ADDRESSING AGRICULTURAL IMPORT DEPENDENCE IN THE MIDDLE EAST - NORTH AFRICA REGION THROUGH THE YEAR 2050

SHORT SUMMARY OF THE STUDY - OCTOBER 2015

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Pluriagri

The Middle East – North Africa region (MENA) is characterized by a particularly high level of dependence on agricultural imports: 40% of its needs for agricultural products are currently being met by imports, while its dependence on cereal imports is among the highest in the world. Over the course of the past several decades, a combination of demographic growth and changes in dietary habits has led to a marked increase in food requirements. Although agricultural production in the region has increased substantially over the same period, it has been unable to keep pace with the increase in demand, partly because of limitations in terms of soil and climate and partly because of limitations in terms of agricultural policy. Regional dependence on agricultural imports is likely to continue to escalate in the foreseeable future, both as a result of ongoing demographic expansion and changes in eating habits and as a result of climate change impacts in a region already recognized as a climate "hot spot."

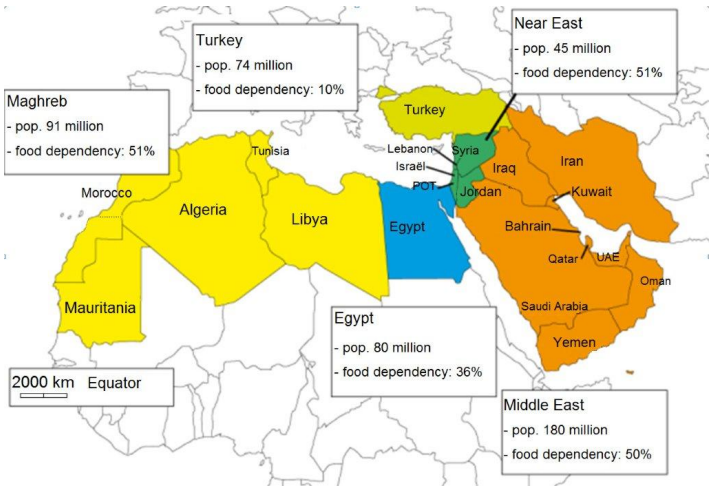
As a global region, the MENA region is both geopolitically complex and highly strategic. Agricultural imports place a significant burden on state budgets, and agri-food policies in the region continue to struggle with urban and rural poverty. In this situation, it is important to understand which factors within the regional agri-food system are most likely to contribute to – or, on the contrary, might help mitigate – a continued increase in agricultural import dependence.

It is for these reasons that Pluriagri has commissioned, and INRA has undertaken, the study summarised here. The project began by examining historic trends (from 1961 to 2011) with regard to the resource-use balance of the regional agri-food system. Next, it analysed several potential future scenarios for the region through the year 2050. To construct the scenarios, the study made use of simulation tools that take into account the anticipated effects of climate change as well as such factors as technical innovation, improved use of irrigation, contrasting patterns in eating habits, and differential changes in demographic and economic development. These simulations suggest that dependence on agricultural imports is likely to continue to increase in the region, especially if the effects of climate change are pronounced. Taken individually, none of the three mechanisms proposed for reducing agricultural import dependence (improved agricultural productivity, moderation of dietary habits, or a reduction in food waste) is capable of correcting this trend in the Maghreb, the Middle East, or the Near East. Such mechanisms may be effective in Egypt, however, and have the potential to strengthen Turkey's role as a net agricultural exporter.

In addition to the political conflicts and tensions affecting the area, the MENA region (an area of 13 million sq km, or 10% of total global land area) is notable both for its high percentage of arid and semi-arid lands, characterized by low agricultural productivity, and for its rapid demographic expansion, with a population that has increased by a factor of 3.5 in fifty years – from 139 million inhabitants in 1961 to 496 million in 2011 (Figure 1). A key challenge for the region thus lies in its ability to meet its food needs.

As S. Abis (2012) has put it, this region of the world is a "magnifying glass for global food challenges and [… the] barometer for the competition in which the planet's major agricultural actors are engaged". [2]

Figure 1 – The MENA region and its sub-regions (2011 data; "food dep." = dependence on imports [percentage of kilocalories consumed that are supplied by food imports])

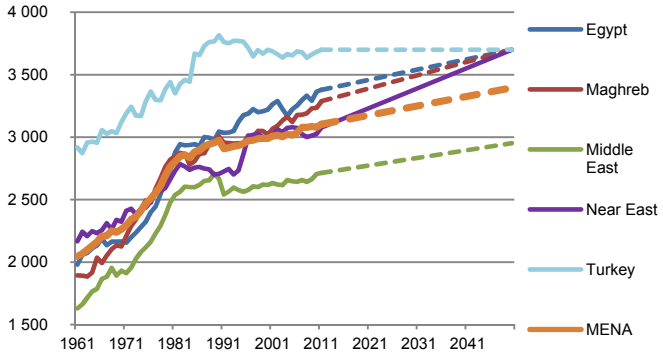


Agricultural imports currently supply 40% of regional food requirements and are increasing rapidly

