development of this sector also offers opportunities to the Dutch potato sector. Demand for potato processing machinery will increase and the project has the potential to increase demand of new, patented and more sustainable potato varieties especially for processing. Development of a professional and reliable post-harvest value chain in the potato sector furthermore has the potential to contribute to Algeria's ambition to increase exports. Currently the Algerian potato production is consumed domestically.

The study will also identify constraints in the business climate, hampering the development of the potato value chain. It will suggest solutions for improvement and opportunities for the Netherlands to contribute in the improvement.

1.3 Objectives and approach

This study examines how the post-harvest (packaging, transport and storage) and processing parts of the potato value chain can be strengthened and professionalized, by including Dutch and Algerian businesses currently active in the sector.

The following activities have been carried out during the study mission. A summary of the mission program is given in Annex 1.

- Preparation: Introduction and discussion with the Netherlands Enterprise Agency and the Netherlands Embassy in Algeria. Gathering available knowledge about the current potato production chain in Algeria from reports, information on the web and discussions with experts. Reports of WUR and Agriplan in particular have been valuable in this regard (see References).
- Introduction and discussions with the Ministry of Agriculture in Algiers, (Department of Agricultural production, Department of Plant Protection) the National Centre for Seed and Plant Certification (CNCC), and the National Institute of Plant Protection (INPV).
- Visit to the Algerian Chamber of Commerce and Industry (CACI) in Algiers and discussions with representatives from several potato and vegetable processing companies and private entrepreneurs interested in potato processing.

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- Introduction and discussion with the Directorate of Agriculture Services (Ministry of Agriculture) and the Chamber of Commerce and Industry (Ministry of Trade) in Ain Défla and Mostaganem.
 - Introduction and discussions with the National Chamber of Agriculture (CNA) in Algiers and with the National Potato Council (CNIFpt)².
 - Visit to Potato farmers harvesting potatoes and potato cold stores in Boumerdes, Ain Défla and Mostaganem. Discussion about potato production in general, land use, soil preparation, mechanisation, harvesting, logistics and storage.
 - Visit to SMCI, the agricultural machinery company in Ain Défla, with special interest in soil preparation and potato harvesting machinery.
 - Visit to potato storage and grading companies in Boumerdes and Mostaganem, with discussions about potato quality and options for mechanization of potato production.
 - Visit to potato processing companies, French fries processor for local fresh market, and potato chips processor for local and export market.
 - Final wrap up at the Netherlands Embassy in Algiers with the ambassador of the Netherlands Mr. Robert van Embden.

Although the focus of this study is on potato processing and the post-harvest potato chain, this report starts with a description of potato production in Algeria. The potato post-harvest chain, its strong and weak points and ways for improvement and further development cannot be seen separately from the production phase, especially when it comes to quality aspects and standard requirements for processing. This chapter concludes with a short description of the policy of Algerian government and the Potato Council for future development of the potato sector.

Chapter 3 deals with storage and processing of potatoes, it describes the current situation, the most important constraints and suggestions for improvement.

Chapter 4 presents the need for further development of a market driven potato post-harvest and processing industry.

Finally, recommendations for cooperation between Algeria and the Netherlands on improving the potato chain are outlined in chapter 5.

² The *Conseil National Interprofessionnel Filière pomme de terre* (founded in 2013) is responsible for managing and regulating the potato sector. The National Potato Council consists of representatives of the whole potato chain, from producers until processors. Its members are elected.

2 Potato production in Algeria

2.1 Introduction

Land use and land ownership in Algeria has been subject to differences in government policies with regard to agriculture in the past³. It is difficult to get a clear picture of the current farm size in agriculture in Algeria. According to the General Census in Agriculture in 2001⁴ about one-fourth of the farms had an effective area of 2 – 5 ha, while one-third of the farms was between 5 and 20 ha. Only 10% of the farms had a farm size of more than 20 ha. The total agriculture area was about 8.5 million ha, with an average farm size of 8.3 ha (see table 1). Regarding acreage distribution, 25% of the arable land was exploited by farms less than 10 ha, while 22 belonged to farms bigger than 50 ha.

Table 1 Statistical information about number of farms in different farm size categories.

Farm size class in Ha	Farms			Acreage			Average
	Number	%	% Cumulative	Ha	%	% Cumulative	Size (ha)
0.1 < 0.5	88 914	8,7	14,1	20 109	0.2	0.2	0.2
0.5 < 1.0	78 266	7.6	21.8	50 407	0.6	0.8	0.6
1.0 < 2.0	128 864	12.6	34.4	162 314	1.9	2.7	1.3
2.0 < 5.0	239 844	23.4	57.8	722 275	8.5	11.3	3.0
5.0 < 10	181 267	17.7	75.5	1 200 598	14.2	25.4	6.6
10 < 20	142 980	14	89.5	1 896 466	22.4	47.9	13.3
20 < 50	88 130	8.6	98.1	2 484 971	29.4	77.2	28.2
50 < 100	14 294	1.4	99.5	930 765	11	88.2	65.1
100 < 200	4 063	0.4	99.9	532 146	6.3	94.5	131.0
> 200	1 242	0.1	100	458 628	5.4	100	369.3
Livestock farmers	55 935	5.5	5.5	-	-	-	-
Total	1 023 799	100		8 458 680	100		8.3

Source: General Census of Agriculture 2001 (in Ahmed Ali A., 2011).

Over time the trend of further fragmentation of the agricultural land has reversed. More recent statistics of the Ministry of Agriculture and Rural Development (MADR), in 2012, reported there were 1,198,057 farms. 50% of the total Agricultural area was exploited by farms less than 20 hectares and 26% by farms less than 10 hectares. The average farm size decreased from 11.5 hectares in 1973 to 8.3 hectares in 2012. The main crops are cereals (mainly wheat and barley), with other important crops such as potatoes, fruits: citrus fruits, olives, dates⁵. (Agricultural and Rural Training FAR, 2012).

Most of the farmers are individual producers and most of them are small producers as is shown in table 1. The farmers are organised in associations, like UNPA (Union Nationale des Paysans Algériens). This organisation has also the possibility to talk to the Minister of Agriculture to ask for more assistance to the producers.

There are several associations for potato farmers. CNIFpt is the National Potato Council in which all the stakeholders of the potato value chain are represented (from the producers until the processors). Its members are elected. CNIFpt is linked to the National Chamber of Agriculture. There is a CNIF for every main agricultural produce. The CNIF is a platform to discuss the issues for a better coordination among the stakeholders. The Ministry of Agriculture is still the big player in the agricultural sector because of the government subsidies which are allocated to the producers.

³ For more information we refer to: LAOUBI, Khaled & YAMAO, Masahiro, 2012. The Challenge of Agriculture in Algeria.

⁴ Ahmed Ali A., 2011; Land legislation in Algeria and forms of access to land. CIHEAM, Mediterranean Options, Series B, pp 35-51. The data looks old, the last General Census has been done in 2001, which means it's the last data available.

⁵ Agricultural and Rural Training FAR (FAR International Network), FAR Algeria Sheet, 2012. <https://www.reseau-far.com>

Potato production in Algeria is carried out in different areas spread throughout the country. Most important areas can be found:

- On the strip of coastal plains as a vegetable crop, on small plots varying in size from a few acres to a few hectares.
- In the inland plains from east to west in rotation with vegetable crops on small areas of less than 10 ha or in rotation with cereals on areas of 10 ha to more than 200 ha.
- In the South on small areas in oasis or plots from 2 ha or less to 10 ha in the lands of the agricultural concession (land allocated as part of the Revival of Agriculture in the South).

Potatoes are grown on farms of different sizes, where irrigation water is available. The largest potato farms are located in the large producing wilayas in the north, such as Mostaganem, Ain Défla and Mascara, and in the wilaya of El Oued in the south. They are also found in a moderately productive wilaya, such as Boumerdes, where the most important potato stores in the country are concentrated. The size of a farm does not necessarily reflect its volume of potato production. Indeed, large producers often resort to leasing land, including in other wilayas, which has a tendency to distort statistics regarding the importance of potatoes on farms and the regional distribution of this crop.

Potato is Algeria's first vegetable crop both in terms of area and production and is an import staple crop. Both consumption and production have expanded considerably over the last three decades and the sector is still growing fast. The average area of recent years is about 153,000 ha with a total production volume of 4.7 million tons annually. Most of the Algerian potato production is consumed domestically and Algeria is more or less self-sufficient in its potato production.

Table 2 *Potato production data of Algeria*

Year	Area harvested (ha)	Production (tons)	Yield (ton per ha)
2009	105,121	2,636,064	25.1
2010	121,996	3,300,414	27.1
2011	131,903	3,862,198	29.3
2012	138,666	4,219,507	30.4
2013	161,156	4,886,596	30.3
2014	156,176	4,673,516	29.9
2015	153,313	4,539,577	29.6
2016	156,308	4,759,677	30.5
2017	148,822	4,606,402	31.0
2018	149,665	4,653,322	31.1

Source: Ministry of Agriculture, annual statistics on potato production

The most important potato production regions are concentrated in the Northern, Mediterranean areas (Mostaganem, Mascara and Ain Défla, Tipaza, Boumerdes, Bouira, Setif) and a region in the south-east of Algeria with an arid climate (El-Oued).

2.2 Potato production seasons

Due to different climate zones, potatoes can be grown almost all year round. Three different potato production seasons can be distinguished:

- First season, planting in January – March; harvest in May – July, 54% of production volume
- Last season, planting in August/September, harvest in December, 40% of production volume
- Primeur season, planting in October/November, harvest in March, 6% of production volume.

The first season is the main potato production period in Algeria. Potatoes are planted in January – March, imported seeds are the most important origin. First season potatoes were produced in 45 wilayas in 2017, total production was about 2,637 thousand tons out of 80,000 ha with an average yield of 33 ton/ha. (See annex 2 for detailed information per wilaya). The most important wilayas for first season potato production are: El-Oued (385 thousand tons), Ain Défla (383 thousand tons), Mostaganem (345 thousand tons) and Mascara (204 thousand tons).

The last season is the second important potato production period. For this season, locally produced seeds are used as planting takes place in August – September. Last season potatoes were produced in 46 wilayas in 2017, total production was 1,862 thousand tons out of 64,300 ha with an average yield of 29 ton/ha. (See annex 2 for detailed information per wilaya). The most important wilayas for last season production are: El-Oued (768 thousand tons), Ain Défla (305 thousand tons), Mascara (151 thousand tons) and Mostaganem (91 thousand tons).

The primeur season is of minor importance; it accounts for 6% of the total production. Potatoes are planted October/November. These potatoes were produced in 16 wilayas in 2017, total production was 107 thousand tons out of 4,500 ha with an average yield of 24 ton/ha. The most important wilayas for the primeur production are: Boumerdes (26 thousand tons), Tipaza (21 thousand tons), Skikda (20 thousand tons) and Mostaganem (12 thousand tons). (See annex 2 for detailed production data).

2.3 Regional developments in potato production

The area of the potatoes during 2013-2018 ranged from 148,800 ha in 2017 to 161,200 ha in 2013; in 2018 the total area was 150,000 ha. The wilaya of El-Oued has become the most important potato production region, with annual areas ranging from 33,000 hectares in 2014 and 2015 to 36,200 ha in 2018. Note that in 2009 Ain Défla was the largest production region. Fluctuations in acreage are partly due to changes in prices over time. See annex 3 for detailed information about regional developments in potato production since 2013.

Climatic conditions in Mostaganem are very favourable for both first season and last season potato production, the area has grown from 12,600 hectares in 2013 to 15,900 hectares in 2018. In Mascara as well potato production has grown from 10,900 hectares in 2013 to 14,000 hectares in 2018. There is, however, a decline in some other wilayas, such as Ain Défla, which area has decreased from 24,500 ha in 2014 to 15,800 ha in 2018. Soil sanitary problems (like nematodes) are the main reason. Some producers of Ain Défla moved to other regions with less soil sanitary problems and better opportunities for potato production. Another reason is that because of the high and increasing cost of potato production, potato farmers, especially small farmers, shift to other crops with less risks, for example tomatoes for the processing industry, or fruit trees. Gradually potato farmers in Ain Défla have specialized themselves more in seed potato production; this development went along with the increase in storage capacity from 20,000 m³ in 2000 to 500,000 m³ at present.

The first potato growers in El-Oued successfully used sprinkler irrigation and applied chicken manure. This experiment was followed by others. In addition the region has benefited from special development programs for the southern regions, in particular the system for land concession for agriculture. Nowadays 22% of the national potato acreage lies in El-Oued, in 2009 the share of potato production acreage in El-Oued was about 14% of the national acreage. The average yield per ha in El-Oued too belongs to the highest in Algeria. Potato production in El-Oued has increased very strongly over the past 15 years, making El-Oued the most important potato production region with a total production volume of 1,136 thousand tons in 2018.

On the other hand, production has stagnated over the past 5 years, due to problems related to crop management: irrigation and drainage, salinity and diseases.

In some wilayas in the north of the country, it is sometimes difficult to find land for rent, so producers turn to other wilayas to grow potatoes. This is the case, for example, of the Haouchine production locations in the wilaya of Boumerdes that we visited. The production locations grow more than 400 hectares each year; land is leased according to the availability of land, in the wilaya of Boumerdes or in other wilayas. For the 2018/2019 campaign, potatoes have been planted for all three production seasons, primeur season, the first season and the last season. For the last season potato production, the land was rented in the wilayas of Boumerdes, Algiers, Blida and Skikda.

Shifting to other wilayas, further away from the big cities, will lead to higher cost for instance for transportation and organizing manual labour. On the other hand the cost for renting land may be lower and if soil quality is better, productivity may increase as well. So there are many pro's and con's to shifting to other areas; but the availability of land of good quality is dominating.

2.4 Land use and soil management

The Mediterranean agricultural areas are known for their heavy clay soils. These soils have a low organic matter content and are hard to prepare for sowing and planting crops like potatoes and onions. Moreover these soils contain a lot of stones, which makes it difficult or even impossible to mechanize and to use a rotary tiller or powered harrow for soil preparation before planting.



Figure 1. Soil preparation with a disc harrow near Algiers, note the big hard clods.

Ploughing is often carried out at a depth of 50-60 cm, as a water drainage measure during heavy rainfall. Ploughing that deep will impoverish the soil as the fertile topsoil is deeply ploughed and poor soil is brought to the surface. This deep ploughing will also make soil tillage more complicated as hard clothes and stones are brought up to the surface as well.

In Algeria, most of the farmers do not own the land, they rent the land for one year or a few years at the most. Because of that farmers have no incentives at all to invest in soil quality improvement, like removing the stones, apply crop rotation and increase organic matter content. This typical situation has a negative effect on the quality of potatoes during production and harvest.

As Soil quality is one of the most important production factors in agriculture in general, it is amazing that such little attention is given to this aspect. Adequate soil management is required to improve soil structure, soil fertility and soil health. This is of course a long term approach and in practice farmers will only invest in soil management if they have reasonable guarantees that they will earn back the investment. This means that fundamental changes in land use and land ownership will have to take place to overcome this issue.

2.5 Seed potatoes and varieties

Algeria is the biggest importer of seed potatoes from the Netherlands outside the EU. On average 80,000 tons of seed potatoes are exported from the Netherlands to Algeria annually. Next to that, large quantities of seed potatoes are imported from other countries like Germany and France (see table 3 and 4). On average almost 50% of the total seed potato imports comes from the Netherlands. In general the imported basic seed potatoes (class SE and class E) are used for the production of so

called local seed potatoes (class A); the imported certified seed (class A) is used for the production of ware potatoes.

Due to a difficult situation in Algeria, linked to the reduction of the country's foreign exchange receipts from hydrocarbon exports, the government has decided, from 2018, to reduce imports of all kinds. With regard to the potato sector, the government's policy is to increase local seed potato production and become less dependent on import from other countries.

Table 3 *Total Imports of seed potatoes in Algeria, 2012 – 2018*

Year	2012	2013	2014	2015	2016	2017	2018 (11 months)
Volume (tons)	150 739	136 802	123 555	152 943	87 171	141 694	55 679
Value (\$)	106 946 011	96 398 565	88 178 333	92 963 964	53 722 883	94 231 019	42 375 489

Source: Ministry of Agriculture

Table 4 *Export of seed potatoes from the Netherlands to Algeria*

Year	Harvest 2012	Harvest 2013	Harvest 2014	Harvest 2015	Harvest 2016	Harvest 2017	Harvest 2018
Volume (tons)		75 311	93 527	83 649	73 145	82 372	74 083

Source: NAO, Dutch Potato Organisation

The production of seed potatoes in Algeria is controlled by the Ministry of Agriculture and its agencies (the National Centre for Seed and Plant certification CNCC and the National Institute of Plant Protection INPV). The Algerian classification system for seed potatoes is very similar to the Dutch system controlled by the NAK; classification standards are more or less the same and seed potatoes are automatically declassified each year. CNCC staff has been trained by the NAK in Emmeloord and regular contacts still exists between CNCC and NAK.

Algeria has 2 important centres for production of mini-tubers and in-vitro plants (pre-basic seed), to provide in the need of basic seed. These facilities are situated in the wilayas Setif (facility has been established in the eighties) and Tiaret (established in 2008). The laboratory processes are perfectly controlled, but there were many problems due to lack of aphids control, after lab production of plants and mini tubers. Last year the centre SAGRODEV of Setif produced 800,000 vitro-plants (G0).⁶

Spunta is by far the most popular potato variety in Algeria. Spunta is an old, well-known Dutch variety (originally represented by HZPC, yet a free variety now) and is still very popular in the Mediterranean countries for its high yield potential, big tubers and easy growing conditions in this climate. Spunta is preferred as potato for direct consumption. It is not suitable for processing due to its low dry matter content. Other popular varieties are Fabula, Desiree, Maritiema, Arizona, Rudolph.

For processing, varieties with a high dry matter content (dmc) are needed. For French fries we prefer dmc 20-22%, for chips dmc 22-24%, next to other standards like tuber shape and size, color, frying qualities, etc. Though so called processing varieties are registered in Algeria, farmers do not grow these varieties because of their lower yielding potential and in some cases higher production risks. Farmers stick to the easy growing and high yielding traditional varieties like Spunta, Desiree, etc.

⁶ In 2008, a study has been realised to evaluate the potential of SAGRODEV to cover the needs of the country of G0 seed potatoes. It was calculated, that 800,000 G0 plants were sufficient. The laboratory of vitro - culture produces micro-tubers and vitro-plants which are put to grow in greenhouse for the production of mini-tubers. These mini-tubers, considered as G0 are harvested to be planted in the field to grow G1 category. The multiplication will continue with G2, G3, G4... The G1-G4 are considered as basic seeds. Planting G4 will produce class SE and E seed potatoes which should cover the national needs of SE seed potatoes. Unfortunately, the program has never been applied, because of the national seed system in general was not ready at that time. It seems that a resolution has been taken recently to renew its application (Bruno van der Hofstadt & Abdelkader Aissat, 2008).

2.6 Potato production and harvesting

Potatoes are planted by hand on small farms. Bigger farmers use a 2 row potato planter pulled by a tractor, followed by several men to correct mistakes of the machine. From the few fields we have seen during the mission we get the impression that the potato ridges are rather small. This is probably mainly due to the difficult circumstances for soil preparation before planting: heavy clay soils, big hard clods, and less loose soil. If for instance soil preparation could be improved by using a rotary tiller or driven harrow, more loose soil will be available for making bigger ridges. Bigger ridges mean more growing space for the new potato tubers and less chance of greening tubers by exposure to light which has a negative effect on potato quality, both for direct consumption and for processing as well.

Most farmers in the Mediterranean regions use sprinklers for irrigation. Water scarcity is a big issue in Algeria. Therefore the use of water saving techniques is highly recommended. Drip irrigation for instance could be a good alternative in this respect. From examples in other countries like Iran we know that a set of reels for the drip hoses can easily be mounted on the potato planter and that the drip hoses are automatically put in top of the ridges during planting.



Figure 2. Harvesting a seed potato field at Haouchine Farm in Algiers. Grading is done on the field while collecting the potatoes. Big sized tubers will be stored for the consumption market, small and medium sized potatoes will be stored as seed potatoes to be planted in August.

Harvesting of potatoes is done mainly manually. Some farmers use a grub-ax pulled by a tractor to open the potato ridge (see picture above), potatoes are collected manually in plastic crates of 22-25 kg. The crates are loaded on a truck and transported to the store.

A next step in potato harvest mechanisation would be the 2 row potato digger (see picture below).

Farmers have the opinion that this harvesting machine cannot be used in these regions because of the stones and the hard clods.

Many farmers do not apply haulm cutting before harvest and when they do so, the time before harvesting is often very short, 1 or 2 days. For a proper skin set more time is needed between haulm cutting and harvesting, especially when the crop is still green. A proper skin set is absolutely necessary for quality preservation of the potatoes after harvest.