Demand for agricultural products increased sixfold from 1961 to 2011

The region's dramatic growth in population is in large part responsible for its increased demand for food and other agricultural products. But the impacts of demographic expansion have been heightened by the changes in eating habits that typically accompany economic development and rapid urbanisation. In the MENA region, these dietary changes include a pronounced nutritional transition together with the maintenance of certain features of the Mediterranean diet. On the one hand, daily caloric intake has increased sharply, reaching 3,200 to 3,700 kcal/pers/day in some areas (average caloric intake remains lower in the Middle East due to its recent history; see Figure 2). A significant increase in the importance of vegetable oils and sugary foods in the diet has also taken place, along with a notable reduction in the consumption of traditional cereals (Figure 3). On the other hand, changes in dietary habits differ from the "Western" model in the extremely low amounts of animal foods consumed (which have levelled out at 10% of caloric intake); by the continued although diminishing importance of cereals (currently around 55%); and by the steady consumption of fruits and vegetables (just under 10% of total caloric intake).

Figure 2 – Daily caloric intake in the MENA region and its 5 subregions, 1961-2011 and as projected through 2050
("food availability" as defined by the FAO, in kcal/person/day)



Sources: *FAOStat* & *GlobAgri-Pluriagri*

[1] *Pluriagri* is an association of representatives of the commodity sector (including Avril, the *Confédération générale des planteurs de betteraves* [the French Confederation of Sugar Beet Producers], and Unigrains) together with Crédit Agricole S.A. (a major bank), supporting foresight studies of agricultural markets and policies.

[2] Abis S., 2012. *Pour le futur de la Méditerranée, l'agriculture*. Paris: L'Harmattan, 150 pp.

The nature of the animal products consumed is also changing. While consumption of dairy products remains significant, its importance is diminishing and is being replaced by an increased consumption of poultry products (poultry meat and eggs). Together with changes in livestock production practices, this shift in the type of animal products consumed has spelled a shift in demand for animal feed materials. Reduced reliance on grazing and the spread of "intensive" livestock production systems has resulted in an increased use of maize and protein meals (especially soyameal) in animal rations, to the detriment of cereals such as barley, oats, and to a lesser extent wheat. Demand for crops for use as animal feed has increased eightfold over the time period examined vs. fivefold for crops destined for human consumption.

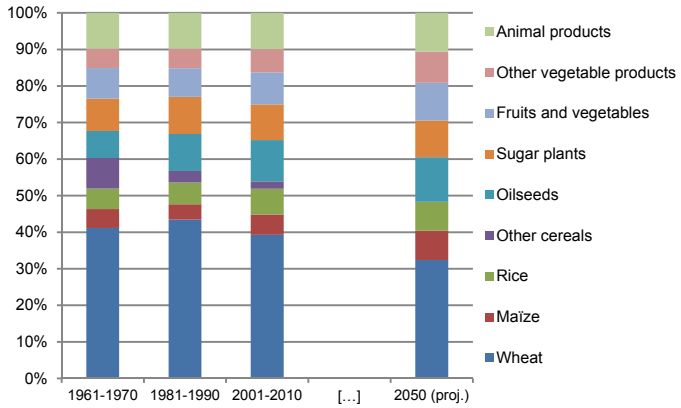
Taken together, these trends have led to a sixfold increase in demand for agricultural products in the region over a period of fifty years.

Despite strong gains, agricultural production has not kept up with demand

Although crop production in the region has increased dramatically, amounting to a fourfold increase in fifty years, it has been unable to keep pace with these changing demographics and food requirements. For cereal crops in particular, significant and lasting yield gains have only been achieved in Turkey and Egypt. The Middle East, the Near East, and the Maghreb remain well behind in terms of cereal yields and output, with the Maghreb and the Near East also experiencing high interannual variability in terms of yields.

The nature of the crops grown, moreover, has changed little over time and in this way has failed to keep pace with evolving food and feed requirements. Cereals continue to occupy a central place in regional agricultural production, accounting for between 65% and 70% of total crop output (in terms of kilocalories), with wheat remaining the most important crop. Other cereals, primarily barley and oats, have diminished in importance, while maize has increased. Production of oilseed crops has fallen, meanwhile, due to their greater availability on international markets, while production of sugar-producing crops and of fruits and vegetables has increased. The latter have been the focus of specific policies intended to boost production, in part for export markets.

Figure 3 – Dietary composition in the MENA region by decade from 1961 to 2011 and as projected through 2050
(expressed as a % of kcal per person)



Sources: *FAOStat* & *GlobAgri-Pluriagri*

Quantities of animal products produced locally have increased fivefold, and have changed in nature to some extent: a continued importance of dairy production and a reduction in the rearing of small ruminants has been accompanied by the appearance of intensive poultry operations producing large quantities of eggs and poultry meat (tonnages of which have increased by a factor of 26). These shifts in animal production have led to a reduction in grassland and a weakening of the region's pastoral tradition.