During our field visits in Mostaganem we saw potatoes being harvested with a 2 row potato digger, which proved that mechanisation of potato harvesting is possible. The soil of the potato fields we visited was not as heavy as in Algiers. The conditions were far from ideal:

- Stones and big hard clods,
- Potato ridges were rather small,
- Potatoes were planted with a 2 row planter, working width 1,20 – 1,30 meter.
- Working width of the 2 row Italian harvester was 1,70 – 1,80 meter.

Standardization is a necessary requirement for mechanisation, this means that all machinery including the tractor should have the same working width and distance between the tracks. For instance the farm machinery has a working width of 1,50 meter (or a multiple of that) and the distance between two potato ridges is 0,75 meter. Absence of standardization will lead to more or less damage of the crop and loss of quality of the produce.



Figure 3. Harvesting a potato field in Mostaganem with a 2 row potato digger.

2.7 Policy of the government and the potato sector

The potato sector is an important economic sector of Algeria. Algeria is the number one potato producing country in Africa with a total production of 4,6 million tons in 2017, while Egypt ranked second (4,3 million tons) and South Africa ranked third (2,5 million tons). Potato is Algerians first vegetable crop in terms of hectares and production volumes.

The Algerian government has a policy to increase potato production and add more value to its current potato sector. Both the government and the potato sector want to increase their own seed potato production to be less dependent of import of seed potatoes from outside⁷. Although in the existing potato production regions, especially in the Mediterranean areas the disease pressure for potatoes is high and seed potatoes will degenerate quickly, there are more isolated areas in the South where the problems with aphids as transmitters of diseases are absent and the production of healthy seed potatoes seems possible. These areas are seen as the new regions for high quality seed potato production in Algeria. More quality control labs are to be established near the production regions.

Seed potato production is supported by the government. Seed potato farmers need authorization by the government. Before planting the fields are examined on sanitary situation – for instance the fields must be free of nematodes – and during the growing season regular monitoring on viral and bacterial

⁷ See remarks in chapter 2.5 about mini-tuber production and covering the nation's need for seed potatoes of class SE.

diseases is carried out by the CNCC. Seed potato producers receive a subsidy of 6 DA/kg, divided as follows: 3,5 DA/kg for the grower and 2,5 DA per kg for the certificate owner. For storage of seed potatoes a subsidy of 0,75 DA/kg/month – for registered seed potato producers only – is granted by the government.

The prices of potatoes fluctuate heavily in time. By subsidizing the storage of ware potatoes, the government wants to avoid heavily fluctuating prices and regulate the market in that way. Potatoes are stored in times of surplus in the market and potatoes are sold in times of shortage⁸. For instance during last winter period a total volume of 80,000 tons of potatoes has been scheduled by the Ministry of Agriculture for storage to regulate potato prices and its availability during February and March. The main objective of this storage program is to avoid scarcity of potatoes in certain periods. But this program also aims the absorption of surplus production. Destocking surplus production later in the season may have a negative impact on potato prices which sometimes drop considerably because of this. ONILEV (Office National Interprofessionnel des Légumes et des Viandes) is in charge of controlling the market for vegetables (including potatoes) and meat on behalf of the Ministry of Agriculture by granting subsidies on storage. The subsidy for storage of ware potatoes is 1,80 DA/kg/month, storage of seed potatoes is subsidized with 0,75 DA/kg/month.

The policy of the National Potato Council (Conseil National Interprofessionnel de la Filière pomme de terre) CNIFpt for future development of the potato sector is clearly focussed on two lines.

1. Processing of potatoes (potato chips, French fries, starch, snacks)
2. Export of seed potatoes to African countries, ware potatoes to Europe and also export of processed potato products like chips.

The Potato Council wishes to cooperate with Dutch companies and institutes. During discussions the following proposals were made by the Potato Council.

- Assisting for export, seed potatoes to African countries and fresh and ware potatoes to Europe. Algeria wants support from the Netherlands to help the potato sector to develop and become a potato exporting country.
- Practical support from the Netherlands is requested on the whole potato chain, practical expertise on the production of seed and ware potatoes, how to improve potato production through mechanisation, knowledge transfer on soil management and harvesting.
A common 3-4 year demonstration project on potato production from soil preparation up to and including harvesting using Dutch machinery and technology is highly recommended.
- A seed potato project using Dutch expertise and technology has been proposed by the Potato Council.
- New potato varieties are available in the Netherlands, but not (yet) in Algeria. The Algerian potato sector needs new varieties, especially for processing into fries, chips, flakes. Algeria prefers varieties from the Netherlands because of the good experiences with Dutch companies and their varieties.
- Algeria is an observer member of UPO, not a full member of UPOV, (<https://www.upov.int/members/fr/observers.html>). Dutch seed potato companies take into account this situation for their export of new varieties to Algeria, especially when Algeria will succeed more and more in developing its own production of seed potatoes.
- In Algeria storage of potatoes is carried out for a rather short period up to 3 months, sometimes 6 months, which is quite different from the situation in the Netherlands where potatoes are stored for long periods of 8 months and more. In the cold stores that we have seen, potatoes are stored at low temperatures (4°Celsius) for a short period, with non-forced ventilation and no control of CO₂ and relative humidity. The Potato Council asks for Dutch expertise to improve storage of potatoes, not only for storage during short periods but for long time storage as well. A demonstration project to compare traditional storage with improved storage has been discussed.

⁸ Production excesses sometimes occur in the potato production system. They exist at the seasonal peak of potato production during autumn. For instance seasonal production in 2017 was as follows: First season: 2.6 million tons, late season 1.9 million tons, primeur season: 0.1 million tons.

3 Storage and processing of potatoes

3.1 Introduction

The post-harvest potato chain is primarily focussed on the domestic consumption market. Potatoes are grown in different seasons and therefore potatoes are available for the consumer market almost all year round. From own observations during the field visits to Algiers, Ain Défla and Mostaganem and from discussions with stakeholders we have the impression that many new cold stores have been built during the last decade. Most of the stores are used for storing fruits and vegetables and for storing seed potatoes. Due to the market regulating policy of the government by subsidizing storage of potatoes, more and more ware potatoes are stored for a few months depending on the market situation.

The potato processing industry is still a very small sector in Algeria. Algeria is by far the biggest potato producer in Africa, yet when it comes to processing to chips or French fries, other African countries are far ahead.

This chapter describes the current situation of storage and processing of potatoes, based on our findings during the potato mission in June 2019, and suggestions for development of this sector.

3.2 Storage of potatoes

We have visited several modern potato stores in Algiers, Ain Défla and Mostaganem. These stores have more or less the same characteristics. Cold store rooms with a capacity of about 200 – 250 tons, with adequate temperature control only. There is no (forced) ventilation and no climate control of CO₂ and relative humidity. In Algeria it is common practice to collect the potatoes in plastic crates of 22 – 25 kg at harvest and transport them from the field to the store by truck. There the truck is unloaded manually and the crates are stacked on pallets, and subsequently the pallets with crates are piled up.



Figure 5. Unloading the truck with potatoes from the field. Note that crates with big potatoes and small / medium sized potatoes are separated.



Figure 4. Pallets with crates are put in the store.

Just after harvest, potatoes are stored immediately if it is still cold, or stored for the night in the hall of the entrance, before storing in the cold rooms. After filling the store, cooling of the produce starts immediately. Sometimes the temperature is set at 4 degrees at once, but it takes about 5 days to reach that temperature. In other stores a more graduate strategy is followed, like cooling to 14 degrees as soon as possible and after that the temperature is decreased by 2 degrees per day until the final storage temperature of 4 degrees has been reached. There is no (forced) ventilation for

drying the product. Automatic climate control during storage is restricted to temperature control only. Advanced climate control systems for monitoring and control of relative humidity and CO₂ as well are not common practice in Algeria. From time to time the doors of the ventilation rooms will be opened for a short period for refreshing the air.

It is probably because of the short storage period that the common storage practice in Algeria will do with acceptable losses. However when potatoes are put in the store under humid or wet conditions, one might expect severe losses following this strategy. In the Agriplan report (2013), storage losses of up to 50% were mentioned for storing potatoes in bulk under these circumstances. Nowadays it seems that the situation has improved by storing in crates; average losses are estimated at less than 20%.

The Dutch approach for storing potatoes is to start with ventilation immediately during/after filling the store. Potatoes and adhering soil must be dried as soon as possible after entering the store to prevent diseases from spreading. After drying, wound healing of potatoes has to take place so that cork layers will form on damaged parts (wounds) of the potato tubers. This curing takes about 2 weeks at 15 degrees Celsius and 95% humidity. During the curing period ventilation is minimised to keep the relative humidity high. After curing, temperature will gradually be decreased until the desired temperature has been reached.



Figure 6. Cold store room for storing potatoes in plastic crates.



Figure 7. Potatoes stored in wooden boxes

In some stores potatoes are stored in wooden boxes. In that case the plastic crates with potatoes are emptied in the wooden box manually. Emptying the wooden boxes after storage is carried out manually as well, although relatively simple equipment for loading and unloading wooden boxes is available on the market, but probably not known or practiced yet in Algeria.

The storage temperature for potatoes in cold stores is about 4 degrees Celsius. This is ok for seed potatoes and table potatoes. For processing purposes however higher storage temperatures are required. Potatoes for French fries production must be stored at 6 to 8 degrees Celsius, potatoes for crisp production must be stored at 7 to 9 degrees Celsius. Lower storage temperatures will lead to high levels of reducing sugar content, giving the fries and crisps a bad (too dark) frying color. Storing at higher temperatures of about 8 degrees will force potatoes to sprout earlier than storing at 4 degrees. Sprout inhibitors like CIPC formulations or Ethylene can be applied to prevent potatoes from sprouting.

3.3 Potato processing in Algeria

The worldwide market of frozen potato products is expected to grow steadily. In PotatoPRO.com⁹ of September 2019, a future growth rate of 4% annually was mentioned. According to a study of Rabobank Research¹⁰ the expected consumption growth of frozen potato products in the Middle East and Africa is about 5% annually for the period 2018 – 2022.