Severely limited land and water resources

Increases in agricultural productivity in the MENA region must be considered in conjunction with the severely limited nature of the key agricultural resources of cultivable land and water.

Out of the 1,300 million hectares making up the region, only 84 million hectares were in cultivation in 2011 (including arable land and perennial crops), with another 362 million hectares in permanent pasture. Land in cultivation increased by 11% between 1961 and 2011; permanent pasture by 27%. Compared with lands considered "cultivable" by agronomists (Classes 1 through 4 according to the Global Agro-Ecological Zones classification, or GAEZ),[3] cultivated land area in the region is already well in excess of cultivable land area: more than half of land currently cultivated is considered "non-cultivable" according to its GAEZ classification. Irrigation accounts for some of this discrepancy, notably in Egypt, where none of the country's 3.5 million cultivated hectares (all of them irrigated) are classed as "cultivable". In the four other sub-regions, the contribution of low-quality land to cultivated land area is also significant: 44% of cultivated land in the Maghreb, 43% in the Near East and 42% in the Middle East corresponds to land area classed as low quality according to the GAEZ. Even Turkey appears to have reached its limit in terms of "cultivable" land area, with 5% more land in cultivation than it has "cultivable" land according to the GAEZ. Moreover, and probably in connection with this use of low-quality land, the soils of the region are subject to strong processes of degradation, including natural erosion, chemical degradation, and the risk of salinisation.

Although Turkey and (within the Middle East) Iran present something of an exception, the region is likewise characterized by low precipitation and growing concerns with regard to water management. Land areas equipped with irrigation increased from 15% to 34% of cultivated land over the course of the period under consideration, and competition for water with other uses, including industrial and urban use, is becoming more intense. Most countries in the region have passed the threshold of 80% usage of renewable water resources, suggesting that the limit on this essential resource has been reached (or even exceeded, as in some areas of the Arabian Peninsula).

Increased dependence on food imports

As gains in agricultural production have failed to keep pace with rising food requirements in the region, the imbalance has been made up by an increased reliance on international markets to meet human and animal food requirements: net dependence on agricultural imports[4] has thus increased from 10% to 40% in fifty years, with significant variation among sub-regions (cf. Figure 6). Between the beginning of the 1960s and the end of the 2000s, the Maghreb and the Middle East thus saw their levels of import

[3] See the FAO Web site: <http://www.fao.org/nr/gaez/fr/>.
[4] Percentage of net imports (imports minus exports) within total domestic consumption.

dependence increase from 10% to 54% and from 15% to 50%, respectively. In the Near East, where import dependence already stood at 40% at the beginning of the time period under consideration, a similar level was reached by the end of the 2000s. Egypt shows lower levels of agricultural import dependence, but nevertheless moved from 10% to 30% over the same time period. Turkey is the exception within the region, with a historically low coefficient of agricultural import dependence that has reached 10% only in the past few years.

Because of the composition of human diets and animal feeding requirements, cereals and oilseed/protein crops account for the largest share of regional agricultural import dependence. As a region, the MENA region has become one of the biggest net importers of cereals in the world, with imported tonnages having increased fifteenfold over the period under consideration. Wheat is the most imported cereal, with net imports having increased from 5 to 44 million tonnes. Maize is now in second place, with 23 million tonnes imported in 2011 (vs. 300,000 tonnes in 1961), followed by "other cereals", at 12 million tonnes (vs. 900,000 tonnes in 1961). Imports of oilseed and protein crops have also increased sharply, from approximately 1 million tonnes in 1961 to nearly 30 million tonnes today. These include both vegetable oils for human consumption and oilseed and protein meals for animal consumption. Imports of sugar products have increased fifteenfold over the period studied and currently stand at 12 million tonnes, for a dependence level of 37%.

Historically supplied for the most part by Europe and North America, these considerable quantities of agricultural imports have gradually come to include other global suppliers, particularly South America for oilseed and protein crops and the former Soviet countries for cereals.

Some countries and sub-regions, such as Turkey and the Middle East, also export considerable quantities of agricultural and food products. For the most part these exports are made up of fruits and vegetables, with the addition of rice in the case of Egypt and wheat in the case of Turkey.

Between now and 2050, the continuation of existing trends will exacerbate agricultural import dependence in the Middle East, the Near East, and Egypt

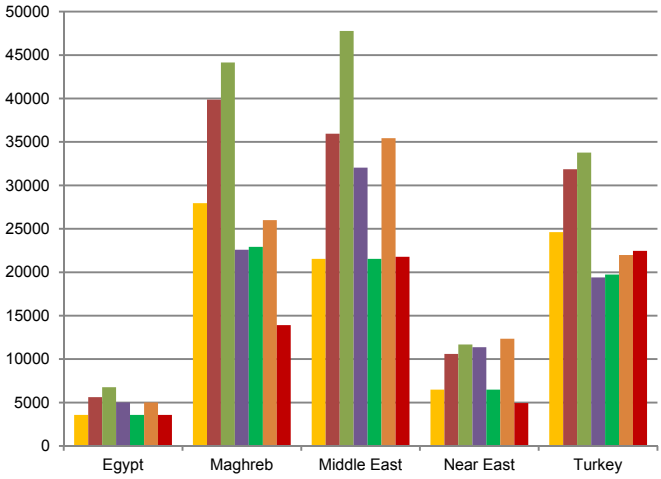
In this context, we used the *GlobAgri-Pluriagri* model (see box on page 5) to simulate the effects on agricultural production levels and trade of a projection of different elements of the regional agri-food situation through the year 2050.