The international market on frozen processed potatoes is highly competitive. Belgium and the Netherlands are dominating this market, together they have more than 50% of the export market worldwide of deep-frozen potato products. Other important exporters are Canada and the USA, together with Belgium and the Netherlands their share in the worldwide export volume is about 80% (see Annex 4). The average price per ton in the first six months of 2019 was about € 848 for French fries from the Netherlands, whereas the average price for French fries from Belgium was € 700 per ton (this equals about DA 93 per kg). Obviously there is a wide range in international prices for deep-frozen processed potatoes, regarding country of origin, quality, branding, etc. It is very hard for new starting potato processing companies to compete with potato processors from Belgium and the Netherlands, especially for relatively small companies in African countries where production chain circumstances are not optimal. It is therefore not unusual for these countries to try introducing import duties or other import restrictions to facilitate local production of French fries.

Algeria produces up to 5 million tons of potato according to the Ministry of Agriculture. Most of it is consumed in Algeria. Wherever you go in Algeria, you find Fast Food restaurants for cheap meals. Most of the young consumers prefer sandwiches with French fries. And the Fast Food shops very often cannot meet the demand in French fries of the consumers especially at the lunch time. The Algerian population lives more and more in urban areas. More and more women have a job and would be very happy to have the French fries ready when they return home. So the market potential for French fries in general and for industrial French fries in particular is evident.

Table 5 Annual Imports of processed potato products in Algeria, 2012 – 2018

Year	2012	2013	2014	2015	2016	2017	2018 (11 months)
Fresh or steamed potato products							
Volume (tons)	5 620	106	69	1 633	580	93	
Value (\$)	2 594 125	96 864	76 797	1 268 246	477 502	87 633	
Potato flours							
Volume (tons)	19	22	2	157	191	152	51
Value (\$)	19 350	48 456	3 800	184 521	255 972	259 989	88 813
Potato Starch							
Volume (tons)	1 366	519	1 729	1 249	1 951	2 487	6 299
Value (\$)	1 196 941	401 223	1 557 666	853 841	1 459 940	1 796 436	4 907 972
Potato flakes and pellets							
Volume (tons)	1 658	3 093	2 422	3 979	1 544	2 024	3 165
Value (\$)	2 578 003	4 822 550	3 909 461	5 316 996	2 265 290	2 879 846	4 271 637
Preserved potato products, frozen or non-frozen							
Volume (tons)	3 959	4 252	5 662	3 751	4 291	3 599	2 173
Value (\$)	5 503 178	7 758 188	14 141 858	6 205 206	10 109 079	6 788 890	6 533 814
Total imports of potato products in all categories (excluding seeds)							
Volume (tons)	163 369	144 794	133 439	163 712	95 729	150 049	67 366
Value (\$)	118 837 608	109 525 847	107 867 915	106 792 775	68 290 666	106 043 815	58 177 725

Source: Ministry of Agriculture

⁹ PotatoPRO.com, web news on the potato sector worldwide, available at <https://www.potatopro.com/>

¹⁰ Rabobank Research. De wereldwijde honger naar frites, Augustus 2018.

Potato processing in Algeria is a very small sector. Based on discussions with experts, less than 1% of the annual potato production volume is processed. It is the Algerian authorities' policy to develop the potato processing sector to increase the total potato market and to contribute to stabilising heavy price fluctuations. The second reason for developing local potato processing industry is to reduce the amounts of imports which requires foreign currency. Table 5 shows an overview of annual imports of different kinds of processed potato products and the import values in foreign currency.

It is the main purpose of this study to analyse the main obstacles for potato processing in Algeria and to present suggestions for future development of potato processing.

There are 15-20 potato chips processing companies in Algeria, most of them are very small. The company SNAX (Algiers) is the biggest one in Algeria, they have a 1 ton per hour processing line which operates 350 days a year. There are plans for increasing production capacity by 50% next year. Nearby the processing plant is a potato store with a capacity of storing 700 tons of potatoes, which is sufficient for a 1-week buffer supply.



Figure 6. Mr Slimani, director of Fritop, processing company of French fries for the fresh market.

Processing of French fries is rare in Algeria. We visited a small company called Fritop / Royal Agro Services in Ouled Moussa, south east to Algiers. They produce French fries for the fresh market, 2 tons per day. The company started from scratch, with little financial means.

We were informed about several investors who started with French fries processing in Algeria, but had to quit their business because of unfamiliarity with and many problems in the potato processing industry. At the period of the visit, three relatively new Belgium potato processing lines were non-operative and offered for sale.

The current market for industrially produced French fries is almost non-existent in Algeria. There are less than a dozen producers of fresh or frozen French fries in Algeria. In the Algiers region, there are two frozen fry manufacturing units, located in the town of Tessala El Merdja, 30 km south of the capital: ALITECH (Frito Dido) and BFK food.

The quantities of industrial fries put on the market are very small and are generally found only in supermarkets and a few minimarkets. In general, the Algerian consumer does not buy frozen fries, let alone fresh fries! The fries consumed are made at home from potatoes available in retail markets, in numerous fruit and vegetable shops and from street vendors.

Among restaurant professionals, only large restaurants and hotels use frozen fries, which does not represent large quantities, compared to the national consumption for this product. The largest quantities of French fries are sold as sandwiches or added to hamburgers in the many Fast Foods Restaurants that exist in all locations across the country. All the fries used in this case are made on site, from fresh potatoes, available all year round and close to food shops.

There is a small amount of French fries imported from Belgium on the market, but it is not a large market; besides, lately, we haven't seen them in supermarkets. Perhaps these fries are on the list of banned import products, following the budgetary restraint measures that the country imposed from the year 2018 ...

Although the market potential for French fries is evident, also potato processors themselves believe that the future is for fries, there are still difficulties that need to be overcome to make this sector grow. First of all there is the international competition, especially from Belgium exporters of French fries. The other problem is the question why three French fries producing units were stopped and offered for sale recently. Maybe the investors were not professional enough or were unfamiliar with

the potato production and processing sector. It is important to carry out an investigation to find out the reasons why they stopped.

The main problems with respect to potato processing are related to potato cultivation. According to the processors (SNAX and Fritop):

- In general most of the farms are small; small farmers have no machinery, they receive no technical advice, they are traditional and have no financial backing. This hinders the production of high quality potatoes, necessary for the processing industry.
- They do not own the land and therefore do not invest in the land, they rent it. Product quality of potatoes (and other crops) can be improved by proper soil management.
- Farmers do not apply haulm cutting before the potato harvest and if they do apply haulm cutting it is often carried out too short before harvest. Because of that, there is not a proper skin set of the potatoes, leading to more damages and infections of the potato tubers in the post-harvest period.
- The dry matter content (dmc) of the potatoes is too low for processing, due to the use of unsuitable varieties. Most farmers prefer traditional, high yielding and easy to grow varieties like Spunta (dmc 17 %). For processing other varieties which a high dmc are needed: French fries: 20-22% and potato chips: 22-24%. Suitable varieties for processing are: Agria, Sarpo Mira, Royal, etc.
Harvesting of potatoes often occurs when the foliage is still green. Dmc of a crop that is not mature will be lower compared to a mature crop. Fertilisation is also important with regard to this aspect. It is a real challenge to produce potatoes for processing with the proper dmc.
- Farmers are not used to contracts. The experience of SNAX in organizing their supply and solving production and supply problems is an illustrative example. After many years of problem solving and organizing, SNAX has succeeded in setting up a contract system via a supplier, offering the farmers a guaranteed price for their potatoes. Farmers producing for SNAX are obliged to grow specific varieties suitable for processing according to the terms of SNAX. Even when paying in advance a higher price than the average market price, it is a struggle to keep farmers reliable to the contract. Especially at times when actual market prices are high(er), farmers go for short term income instead of long term earnings.
- In winter period the dry matter content of the potatoes is lower, which has a negative effect on processing quality. Quality for the local market is still acceptable, but not for export. For export purposes, potatoes from the autumn season with proper dmc need to be stored for a longer period.
- During the period March-May/June, the supply of fresh potatoes is low, which makes it more challenging to organize potato supply for processing.
- In Algeria potatoes are stored for a short time, up to 3 months, sometimes longer 3 – 6 months, especially during times of excess supply in autumn as described in chapter 2.7. Potatoes are stored at low temperature of 4 degrees Celsius. For processing this storage temperature is too low, it leads to high levels of reducing sugar content which will give a poor frying color of the French fries and chips. Especially when potatoes are stored for a longer period, temperature becomes more and more critical. For processing a temperature during storage of 7-8 degrees Celsius is preferred.
- Marketing of processed potatoes is absent and is needed for further development of a sound sector. Mr. Slimani, director of Fritop, provided us with some quantitative data from his sector of French fries for the fresh market from his own experience.
Buying price of potatoes for processing: 40 DA/kg.¹¹
Selling price of processed French fries to local restaurants: 80 DA/kg.¹²
Out of 1 kg fresh fries, 3 dishes can be made which are sold at: 150 DA each.
Retail price of imported frozen French fries: 220 – 280 DA/kg¹³.

¹¹ Prices mentioned are the prices at the time of our visit to Algeria in June 2019, they may be different in other seasons. For instance in October 2019 potatoes are sold on the retail market at a price of 50 – 60 DA/kg.

¹² We have doubts for this selling price, given the level of buying prices for potatoes at the retail market.

¹³ From visits to supermarkets in Algiers and Blida (October / November 2019), we noticed that there were no frozen French fries from Belgium (brand "Frutosa"). The price per kg of frozen French fries has increased considerably, perhaps because of the lack of imported fries: BFK Food (Algiers): 350 DA/kg; El Rayane (Mostaganem): 300 DA/kg. The level of these prices is relatively high, knowing that the SMIC (guaranteed minimum wage) is 600 DA/day.

Although restaurants “complain” about the buying price of fresh fries, it is obvious that 80 DA/kg is a very low price which could be improved through adequate marketing within this sector.

- The delivery of fries in Algeria needs a frozen chain, that is a problem. In that respect production and distribution of potato chips is less complicated, the product is dry, it is not perishable like fresh French fries and does not need a frozen chain.
- Government support for processing is absent in Algeria, although the governments’ policy is to develop the potato sector through processing and through export. Despite several subsidy programs for potato production and storage, subsidy for processing is lacking¹⁴. It is not quite clear to which Governments’ domain potato processing belongs, the Ministry of Agriculture or the Ministry of Industry? This situation might best be explained because potato processing in Algeria is a rather new industry. A temporarily support from the government in starting a processing company might be very helpful. It is not only the processing plant that has to be built, but the whole chain has to be organized: the right varieties, the production by the farmers according to the pre-arranged standards, transport, storage, etc. In other words, a transition from a supply oriented potato production chain to a market oriented potato chain is needed. This approach for a total chain concept and the organization of production and supply of quality potatoes for the processing is the most important challenge for individual processors and the future development of this sector in Algeria. Unfamiliarity with the potato sector has already caused significant failures in this industry.