Cultivated land requirements could increase by 71% (relative to 2008) in response to mounting food needs

According to the median projection made by the UN in 2012, the population of the MENA region will rise from 464 million inhabitants in the reference year 2008 (average 2007-2009), to 704 million inhabitants in 2050, or an increase of 50%.[4] Thus the increase in food requirements resulting from population growth alone – if dietary habits, crop and animal yields, and reliance on agri-food imports remained unchanged – would lead to a 47% increase in cultivated land area requirements in the region. The Middle East and the Near East would be particularly strongly affected in this scenario, with cultivated land requirements rising by 66% in the Near East and by 62% in the Middle East (cf. Figure 4, "Population Effect" vs. "2008").

Cultivated land requirements will increase further as a result of changes in dietary habits. If past trends continue, average daily caloric intake in the MENA region in the year 2050 will be equivalent to current levels in European countries (3,700 kcal/inhabitant/day), with the exception of the sub-region of the Middle East, where levels are projected to reach just 3,000 kcal/person/day (Figure 1). In keeping with existing trends, the percentage of plant products in the diet will remain high and stable, around 90%; within this part of the diet, there will be a diminishing importance of wheat and an increasing importance of maize, vegetable oils, and fruits and vegetables (Figure 3). The increased consumption of poultry meat will continue, with a slight reduction in the consumption of milk and other dairy products. Using these hypotheses combined with the demographic projections cited previously, and keeping yields and import dependence steady, the need for land in the region will increase by 71%, with two-thirds of this increase attributable to population growth (Figure 4, "Population + Food Effect").

Figure 4 – Cultivated land area requirements through 2050, initial situation 2007-09 ("2008") and according to projected scenarios
(in thousands of hectares)



2008: initial situation (2007-2009)

Population Effect: median UN projection (2012 edition)

Population + Food Effect: above scenario + projected dietary habits in keeping with trends over the past 20 years

Population-Food Effect + Yields_1: above scenario + projected yields in keeping with trends over the past 20 years

Trends Scenario: above scenario with limits on cultivated land area

Population-Food Effect + Yields_2: "Population + Food Effect" + yield projections taking into account severe climate change impacts (RCP-8.5)

Trends Scenario with increased climate change impacts with limits on cultivated land area and taking into account severe climate change impacts (RCP-8.5)

[4] The 2015 revision of the UN projections arrives at a higher median value (750 million inhabitants in 2050), nearer to the "high" projection figure cited by the 2012 report.

The *GlobAgri-Pluriagri* model

GlobAgri is an information system and quantitative modelling tool used by INRA and CIRAD to analyze agricultural resource use and availability at the global and regional levels. Using the *FAOStat* database and a few sources of complementary data, *GlobAgri-Pluriagri* divides the MENA region into five sub-regions (Figure 1); the rest of the world is divided into 12 regions. For each of these 17 regions/sub-regions, the model then establishes a material balance for 36 agricultural products in which domestic production plus net imports (imports minus exports) equals the sum of uses of the product for human consumption, animal consumption, and other uses, plus losses (mainly associated with transformation phases) and variations in stocks.

Since the model does not include economic variables, levels of production and consumption do not adjust according to the economic behavior of producers and consumers. Consumption levels are instead set *a priori* by the modeller, along with certain production factors such as crop and livestock yields. Adjustments are then made to determine the levels of imports, exports, and domestic production necessary to achieve equilibrium between resource availability and resource use. To do so, two constraints are introduced: the first ensures that, at the global level, the sum of all imports equals the sum of all exports; the second imposes a maximum cultivable land area for each region.

In cases where the limit on cultivable land area is reached, equilibrium must be achieved by reducing exports (i.e., the percentage of the global market supplied by the region) and/or increasing imports (i.e., the coefficients of import dependence). In the case of the MENA region, the model did not adjust quantities exported via a reduction in the percentage of the export market, these being supposed to be stable given the specificity of the production types involved (mainly fruits and vegetables).