¹⁴ General support for industrial investments is available through the National Agency of Investment Development (ANDI), part of the Ministry of Industry and Mines (<http://www.andi.dz/index.php/en/>). See also Annex 5 for a short overview of support and projects by ANDI.

4 Towards a market driven potato processing industry

4.1 Introduction

The potato processing sector in Algeria is a rather new industrial sector. It is estimated that the total annual volume of potato processing is less than 1% of the total production volume of potatoes. The sector is increasing. Domestic consumption of industrial processed potatoes rely heavily on import of potato chips and frozen French fries. According to experts, the market is big enough. Processing of local potatoes will also encourage the potato sector to increase, as export of potatoes and potato products will do.

Potato farmers are not used to produce for the processing market, they prefer easy to grow and high yielding varieties like Spunta. Spunta however is not suitable for processing because of its low dry matter content of about 17%, whereas processing requires a dmc of 20+, 20-22% for French fries and 22-24% for potato chips. New varieties for processing are available in Algeria, but farmers stick to the old familiar varieties because these potatoes can easily be sold on the market.

The processing industry does not only require other varieties, it also demands for specific production and storage conditions. It is a well-known phenomenon in many countries, a sound potato processing industry requires a shift from the traditional product driven approach to a market driven production chain.

4.2 Contracts

It is important for the processor to organize a continuous supply of the required potatoes for the processing plant. The chips processing company SNAX in Algiers has been working on organizing production and supply for many years by trial and error. By now they can manage pretty well. Their organization can be a good example of how to develop the potato processing industry in Algeria. They have outsourced production and supply to another company (Danespo) which does the job on SNAX's own terms. A group of 40-50 farmers in important potato production regions of Algeria has been selected to produce potatoes for processing for SNAX. Even the import and supply of the seed potatoes of required varieties to these farmers is done by Danespo. Together they have developed their own contract system with the farmers, offering them a guaranteed price for several years which is above the average market price. Next to price agreements, the contract includes the delivery terms about variety, quality, etc. Farmers in Algeria are not used to this kind of contract system and it has taken SNAX many years to implement it properly.

Such a contract system is favourable to both parties, farmers / suppliers and processor, and even then it is still quite a challenge to keep farmers reliable to the contract and the other way round. An independent authority, respected by both parties, might be useful to judge in case of disagreements.

Leading European potato processing countries like Belgium and the Netherlands have many years of experience in this transition process of shifting from a product driven potato production to a market driven potato chain and in organizing production and supply for the potato processing industry.

The international market for processed potatoes is very competitive, especially for French fries. New entrants to the market therefore must be able to produce very efficiently according to the highest quality standards. A sound potato processing industry in Algeria thus requires high quality production and supply of potatoes from the best available varieties meeting the processing standards either for French fries or for potato chips.

The processing industry itself should take the lead to organize production and supply, according to its terms and standards. A cooperation of processing industry, potato sector and government might be useful to facilitate and encourage this transition towards a market driven potato sector.

5 The way forward: Algerian – Dutch cooperation

5.1 Introduction

The main purpose of this mission was to study the potato chain, with main focus on the post-harvest phase, storage and processing, and to identify the main obstacles and propose suggestions to solve the problems. In the past chapters the potato production and post-harvest chain has been described and analysed from the point of view of requirements for the potato processing industry. Therefore not all aspects of potato production (for instance fertilization, pest and disease control, irrigation) have been described, focus has been given to the major aspects determining quality production and supply for the processing industry.

The Netherlands potato sector is famous all over the world, not only because of the availability of high quality seed potatoes of hundreds of varieties suitable for almost every climate condition. The Dutch agriculture and the potato sector in particular is also highly appreciated for its knowledge and innovation power, technology, machinery, handling, packaging and storage equipment, climate control, equipment and technology for all kinds of processing, etc., etc. Therefore Dutch companies and institutes often are seen as preferred partners in working together in the potato sector in other countries like in Asia and Africa.

During our Algeria visit we were told several times that Dutch machinery & technology is more expensive compared to machinery from Poland and/or technology from China. We also learned that Algerian farmers and investors in storage and processing tend to go for short term profit and return on investment and prefer “cheap” machinery and technology. From this point of view, Dutch companies may have a disadvantage in doing business in Algeria. On the other hand, it is a well-known fact that machinery and equipment from the Netherlands and other Western European countries is of higher quality and consequently has a longer life-cycle compared to cheap equipment from Eastern Europe and China. Besides the Dutch companies and institutes are well-known for offering a total chain concept. This goes far beyond selling a single potato harvesting machine for example or a French fries processing line. This total concept approach for potato production, for packaging and storage and for processing is why we believe that there are good opportunities for Dutch companies and institutes to cooperate and do business with Algerian partners. For small scale machinery and relatively small processing lines as well Dutch companies can be business partners. This also counts for education, especially practical education in all aspects of the potato chain. A good example is the Potato Business School in Emmeloord¹⁵.

5.2 Opportunities and recommendations

In the many meetings with Algerian authorities and institutions, potato farmers, processors, store owners, experts and other stakeholders involved, a range of opportunities and suggestions for future cooperation between Algeria and the Netherlands have been discussed, such as demonstration projects, seminars and knowledge exchange. Besides some of the potato producing and processing companies discussed concrete development plans for expanding their companies, which may lead to business opportunities for Dutch companies.

¹⁵ The Potato Business School has been founded by Dutch private companies working in the potato sector and institutes. The PBS offers education and practical training on all aspects of potato growing, management, mechanization, sorting and packaging, storage and processing. Unique to this initiative is that some of the participating companies and institutes are competitors of each other, yet they join forces in the approach to offer services especially for international clients and interested companies. More information can be found on www.pbsemmeloord.nl.

For all the initiatives and opportunities, it is clear that they have to be based on concrete needs of Algerian companies and institutes and that they have to be worked out in detail accordance with the available legislation and together with the Algerian counterparts involved, in order to be successful. The opportunities and project ideas listed below are clearly based on discussions and concrete questions from Algerian companies, institutes and farmers.

In this section distinguish will be made between:

- Concrete business opportunities,
- Opportunities for cooperation, leading to business opportunities in future,
- Cooperation at Government level, in order to eliminate trade barriers.

Concrete business opportunities

1. Establishing potato production by SNAX

During our visit to the SNAX chip factory in Baba Ali, on the outskirts of Algiers, the owner told us of his plans to start producing potatoes, for the supply of his factory, himself, in order to remove his company from the many constraints and difficulties arising from the producers with whom he works under contract. The head of the company has admitted to us his desire to cooperate with a Dutch company that can support SNAX in establishing a large potato production farm. This is a concrete case emanating from the largest snack production company. It remains to establish the first contacts, and then consider the different steps, for the realization of the project.

Opportunities for Dutch companies: Farmer-consultants, irrigation specialist (water use efficiency), knowledge institutes, seed potato companies, machinery companies, storage and climate control companies.

2. Expanding processing capacity at the SNAX chips factory site

SNAX potato chips factory started in 2004 with a 250 kg/hour processing line. In 2015 they expanded processing capacity to 1 ton per hour (during 350 days, 7 days a week in 3 shifts). For next year they want to expand processing capacity again to 1.5 ton per hour.

Opportunities for Dutch companies: processing (and storage) specialists, processing companies, storage and climate control companies, packaging industry.

3. FMC, Ain Défla, Establishing an Agricultural Platform

FMC is a private seed potato producing company in Ain Défla, the company has a partnership with the government (34% government and 66% private). FMC is authorized for the import and production and storage of seed potatoes. All together they produce about 650 hectares of seed potatoes in 3 different regions. The company has future plans to establish an Agricultural Platform for storage of olives and potatoes and processing of potatoes. A nice and impressive scale model was shown to us at the headquarters of FMC.

Opportunities for Dutch companies: storage and processing consultants for the short term, processing companies, storage and climate control companies, packaging companies on the longer term.

4. Fruits & vegetables processing industries want to start in potato processing

At the meeting with the Chamber of Commerce in Algiers, the directors of Nafaa (Fruits and vegetables processing) and Afridat (producer and exporter of dates) have indicated that they want to start in the potato processing (Afridat) / French fries (Nafaa) and that they are interested in doing business with Dutch companies.

Opportunities for Dutch companies: storage and processing consultants for the short term, processing companies, storage and climate control companies, packaging companies on the longer term.

Opportunities for cooperation, leading to business opportunities in future

1. Demonstration project on potato production in the heavy clay areas.

This project should focus on establishing mechanized potato production. Because the problematic soil structure impedes mechanisation of potato production, this project must pay much attention to improved soil management. The projects includes mechanisation of almost all activities in potato

production, starting with ploughing before winter, soil bed preparation before planting, planting and ridging, fertilization, applying chemicals for pest and disease control, harvesting and collecting potatoes. It certainly is a challenge to implement mechanisation under these specific conditions on the heavy clay soils. Therefore the project should last for several years to find out which machinery can best be applied under which circumstances.

Mechanisation is the first focus within the project, yet attention should also be given to the production of high quality potatoes for processing, especially with regard to dmc. Choosing the best varieties and applying the correct amount of fertilizers under the best circumstances are important issues in this respect. If possible, field trials as part of this demonstration project are recommended to find out the best strategies for producing potatoes for processing with a dmc between 22 and 24. In case the project set up will become too complicated, a separate project achieving high dmc should be established.

The project should also facilitate practical field training sessions on specific aspects of potato production and soil management. Intensive cooperation between Algerian and Dutch companies and institutes under a joint supervision is recommended.

The Haouchine seed potato production farm in Boumerdes has offered to make available a plot of land for establishing the demonstration project. It is recommended that the National Potato Council is in charge of organizing the project from the Algerian side. A soil management expert should have an important role in the project. Other participants are: seed potato companies, machinery companies, experienced farmer-consultant, knowledge institutes. Recommendation for financing: Ministry of Agriculture Algeria, Chamber of Agriculture, Netherlands Enterprise Agency, Participating companies.