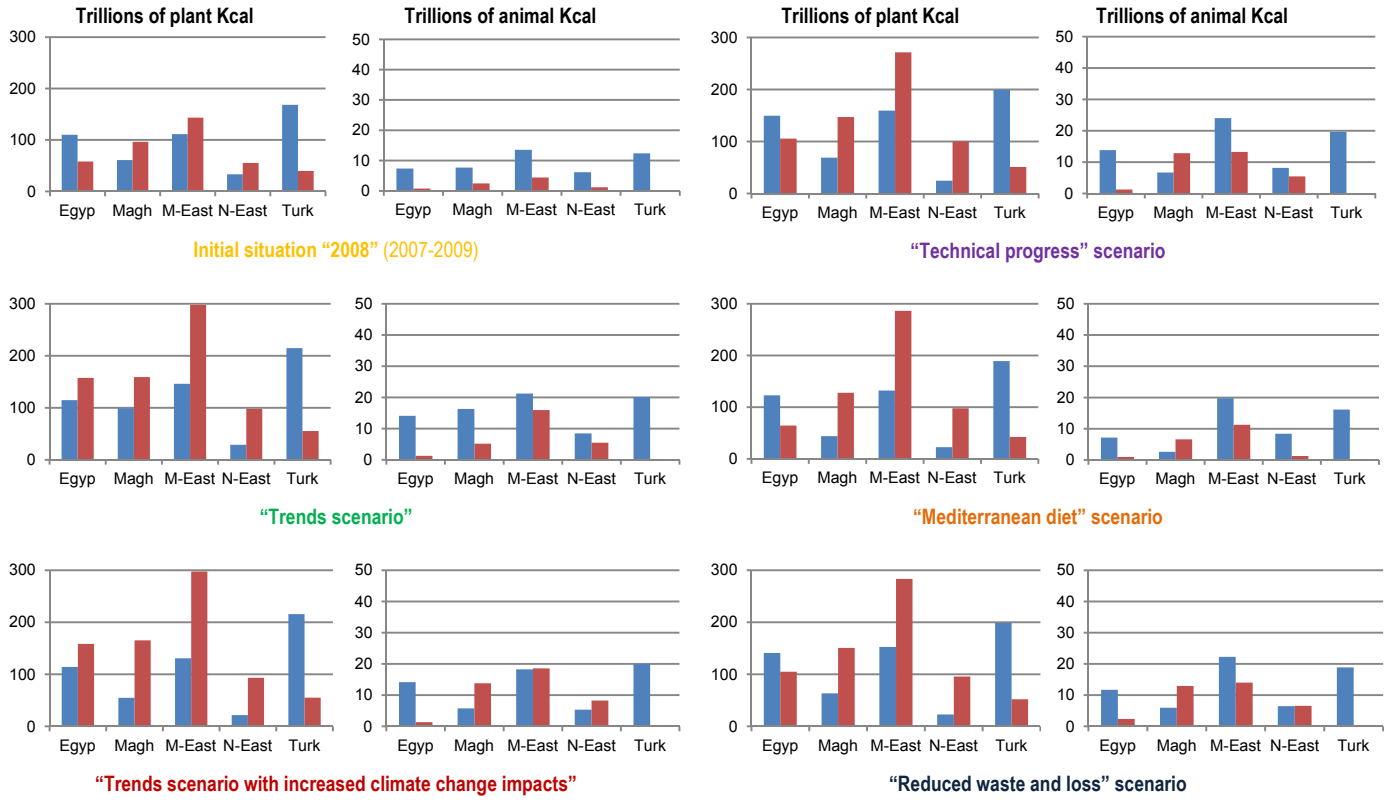
If limits on cultivable land area are not reached, the region will retain its share of the global export market and its coefficient of import dependence will be calculated according to the initial situation, with domestic production being adjusted as necessary to achieve equilibrium. The model thus implicitly supposes that trade between a given region and the rest of the world is not always readily adjustable, but rather will present a certain degree of rigidity. This inflexibility can result in situations in which the freeing up of cultivable land may coincide with maintenance of a certain level of imports.

Pursuit of improved yields will only partially compensate for the need for more cultivated land, giving rise to further dependence on agricultural imports

Next, we can consider a scenario in which existing trends in agricultural production continue, notably an ongoing increase in agricultural yields, especially crop yields. By 2050, these have the potential to double relative to yield levels at the beginning of the time period considered here. In terms of animal outputs, the available data combined with a continuation of the trend toward more intensive production systems suggest relatively limited gains in animal productivity. Taken together, these projected gains in agricultural output have the potential to compensate either entirely or in part for increased land requirements linked to rising food needs in the region (Figure 4, "Population-Food Effect + Yields_1").

This compensation will be partial in the Middle East, the Near East, and in Egypt, where limits on cultivable land area and thus domestic food production capacity will give rise to a net increase in imports (Figure 4, "Trends scenario"). Thus despite an expansion in agricultural production, particularly in the Middle East, agricultural imports in these three sub-regions will increase considerably relative to the initial situation: by a factor of 2.7 in Egypt; a factor of 2 in the Middle East; and a factor of 1.8 in the Near East (Figure 5). The rise in import dependence in these sub-regions will be especially pronounced with regard to wheat and poultry meat.