2. Demonstration project on advanced potato storage

Storage strategies for long time storage need to be improved, especially in the case of storing potatoes for processing. It is recommended to make a comparison between traditional storage practice and advanced storage for the processing industry. The advanced storage strategy should include forced ventilation, climate control, storing at 8°C, with and without sprout inhibitor. So 3 strategies need to be compared: traditional storage, advanced storage with sprout inhibitor and advanced storage without sprout inhibitor. It is recommended to perform the different strategies at the same place where the company in charge has different cooling rooms. Possibly some adjustments will have to be made in one of the cooling rooms to be able to perform the advanced storage strategy. During the demonstration project, seminars on quality assurance of potatoes through improved storage and climate control can be organized. The best place to carry out such a project will have to be discussed further with Algerian partners, like the Potato Council or the Agricultural Chamber. Dutch companies and experts like Omnivent, Tolsma-Grisnich, Mooij Agro, and others can demonstrate their technology. Other possible participants: knowledge institutes, experts on storage and climate control (PUM). Recommendations for financing: Participating companies and Government support from both sides.

3. Seminars on potato processing

One of the main conclusions of this study is that the approach of the potato processing industry as a total chain concept and the organization of production and supply of suitable potatoes is the most important challenge for the future development of this sector. As has been described in the previous chapters, potato processing is a new industry in Algeria and it requires many changes/adjustments in the potato chain. During the mission we learned that there is a lot of interest in potato processing, but little knowledge is available. Potential investors in the processing industry risk to fail when starting a new business because of unfamiliarity with the sector. It is expected that new entrepreneurs entering the potato processing industry will start with relatively small processing lines. Several Dutch companies can supply processing equipment, also for small processing lines.

The idea is to start one or more seminars on setting up potato processing as a new industry. Inviting experts from the Netherlands, has been suggested by local experts and people interested in the industry. The seminar should not only be focussed on knowledge exchange but on setting up a business consortium of Algerian and Dutch participants as well, leading to a successful potato processing sector. Participants are: potato processors, investors looking for new opportunities, Chambers of Agriculture, Chambers of Commerce, potato producers looking for opportunities to produce for processing factories, Ministry of Agriculture, Ministry of Commerce, Ministry of Industry, banks, investment funds, companies supplying equipment for processing, seeds potato suppliers regarding suitable varieties and store owners.

It is recommended that these seminars are financed by the Algerian Government with support from the Dutch Government and possibly processing companies.

4. Training programs and knowledge exchange on all aspects of potato production

During several meetings with farmers, Algerian authorities and the National Potato Council this suggestion of organizing training programs and knowledge exchange came up. If possible they should be linked to the demonstration projects and other events. Although all aspects of potato production can be part of these programs, extra attention should be given to potato quality for processing. These activities can be financed by Governments from both sides; participants of these events should contribute as well.

5. Introduction of new varieties for processing

Processing of potatoes require specific varieties with among others a high dmc. Although processing varieties are registered and available in Algeria, processors and the Potato Council ask for the introduction of new and better varieties for processing, which are already on the market in the Netherlands. Dutch seed potato companies can test new promising processing varieties and offer them for registration. The National Potato Council has an important role in the introduction of new varieties, together with the seed potato companies and the processing industry.

6. Matching Algerian an Dutch companies on storage and processing

During the mission we had many discussions with Algerian storage and processing companies and farmers. Many of them have illustrated their ideas for expanding their business activities in the near future and have shown their interest in Dutch technology and expertise. It is interesting for Dutch companies and institutes as well to have some kind of match making being organized by the Netherlands Enterprise Agency.

Instead of working out separate projects for the above mentioned proposals, one might also consider to establish one *Potato Processing Chain Program* to be financed and steered by the Governments and private companies from both sides. The Dutch Top Sector Agri & Food¹⁶ for example has a number of its own arrangements and offers co-financing for innovative (international) projects. The Netherlands Enterprise Organisation RVO may also offer encouragement programs for innovation, development and international cooperation. May be the Algerian Government has encouragement programs as well to support and co-finance a *Potato Processing Chain Program*.

Cooperation and Actions at Governmental level: G2G

1. Continuation of cooperation between NVWA and INPV (and others)

There has been a very successful cooperation between the Netherlands Food and Consumer Product Safety Authority (NVWA) and the Algerian counterpart in the past. The main goal of this cooperation project was to improve the quality of the phytosanitary control system in Algeria and to improve trade conditions in phyto-material between the two countries. Continuation of cooperation between NVWA and the Algerian counterpart, INPV and others, must first be sought at the level of the Dutch side. During our visit at CNCC in Algiers we were informed that the Algerian control and monitoring system for seed potatoes is based upon the monitoring and control schemes in the Netherlands, carried out by the Dutch General Inspection Service (NAK). Regular contacts and knowledge exchange between CNCC and NAK are still ongoing, yet intensification of contacts and exchange of knowledge (training and staff exchange programs) is warmly welcomed by the Algerian institutes.

2. Assist Algeria to become full member of UPOV.

Discuss respecting breeders' rights for new potato varieties from outside Algeria, and assist Algeria to become full member of UPOV.

Processors want new varieties, but as long as these varieties are still protected and guarantees on

¹⁶ The Top Sector Agri & Food is one of the 9 top sectors in which The Netherlands excels worldwide. Businesses, universities, research centres, governments and social organisations work together on knowledge and innovation, internationalisation, human capital and the reduction of regulatory pressure in order to strengthen this position even more. (see: <https://topsectoragrifood.nl/en/>)

breeders' rights are absent, Dutch seed potato companies are holding back on exporting these varieties. Especially when the Algerian policy is to establish its own basic seed potato program to provide for the national need of seed potatoes.

3. How can Algerian authorities be more involved in processing?

At this moment there are no specific support programs for the processing industry. Processing is a new industry in Algeria and it seems not to belong to the domain of the Ministry of Agriculture neither to the domain of the Ministry of Industry. For the future development of this sector it is important that one of the ministries declares the potato processing sector to be its domain.

At the current stage of development of the industrial market for French fries production in particular, the fundamental question is the viability of investment, especially because some factories producing French fries were closed. That is why it is very important that an investigation is carried out to find out the reason of closure of these factories, and the difficulties the French fries producers are facing.

4. Discuss import 'barriers' on technology and (second-hand) machinery.

Algerian farmers are holding back on investing in mechanisation, not only because of technical problems but also because of the high investment costs. Used machinery could be an interesting alternative to start mechanisation. We were informed that import of second-hand machinery is prohibited by the government (Ministry of Industry). The reason behind it is not clear. On the other hand, the Ministry of Industry can allow import of second hand lines for existing factories to extend their activities (they must make a special request). How can such an option be made applicable for the agricultural sector?

5. How to professionalise marketing for the processing industry?

The processing industry is new and requires a professional marketing for further development and to shift from the use of imported potato products to locally produced potato products.

6. Assist Algeria to export (seed) potatoes and potato products

This request was made by the National Chamber of Agriculture and the Potato Council as well. Both the Ministry of Agriculture and the National Potato Council have a two way policy for the development of the potato sector: processing of potatoes (fries and chips) and export of seeds potatoes (to African countries), ware potatoes (to Europe) and potato products. Because of the many regulations for import in European countries, Algeria seeks support in helping Algerian companies to be able to export among others to Europe.

Especially with regard to the Algerian ambitions for seed potatoes, it is obvious that Dutch seed potato companies will hold back on export of their new varieties and support in general.

5.3 Finally

It should be clear that the above mentioned opportunities and recommendations are based on the findings of our visits in Algiers, Ain Défla and Mostaganem. Unfortunately we could not visit El-Oued, which was on our original mission program. Potato production conditions in the desert area of El-Oued are different from the Mediterranean regions. Recommendations for the El-Oued region especially with respect to potato production might be different as well.

References

Agricultural and Rural Training FAR (FAR International Network), FAR Algeria Sheet, 2012.
<https://www.reseau-far.com>

Agriplan, 2013. Algeria potato sector review; Improving potato cultivation, post-harvest handling and market practices in Algeria from a Dutch perspective.

Ahmed Ali A., 2011; Land legislation in Algeria and forms of access to land. CIHEAM, Mediterranean Options, Series B, pp 35-51.

Algérie Press Service (APS), 2019. Stockage de la pomme de terre: 80.000 tonnes ciblées à l'échelle nationale.

Bessaoud, Omar & Karim Lefki, 2018. Diagnostic du système de régulation de la pomme de terre en Algérie. Rapport final provisoire. ENPARD Méditerranée.

FAO statistics on crop production worldwide.

FVF Fruitandvegetablefacts.com, 2017.

(FvF is an initiative of Jan Kees Boon on analysis of the international fruits and vegetables sector.)

Hofstad, Bruno van der & Abdelkader Aissat, 2008. Analyse du système de multiplication de semence de pomme de terre Algérien dans le contexte d'étude de la filière, en vue de la présentation d'un outil de décision concernant le devenir de SAGRODEV/ONCV (Sétif).

Houben, S.J.G., 2017. Current potato production in Algeria; An explorative research of the current potato production systems in two regions. Wageningen Research, Report WPR-693.

Ministry of Agriculture, Algiers. Potato production data.

NAO, Dutch Potato Organisation. Export statistics of seed potatoes.

PotatoPRO.com, 2019. The potato sector in Africa.

Available at: <https://www.potatopro.com/nl/afrika/potato-statistics>

Rabobank Research. De wereldwijde honger naar frites, August 2018.