Figure 5 – Agricultural production and imports in Egypt, the Maghreb, the Middle East, the Near East and Turkey according to the projected scenarios



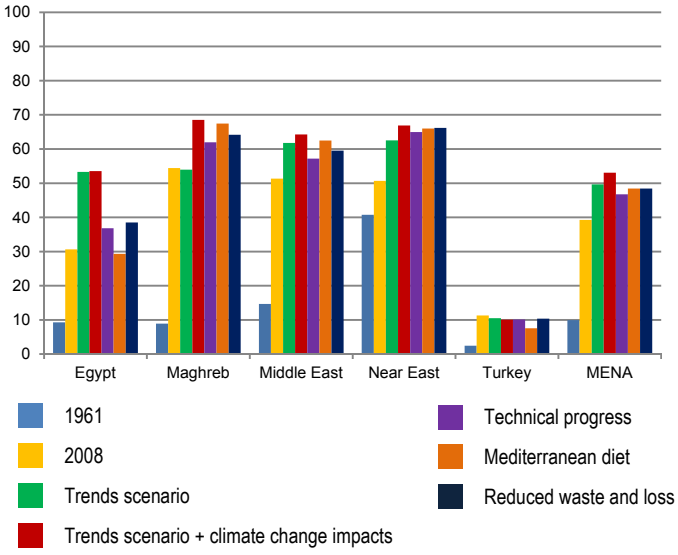
In the Maghreb and Turkey, gains in agricultural production are likely to outpace demand

In the Maghreb and Turkey, by contrast, when projected gains in crop and livestock productivity are introduced into the scenario, a potential freeing up of cultivated areas is observed (Figure 4, "Trends scenario" vs. "2008"). For these two areas, when the production gains obtained through this simulation are combined with the additional productive capacity of the land thus made available, the agricultural output of the Maghreb could double by 2050, while that of Turkey could increase by 60% relative to the initial situation of 2007-2009. These gains would in turn enable the Maghreb to reduce its previously high level of imports by 4-5 percentage points, while Turkey could supply all its domestic needs and become a net exporter of agricultural products.

Assembling all the elements of this "Trends scenario," in which demand for agricultural products increases more rapidly than foreseeable gains in agricultural production, suggests that the region's overall agricultural import dependence will rise by 39% to 49% by 2050 (Figure 6). The sub-regions most strongly affected by this trend will be the Middle East and Egypt, with coefficients of dependence at the end of the time period of 53% (vs. 51% today in the Middle East and 30% in Egypt), and the Near East, with 62% dependence (vs. 50% today). Only the Maghreb and Turkey will be able to expand agricultural production faster than domestic demand, enabling the Maghreb to reduce its dependence on imports and Turkey to become a net exporter.

Figure 6 – Net import dependance of the MENA region and its five sub-regions in 1961, in 2008, and in 2050 for each projected scenario

(% net imports within total domestic consumption, in kilocalories)



Impacts of increased climate change

Trends scenario including climate change impacts

In the "Trends scenario" described above, the hypotheses applied to the different elements of the regional agri-food system include the impacts of climate change as they have been experienced over the past twenty years. These effects are still relatively mild, however, whereas the Fifth Report of the IPCC states with a growing level of certainty that both the magnitude and the impacts of climate change are likely to become more severe. The scientific literature agrees, moreover, that the MENA region will potentially be among those global regions most heavily affected, beginning before 2050. The impacts of global climate change will put a brake on projected yield increases, particularly crop yields, and will further restrict available land area through a combination of rising temperatures and reduced rainfall, leading to an increase in areas subject to desertification.

To address these potentialities, we decided to consider the most extreme case projected by the IPCC, corresponding to a radiative forcing of 8.5 W/m² (RCP-8.5); or, in other words, the probable outcome if international agreements and mitigation policies to address climate change are unable to slow the global processes currently underway. Making use of the available literature, which is extensive with regard to the effects on crop yields but more limited with respect to effects on cultivable land area, we adjusted the hypotheses relative to the agricultural system components so as to construct a "Trends scenario including climate change impacts". Compared to the previous scenario, crop yields obtained from rainfed agriculture in the year 2050 under these circumstances are reduced by 10-20%, depending on the specific crops and sub-regions. Supposing a continued availability of water for irrigation means that yields and cropping areas will change for rainfed agriculture only, with yields and land area for irrigated agriculture remaining the same. In this case, cultivable land area and crop yields for Egypt will remain unchanged.

The Maghreb will be the most seriously affected area, losing close to half of its cultivable land area between now and 2050. The Near East will also be strongly impacted, losing a quarter of currently cultivated area. Cultivable land area will remain unchanged in the Middle East, however, with climate change having only a weak effect on agronomic potential in this sub-region. Given its distinct geography (a more northern position, mountainous areas, more favourable hydrography), Turkey may see a significant increase in cultivable land area, amounting to 3.6 million hectares by 2050, or 15% of currently cultivated land.

The Maghreb will be especially heavily impacted, and only Turkey is likely to avoid an increase in agricultural import dependence

According to this new group of hypotheses, the level of crop production in the Maghreb will be severely impacted, with projected output in 2050 just half that arrived at in the previous "Trends scenario", and indeed less than its current level (Figure 5). Projected gains in crop yields will likewise be reduced in the Near East and in the Middle East, although to a lesser degree.

It should be noted however that in each of these three areas, the deterioration of conditions for agricultural production will not result in an increase in crop imports. Rather, it is animal product imports that will increase significantly, accompanied by a corresponding reduction in domestic animal production compared to the previous "Trends scenario". The model reacts as if – in order to limit their levels of import dependence – these areas would reduce imports of crop products destined for animal consumption and thereby slow further development of intensive livestock production, preferring instead to import more animal products directly. This reaction of the model to the addition of severe climate change impacts calls into question the long-term viability of the strategy, widely adopted in the region, of the development of intensive livestock systems based on imported crop products.

The severe deterioration of the conditions of agricultural production in the Maghreb will result in a sharp increase in its dependence on imports, passing from 54% to 68% of domestic consumption by the year 2050 (Figure 6). The tendency toward

increased dependence on agricultural imports in the sub-regions of the Middle East and the Near East is further confirmed relative to the previous scenario, with coefficients of import dependence reaching 64% and 67%, respectively.

Within this rather bleak overall picture, Turkey appears once again as the exception, with the beneficial impacts of climate change in terms of cultivable land area compensating for the negative impacts in terms of yields within rainfed agriculture. As a result, when climate change impacts are compared to the previous "Trends scenario", Turkey slightly strengthens its position as a net exporter of agricultural products.

A stagnation or even a reduction in agricultural labour productivity, suggesting a persistence of rural poverty through 2050

For each of the scenarios examined above, we further sought to evalute impacts on labour productivity in the region. Although the data available on this subject is limited, we projected through 2050 the effects of a continuation of trends observed with regard to the active agricultural population over the past twenty years. This projection leading to a pronounced increase in the number of agricultural workers, particularly in the Maghreb and the Middle East, the result is a relative stagnation of agricultural labour productivity in the "Trends scenario" and a reduction of agricultural labour productivity in the "Trends scenario with increased climate change impacts", the difference between the two being attributable to a lowering of domestic agricultural production while the number of agricultural workers remains unchanged.

Suggesting as it does a potential reduction in agricultural household income and thus a potential widening of the gap between agricultural and non-agricultural income, this result points to the possibility of the persistence or even the worsening (in both relative and absolute terms) of rural poverty in most areas of the MENA region. Once again the exception is Turkey, where high gains in agricultural labour productivity might be observed.

What strategies are available to reduce agricultural import dependence in the region?

Among the various hypotheses and alternative scenarios examined in this study, several, including more rapid population growth or a greater degree of Westernization in terms of dietary habits, would act to further aggravate the situation of agricultural import dependence in the region. Here we will focus on three scenarios that instead offer ways of reducing the burden of import dependence:

1. The "Technical progress" scenario. This scenario would affect certain aspects of agricultural output. Relative to the conditions of production as defined in the "Trends scenario with increased climate change impacts", this scenario supposes the adoption of technical innovations, improved agronomic and zootechnical practices, and climate change adaptation strategies so as to make possible a 20% improvement in crop yields in both rainfed and irrigated agriculture, as well as a 20% gain in livestock production efficiency. Needless to say, such improvements would require the implementation of agricultural policies and the development of agricultural research tailored to such an outcome, and would involve considerable levels of investment, particularly to increase efficiency in irrigation management and to promote changes in agricultural practices, etc.

2. The "Mediterranean diet" scenario. This scenario focuses more specifically on dietary habits, and proposes bringing caloric intake closer to nutritional recommendations (an average of 2,800 kcal/person/day for all inhabitants in the region – vs. 3,700 kcal/person/day in the two "Trends" scenarios everywhere except in the Middle East, at 3,000 kcal/person/day) while at the same time shifting dietary composition so as to eliminate the nutritional transition elements as observed in the region over the course of the past forty years – in other words, reducing the consumption of sugars, vegetable oils, and poultry meat to the levels observed in 1961-1963 while increasing consumption of cereals and the meat of small ruminants (Figure 3). Such a scenario would require vigorous implementation of nutritional policy measures with the joint aim of promoting broader public health objectives.

3. The "Reduced waste and loss" scenario. This scenario addresses the waste and loss of primary agricultural products. Based on an assessment made by the FAO, the proposed scenario hypothesizes cutting in half the waste and losses suffered at each stage of the food chain from harvest through distribution and consumption. The end result is equivalent to a gain in crop yields of 10% to 20% (depending on the crop) relative to the "Trends scenario with increased climate change impacts", combined with a drop in food consumption of approximately 5%. Here again, such a scenario implies the adoption of the necessary policies to reduce food waste at the distribution and consumption levels, as well as any necessary investments to reduce losses at the edges of the fields.