Annexes

- Annex 1 Potato Mission Program, June 2019
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- Annex 3 Potato Production 2013 – 2018
- Annex 4 Export worldwide of frozen potato products
- Annex 5 Overview of Government support by ANDI

Annex 1 Potato Mission program, June 2019

Summary of the potato mission program

Date	Events, places, purpose of visit	Persons involved
Friday 7 June	Arrival at Algiers	
Saturday 8 June	Haouchine, seed potato producer and potato storage company in Boumerdes	Mr. Farid, general manager Mr. Jamal, Field manager Mr. Malek, store manager
	Fritop, Royal Agri Services, fresh French fries producing company in Ouled Moussa	Mr. Farouk Slimani, director
Sunday 9 June	Ministry of Agriculture, Algiers <i>Technical Institute of Market and Industrial Crops (ITCMI)</i>	Mme BELDHJOURD Siham
	<i>Directorate Regulatory Affairs and Agricultural Production (DRDPA)</i>	Mr. ARED, Tewfik
	<i>National centre for the control and certification of seeds and plants (CNCC)</i> <i>Department of Plant Protection</i>	Mme CHERGUI Zakia EPS MELLAH, general director
	Chamber of Commerce, Algiers	Mr. BOUROUS Mohammed Nabil, Dep. Director International Cooperation Mr. AHMED SAADI Abdelmadjid, director of Nafaa Mr. El-Mouez Kheireddine, director of Afridat Mr. Lefki, seed potato producer, stores exports and supplies to McCain Mr. Mourad Kenaoui, Chief chips production department of SNAX Mme Lynda BESSALEM, Agronomist at SNAX, potato chips processing company
Monday 10 June	Depart to Ain Défla	
	Ministry of Agriculture, Ain Défla <i>Directorate of Agriculture Services (DSA)</i>	Mr. Sadi Amar, general manager Mme Remina Rachida, senior engineer
	<i>FMC, Mantoudjat El Filahia, seed potato producer</i> <i>SMCI, Agricultural machinery company</i> <i>Bouchaoui center, Chéraga</i>	Mr. Ben Ouid Kelifa
	Chamber of Commerce	Mr. DJALALI Hadj, president Mr BOUCHERIT Aissa, director general
	Depart to Mostaganem	
Tuesday 11 June	Directorate of Agriculture Services (DSA), Mostaganem	Mme Said Mansour Aicha Mr. Bendani Cherif
	<i>Visit to Benbaha farm in Sirat, harvesting potatoes with a 2-row harvester</i>	
	<i>Visit to different potato storage facilities in Mesra</i> <i>- Bahar company</i> <i>- Berkane and Associates</i> <i>- SOVEPROAM sarlin</i>	Mr. Abdelhamid Redibi, representative of ONILEV
	Chamber of Commerce, Mostaganem	Mr. Abdelkader BEZZAOUCHI, president Mr. Abdelhamid BELKHOUS, Director

Wednesday, 12 June	Departure to Algiers	
	Visit to SNAX, chips processing company, Algiers	Mr. Samir AIT AOUIDA, President director general Mr. Mourad Kenaoui, chief chips production department Mme Lynda BESSALEM, agronomist engineer
Thursday 13 June	National Chamber of Agriculture	Mr. Quali Belkacem, President Mr. Abdelazis Oudecere, chief vegetable dept. Mr. KHALDI Achour, Consultant - Advisor Mr. Amrar SAÏD, Consultant CNIF P.T. Mr. Ahcene Guedmani (Potato Council, CNIF P.T.)
	National Potato Council, CNIF P.T.	Mr. Amrar SAÏD, Consultant CNIF P.T. Mr. Ahcene Guedmani (Potato Council, CNIF P.T.)
	Embassy of the Kingdom of the Netherlands, Algiers	Mr. Robert van Emden, Ambassador Mr. Daniël Stork, Deputy head of Mission
Friday 14 June	Departure to Amsterdam	

Annex 2 Potato production data 2017

Potato production of first season and last season per wilaya in 2017

Note that production volumes and yields are shown in quintals (100 kg)

Wilaya	First Season			Last Season		
	Area (ha)	Prod. (q)	Yield (q/ha)	Area (ha)	Prod. (q)	Yield (q/ha)
1 ADRAR	0	0	0	0	0	0
2 CHLEF	2 210	675 580	305,7	2 132	589 510	276,5
3 LAGHOUAT	2 203	669 250	303,8	73	18 250	250,0
4 O.E. BOUAGHI	158	54 500	344,9	125	18 737	149,9
5 BATNA	741	236 890	319,8	649	184 530	284,3
6 BEJAIA	217	45 210	208,3	43	6 800	158,1
7 BISKRA	100	20 900	209,0	120	26 500	220,8
8 BECHAR	15	3 160	210,7	96	16 780	175,7
9 BLIDA	590	293 800	498,0	38	7 280	192,7
10 BOUIRA	3 282	1 178 662	359,2	2 933	853 052	290,8
11 TAMANRASSET	11	2 090	190,0	12	2 000	166,7
12 TEBESSA	2 540	920 000	362,2	0	0	0
13 TLEMCEN	3 188	1 020 200	320,0	2 010	501 900	249,7
14 TIARET	4 064	1 131 312	278,4	1 300	338 000	260,0
15 TIZI-OUZOU	458	150 030	327,4	192	52 265	272,9
16 ALGIERS	772	341 230	442,0	45	13 685	307,5
17 DJELFA	2 000	490 200	245,1	1 000	231 100	231,1
18 JIJEL	344	70 800	205,8	40	8 650	216,3
19 SETIF	1 899	525 043	276,5	65	16 500	253,8
20 SAIDA	2 355	703 440	298,7	851	189 626	222,8
21 SKIKDA	3 706	1 078 300	291,0	1 253	302 875	241,7
22 S.B.ABBES	1 819	403 970	222,1	585	134 200	229,4
23 ANNABA	86	36 100	419,8	9	2 500	277,8
24 GUELMA	238	69 750	293,1	1 139	364 561	320,1
25 CONSTANTINE	133	21 600	162,4	34	11 200	329,4
26 MEDEA	1 298	382 095	294,4	891	168 730	189,4
27 MOSTAGANEM	9 964	3 447 444	346,0	3 775	908 660	240,7
28 M'SILAH	330	92 400	280,0	150	42 000	280,0
29 MASCARA	6 611	2 043 300	309,1	5 826	1 509 200	259,0
30 OUARGLA	128	37 387	293,1	1 462	446 522	305,5
31 ORAN	92	27 153	295,9	29	6 985	240,9
32 EL-BAYADH	446	128 707	288,6	490	154 960	316,2
33 ILLIZI	0	0	0	1	75	150,0
34 B.B.ARRERIDJ	47	8 400	178,7	26	6 250	240,4
35 BOUMERDES	1 770	593 870	335,5	210	50 400	240,0
36 EL-TARF	310	123 400	398,1	150	41 500	276,7
37 TINDOUF	0	0	0	4	590	147,5
38 TISSEMSILT	67	12 330	184,0	81	9 740	120,2
39 EL-OUED	11 000	3 850 000	350,0	24 000	7 680 000	320,0
40 KHENCHELA	64	10 550	164,8	29	5 620	193,8
41 SOUK-AHRAS	401	85 650	213,6	75	20 250	270,0
42 TIPAZA	657	308 600	469,7	538	131 560	244,5
43 THOUSAND	1 490	616 440	413,7	197	58 770	298,3
44 AIN-DEFLA	10 000	3 831 722	383,2	10 000	3 047 643	304,8
45 NAAMA	206	40 342	195,8	183	37 863	206,9
46 A.TEMOUCHENT	147	44 310	301,4	71	22 260	313,5
47 GHARDAIA	0	0	0	150	39 900	266,0
48 RELIZANE	1 882	545 640	290,0	1 219	343 035	281,5
TOTAL ALGERIA	80 037	26 371 756	329,5	64 298	18 623 014	289,6

Potato production of primeur season per wilaya in 2017

Note that production volumes and yields are shown in quintals (100 kg)

Wilaya	First Season		
	Area (ha)	Prod. (q)	Yield (q/ha)
1 ADRAR	451	87 745	194,6
6 BEJAIA	35	5 770	164,9
11 TAMANRASSET	4	599	149,8
13 TLEMCEM	85	21 300	250,6
15 TIZI-OUZOU	97	17 180	177,1
16 ALGIERS	252	77 715	308,4
18 JIJEL	136	26 980	198,4
21 SKIKDA	1 000	200 000	200
27 MOSTAGANEM	550	115 500	210
30 OUARGLA	6	1 325	230,4
31 ORAN	1	280	280
35 BOUMERDES	948	260 150	274,4
36 EL-TARF	120	35 400	295
42 TIPAZA	765	208 490	272,5
46 A. TEMOUCHENT	24	6 620	275,8
47 GHARDAIA	14	4 200	300
TOTAL ALGERIA	4 488	1 069 254	238,3

(Source: Ministry of Agriculture)

Annex 3 Potato production 2013 - 2018

Area (ha) of potato cultivation by wilaya 2013-2018

Wilaya	2013	2014	2015	2016	2017	2018
1 ADRAR	278	316	310	361	451	455
2 CHLEF	4 777	4 601	4 411	4 290	4 342	4 045
3 LAGHOUAT	1 727	1 912	2 208	2 247	2 276	2 476
4 O.E. BOUAGHI	592	350	365	479	283	200
5 BATNA	2 543	2 530	2 913	2 686	1 390	1 171
6 BEJAIA	328	325	342	320	295	123
7 BISKRA	94	90	162	210	220	320
8 BECHAR	128	149	93	117	111	170
9 BLIDA	1 045	836	799	735	628	674
10 BOUIRA	6 101	5 522	6 198	6 235	6 215	6 260
11 TAMANRASSET	85	65	59	55	27	52
12 TEBESSA	2 229	1 060	1 200	2 525	2 540	2 974
13 TLFMCEN	5 191	6 196	6 680	6 385	5 283	5 273
14 TIARET	5 428	5 075	5 314	5 749	5 364	5 257
15 TIZI-OUZOU	1 454	1 123	887	938	747	804
16 ALGIERS	2 185	1 944	1 618	1 516	1 069	1 164
17 DJELFA	1 997	2 540	2 584	2 728	3 000	3 782
18 JIJEL	526	524	550	556	520	514
19 SETIF	2 645	2 533	2 292	2 244	1 964	1 754
20 SAIDA	2 191	2 096	1 998	2 718	3 206	3 017
21 SKIKDA	4 520	5 085	5 385	5 656	5 959	5 580
22 S.B.ABBES	1 928	2 095	2 333	2 274	2 404	2 100
23 ANNABA	42	43	70	103	95	286
24 GUELMA	2 871	2 754	1 708	1 903	1 377	368
25 CONSTANTINE	346	494	452	194	167	122
26 MEDEA	2 114	2 214	2 201	2 296	2 189	1 959
27 MOSTAGANEM	12 588	12 612	13 360	12 771	14 289	15 864
28 M'SILAH	1 050	790	600	580	480	635
29 MASCARA	10 938	12 175	12 363	12 500	12 437	14 045
30 OUARGLA	758	1 019	1 666	1 938	1 595	2 845
31 ORAN	423	234	284	243	122	165
32 EL-BAYADH	821	1 077	956	977	936	1 598
33 ILLIZI	3	4	4	2	1	3
34 B.B.ARRERIDJ	214	190	125	151	73	65
35 BOUMERDES	3 836	3 812	3 533	3 740	2 928	2 993
36 EL-TARF	356	475	460	529	580	535
37 TINDOUF	8	10	9	7	4	3
38 TISSEMSILT	165	188	140	143	148	202
39 EL-OUED	35 000	33 000	33 000	34 000	35 000	36 200
40 KHENCHELA	93	131	126	111	93	101
41 SOUK-AHRAS	1 060	1 300	700	900	476	100
42 TIPAZA	4 204	3 971	2 749	2 479	1 960	2 048
43 THOUSAND	1 867	1 632	1 876	1 856	1 687	1 336
44 AIN-DEFLA	24 000	24 525	21 882	21 663	20 000	15 800
45 NAAMA	635	602	617	562	389	410
46 A.TEMOUCHENT	377	346	303	316	242	307
47 GHARDAIA	112	145	102	119	164	236
48 RELIZANE	9 283	5 466	5 328	5 209	3 100	3 279
TOTAL ALGERIA	161 156	156 176	153 313	156 308	148 822	149 665