An integrated approach is essential to reducing agricultural import dependence in the Maghreb, the Near East, and the Middle East

None of these three options, taken individually, would make it possible to significantly counterbalance the worsening of agricultural import dependence in the areas most affected. The "Technical progress" option, by being the most ambitious, would be the most favourable, reducing dependence in the Maghreb from 68.5% to 62% and that of the Middle East from 64% to 57% (Figure 6). Second in terms of impact would be the "Reduced waste and loss" option, with the potential to reduce import dependence levels to 64% in the Maghreb and 59% in the Middle East. The "Mediterranean diet" option would have a relatively weak impact on import dependence levels, but could nevertheless be beneficial in terms of its effect on public health. For the three sub-regions of the Maghreb, the Middle East and the Near East, which stand to be the most negatively impacted by increased agricultural import dependence in the context of severe climate change, only an integrated policy approach seeking to combine these three strategies will be effective in averting a worsening of their situation.

A possible return to current levels of agricultural import dependence in Egypt

In Egypt, the effectiveness of each of the three scenarios outlined above would be considerably greater, with any one of them having the potential to return the country to import dependence levels similar to those observed presently (Figure 6). The underlying mechanisms are different in each case: in the "Technical progress" option, improved productivity levels in both animal and crop agriculture are responsible for the reduction in agricultural import dependence; in the case of the "Mediterranean diet" option, it is the reduction in animal production that makes possible a reduction in crop imports; the "Reduced waste and loss" option, finally, enables both an increase in domestic agricultural production, particularly crop production, and a reduction in overall consumption of agricultural products.

The Turkish exception

All three of these options would, moreover, further strengthen Turkey's position as a net exporter as observed in the "Trends" scenarios examined previously. Whereas the production increases resulting from land areas newly made available would already balance out volumes of imported agricultural products under the two "Trends" scenarios, the "Technical progress" option would enable Turkish crop production to exceed total domestic consumption by 50%. The "Mediterranean diet" would result in a surplus of 38%, while the "Reduced waste and loss" option would produce an agricultural surplus of 40%.

Conclusion

Existing trends in population growth, dietary habits, and agricultural production will lead to a continued rise in agricultural import dependence in the MENA region through the year 2050. Increases in agricultural import dependence will become more pronounced, moreover, as the impacts of climate change are felt in the region. The sub-regions of the Middle East, the Near East, and the Maghreb will be most strongly affected, with net imports reaching 70% of domestic requirements. In Egypt, the situation will be less extreme due to the country's lower current levels of agricultural import dependence. Only Turkey, thanks to its more favourable geography and more advanced level of development, has the potential to become a net agricultural exporter, with a considerable share of its domestic agricultural production potentially available to regional and international markets.

The economic and political risks of reaching such elevated levels of agricultural import dependence are well known: trade imbalances; increased national debt levels; strong exposure to global market fluctuations; recurrent food crises; etc. The large volume of agricultural products involved, moreover, weighs heavily on international markets and can have an impact on prices of critical agricultural commodities such as wheat. Risks of price escalation can in turn create tensions and difficulties for internal markets, national food policies, and the issue of food accessibility for poor populations.

Slowing this rise in agricultural import dependence thus becomes imperative. The measures envisaged here (stimulation of agricultural production, regulation of food demand, improved management of food waste), will require ambitious public policy interventions and significant levels of monetary investment, and will be of limited impact if they are not pursued as an integrated, multifaceted strategy. Nevertheless, given that regional agricultural import dependence will become more pronounced as the impacts of climate change become more severe, the most effective means of limiting import dependence is to take steps to mitigate climate change, which only international agreements and the adoption of vigorous global climate policies will make possible.

Further reading:

Marty P. (with Manceron S., Le Mouël C., Schmitt B.), 2015a. *Le système alimentaire de la région Afrique du Nord – Moyen-Orient: Une analyse rétrospective, 1961-2011*. Report for Pluriagri. Paris: INRA-DEPE, 213 pp.

Marty P., Manceron S., Le Mouël C., Schmitt B., 2015b. *Le système alimentaire de la région Afrique du Nord – Moyen-Orient: Une analyse rétrospective, 1961-2011*. Summary of the report for Pluriagri. Paris: INRA-DEPE, 30 pp.

Le Mouël C., Forslund A., Marty P., Manceron S., Marajo-Petitzon E., Caillaud M.-A., Schmitt B., 2015. *Le système agricole et alimentaire de la région Afrique du Nord – Moyen-Orient à l'horizon 2050: Projections de tendance et analyse de sensibilité.* Final study report for Pluriagri. Paris and Rennes: INRA-DEPE & INRA-SAE2, 134 pp.

Project organisation

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As with all foresight studies, a working group including both scientific experts (agronomists, economists, political scientists) and stakeholders (in this case, French) was given the task of constructing the scenarios and discussing the results. The working group for this study consisted of S. Abis (CIHEAM), C. Ansart (Unigrains), P. Blanc (Bordeaux Sciences-Agro and Sciences Po Bordeaux), X. Cassedanne (Crédit Agricole), R. Cuni (CGB), J.-C. Debar (Pluriagri), P. Dusser (Avril), H. Guyomard (INRA), F. Jacquet (INRA), Y. Le Bissonnais (INRA), M. Padilla (CIHEAM-IAMM), M. Petit (FARM), P. Raye (CGB France) and G. Regnard (Crédit Agricole). The steering committee were J.-C. Debar, H. Guyomard and M. Petit.

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