(Source: Ministry of Agriculture)

Potato production volume (quintals) by wilaya 2013-2018

Wilaya	2013	2014	2015	2016	2017	2018
1 ADRAR	42 300	43 680	46 905	54 310	87 745	89 635
2 CHLEF	1 498 910	1 827 260	1 272 040	1 295 530	1 265 090	1 133 195
3 LAGHOUAT	449 980	556 863	623 800	561 750	687 500	700 560
4 O.E. BOUAGHI	112 266	70 125	89 599	93 940	73 237	52 300
5 BATNA	736 900	756 540	459 950	832 635	421 420	338 420
6 BEJAIA	84 245	60 210	72 847	59 230	57 780	23 714
7 BISKRA	20 724	19 890	34 320	61 240	47 400	52 950
8 BECHAR	19 504	33 487	18 132	22 877	19 940	37 000
9 BLIDA	427 770	492 800	329 290	271 410	301 080	249 180
10 BOUIRA	2 081 500	1 760 499	2 086 049	2 131 289	2 031 714	2 032 205
11 TAMANRASSET	13 815	9 791	10 614	8 352	4 689	7 605
12 TEBESSA	771 350	360 000	408 000	876 750	920 000	1 309 500
13 TLFMCEN	1 507 000	1 775 100	2 107 000	2 106 500	1 543 400	1 620 500
14 TIARET	1 498 369	1 451 643	1 507 737	1 584 500	1 469 312	1 611 891
15 TIZI-OUZOU	355 463	219 170	176 077	228 353	219 475	221 880
16 ALGER	824 544	733 325	623 200	591 620	432 630	470 300
17 DJELFA	365 000	448 610	535 800	616 520	721 300	1 265 540
18 JIJEL	89 668	86 265	100 118	109 665	106 430	139 395
19 SETIF	681 532	668 175	634 376	631 175	541 543	500 473
20 SAIDA	566 755	545 183	540 640	771 185	893 066	831 040
21 SKIKDA	1 245 570	1 176 798	1 421 961	2 077 705	1 581 175	1 605 865
22 S.B.ABBES	602 330	602 059	621 610	587 490	538 170	525 200
23 ANNABA	8 750	9 140	19 830	34 120	38 600	151 550
24 GUELMA	947 030	848 538	543 930	505 105	434 311	112 090
25 CONSTANTINE	89 350	129 570	111 670	39 165	32 800	32 820
26 MEDEA	587 169	549 582	572 185	614 865	550 825	531 530
27 MOSTAGANEM	3 700 808	3 750 098	3 953 620	3 715 730	4 471 604	5 432 475
28 M'SILA	273 000	237 000	173 000	185 000	134 400	187 750
29 MASCARA	3 172 000	3 598 625	3 788 000	3 633 000	3 552 500	3 660 150
30 OUARGLA	223 070	290 100	488 378	569 200	485 234	941 712
31 ORAN	112 410	64 530	75 414	68 175	34 418	52 220
32 EL-BAYADH	161 975	234 130	216 555	277 890	283 667	502 545
33 ILLIZI	379	540	555	233	75	399
34 B.B.ARRERIDJ	48 252	45 405	30 400	30 800	14 650	12 460
35 BOUMERDES	1 246 600	1 157 115	991 014	1 207 590	904 420	909 630
36 EL-TARF	112 200	115 850	140 500	200 520	200 300	205 625
37 TINDOUF	1 200	1 500	1 275	1 050	590	515
38 TISSEMSILT	25 227	31 585	17 310	21 955	22 070	50 853
39 EL-OUED	11 725 000	10 890 000	10 890 000	10 956 000	11 530 000	11 360 000
40 KHENCHELA	19 030	34 400	16 800	19 305	16 170	17 885
41 SOUK-AHRAS	320 000	335 000	196 000	237 000	105 900	31 000
42 TIPAZA	1 085 770	1 035 470	787 865	727 945	648 650	651 560
43 MILA	704 957	604 184	728 908	786 030	675 210	542 280
44 AIN-DEFLA	7 316 309	7 290 260	6 197 030	6 436 146	6 879 365	5 128 701
45 NAAMA	115 674	106 185	111 846	119 904	78 205	99 860
46 A.TEMOUCHENT	100 350	95 420	86 200	92 890	73 190	86 590
47 GHARDAIA	30 240	39 590	28 860	32 680	44 100	68 920
48 RELIZANE	2 743 135	1 543 865	1 508 560	1 510 443	888 675	943 755
TOTAL ALGERIE	48 865 380	46 735 155	45 395 769	47 596 766	46 064 024	46 533 222

(Source: Ministry of Agriculture)

Annex 4 Export worldwide of deep-frozen potato products

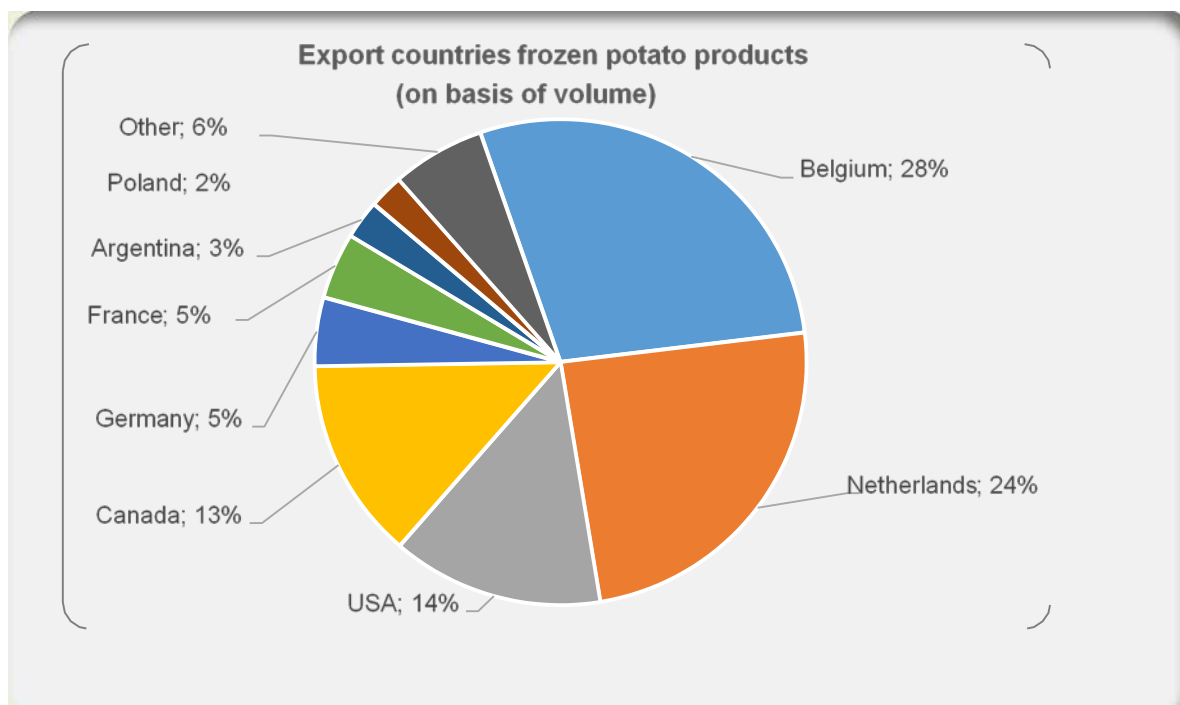
Export of deep-frozen potato products

Export of potato products	2010	2011	2012	2013	2014	2015	2016	2017	2018
Export worldwide in 1000 ton	5.658	5.945	6.197	6.356	6.510	6.870	7.380		
Idem in million €	3.801	4.224	4.502	4.944	4.874	5.366	5.955		
Idem in € per ton	672	710	727	778	749	781	807		
Export from Belgium in 1000 ton	1.414	1.428	1.590	1.647	1.789	1.990	2.081	2.207	2.509
Idem in million €	777	906	972	1.153	1.165	1.229	1.401	1.513	1.652
Idem in € per ton	549	635	611	700	652	617	674	685	659
Export from Netherlands (in 1000 ton)	1.418	1.431	1.459	1.461	1.473	1.610	1.931 ^{*)}	1.958	2.041
Idem in million €	952	1.050	1.035	1.127	1.115	1.234	1.551 ^{*)}	1.583	1.573
Idem in € per ton	671	734	710	772	757	766	803	808	771

^{*)} From 2016 onwards: including estimates for smaller companies

(Source: *Fruitandvegetablefacts.com* and additional information from *Jan Kees Boon*, owner of *FVF*).

Export countries of deep-frozen potato products and their share in total volume in 2016



(Source: *Fruitandvegetablefacts.com*)

Annex 5 Overview of Government support by ANDI

The National Investment Development Agency ANDI's mission is to:

- Registering investments
- Promoting investment in Algeria and abroad;
- Promoting territorial opportunities and potentials;
- Facilitating business practice, monitoring the formation of companies and carrying out projects;
- Assistance, help and support for investors;
- Information and awareness in the business community
- Qualification of projects, their evaluation and the establishment of the investment agreement to be submitted for approval by the National Investment Council.

The Industry Sector is one of the ANDI's areas of interest:

Algeria has recently implemented a new industrial recovery strategy aimed at further developing, modernizing and integrating Algerian industry. With this in mind, the government seeks to improve Algeria's attractiveness as an investment destination in order to modernize industrial activity, create new business opportunities and encourage the establishing of new investments. This initiative also aims to promote the digital economy, develop and make available flexible and innovative financing to encourage businesspersons to modernize their production lines.

The major axes of industrial strategy are:

1. Industry sector rollout:
 - Valuing natural resources
 - Densification of industrial fabric
 - Promoting new industries
2. Industry space deployment:
7. Create synergies by:
 - Exploiting the spatial concentration of economic activities
 - Networking companies, public institutions and research, training and expertise structures
 - Create a micro-business climate and increase investment.
3. Industrial development policies:
 - Business upgrades
 - Innovation drives industrial development
 - The development of human resources
 - Promoting foreign direct investment (FDI)

The agri-food industry is one of the strategic sectors covered by the ANDI.



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