

ORGANIC POTATOES

BETWEEN GROWTH and technical obstacles

In organic farming, potato growers are facing significant challenges, particularly in relation to bioaggressor control (pests and diseases). Although copper is definitely proving effective against potato late blight, it is more crucial than ever to combine all available means.



In 2017, the European Union produced 460,000 tonnes of organic potatoes on 25,600 hectares. The leaders are Germany (142,000 T over 8,600 ha, i.e. 3.7% of its potato crop area) and Austria (60,500 T over 2,900 ha, i.e. 13.6% of its potato crop area).

France comes in third with 38,000 T⁽¹⁾ grown on over 2,400 hectares. However, in 2017, the organic potato area represented only 2.5% of French potato crops, whereas the overall utilised organic farming area exceeded 6.5% for all crops and 3.3% for arable crops. Those low figures can be explained in part by the specialist equipment and technical expertise that this crop requires.

A sector currently far from being saturated

The 1,400 farms growing open-field organic potatoes are not able to meet the demand from the domestic market. Volume of production can be heavily impacted by the season's weather conditions. The need for imports to meet demand varies but remains significant. For example, imports fell by 83% between the 2016-17 and 2017-18 seasons due to sufficient supply on the domestic market; however, they are expected to increase in 2018-19 due to a 14% drop in French production resulting from a lack of water in non-irrigated areas. While the fresh potato home market used to account for almost the entire French production a few years ago, the share of the processing sector has increased significantly over the past two years, reaching 21% in 2017-18⁽²⁾. Growth opportunities are also most likely to come from that sector.

However, production keeps increasing year on year as operators respond to the rising demand. The market predominantly involves long distribution channels (60%) through four main merchants. Sale

prices vary widely from one marketing channel to another as well as from year to year. For example, the ex-field sale price with long distribution channels is around 350-400 euros/T. Costs vary greatly. A 2010 study estimated them at 2,130 euros/ha, 1,700 euros/ha of which were for seed. With an average of 20-25 T/ha, the yield is half of that of conventional agriculture (45-50 T/ha) with, moreover, significant variations between years. Those are mainly due to potato late blight pressure during the season, which is the most problematic disease in potatoes.

So, in order for this crop to develop, technical obstacles along the cropping process must first be overcome. It requires deep soil with few stones, specialist equipment (planting, haulm destruction, harvesting) and a high level of agronomic expertise to be able to control a series of parasitic issues throughout the season.



Various cropping techniques provide potential solutions

The first step towards a successful organic crop is the rotation. It must be as long as possible (at least five to seven years) in order to “clean up” soil pathogens as much as possible, and to maintain a good level of organic matter.

The choice of rotation is influenced by many factors such as the economic characteristics of rotational crops, available land, weather conditions and climate, the farmer's skills and knowledge, and his or her objectives with regard to pest control and soil quality. Peas, beans and red clover should be avoided as they are host plants for some rhizoctonia

species and may promote potato scab. Conversely, after alfalfa or barley, potato yields may increase by up to 18%.

The main solution to reduce plant health issues remains the varietal choice. Varieties must be adapted to the existing parasitic pressure (potato late blight, cyst nematodes, common scab), as well as to soil and weather conditions (earliness, water stress, etc.) and, of course, to the market (culinary purpose). When choosing the variety, the planting date must be taken into account, as “avoidance” remains a good strategy. For instance, against potato late blight, varieties with a short growing cycle, planted early, are harvested at the beginning of the season, before the end of June/July when the pressure from this disease is higher.

Conventional advice still applies: the soil must be well prepared and warm, and the ridging properly carried out to limit greening and the risk of potato late blight on tubers.

To fertilise, manure and composts allowed in organic farming must be well prepared to avoid spreading weed seeds. The first application will take place before planting, in the autumn or spring depending on the soil and the type of fertilisers used. The second one will usually be carried out at the time of the last ridging process, depending on the amount of residual nitrogen. Beware, excess nitrogen produces abundant foliage that, as well as encouraging aphids and potato late blight, lengthens the tubers' growing phase.

To control weeds, the farmer has a whole range of mechanical techniques to choose from: false seedbed, shallow tillage, spiked chain harrow, hoeing and ridging, thermal weed control, etc. Generally, weeds are controlled with a spiked chain harrow and a hoe until foliage closes the drill. On average it requires two or three passes.

Capitalising more on varietal resistance against potato late blight

As far as diseases are concerned, potato late blight remains the main enemy. Given the lack of direct control solutions in organic farming against this tough pathogen, all available means should be used to protect production. *Phytophthora infestans* (late blight) can be detrimental both to yield (a virulent outbreak can go as far as destroying the whole plant above ground) and quality (mildewed tubers, small grades, increased sensitivity to bacterial and fungal rot).

Prophylaxis is crucial: waste management, destruction of remaining potatoes from a previous crop, use of properly dressed certified seed, precision manuring and irrigation.

Here again, varietal choice is the first action lever available. Before choosing a variety, it is essential to take into account its sensitivity to potato late blight (mainly foliage), which is rated from 1 (very sensitive) to 9 (not very sensitive at all). Scores of 6, 7 or 8 should be selected for foliar resistance.

The Mileos decision support tool helps to optimise the varietal action lever. It estimates the risk of potato late blight in real time, based on crop practices and weather data for the parcel. This helps to optimise the use of copper, which remains the only solution proven to control potato late blight. Preventative treatment should be applied before a prolonged wet spell and the rate and formulation (sulphate or hydroxide) should be adjusted according to the level of pressure from the disease. It is possible to supplement this with the use of plant defence stimulators, natural extracts, etc.



Controlling a range of bioaggressors effectively

In addition to potato late blight, potatoes are sensitive to a large number of bioaggressors, but there are solutions available to manage them (see table below).

Haulm destruction (see insert) a while before harvest is essential to produce the desired size of tuber, achieve a reasonable dry matter content, and help the skin to set properly, to reduce the risk of mechanical damage to the potato. It also destroys any weeds that may be present, which will make harvesting easier. In organic systems, it can be used to stop a potato late blight outbreak as it starts, or to limit the risk of the disease contaminating the tubers at the end of the plant's growing period, or if the pressure from the disease is very high.

For ware potatoes, good storage conditions are key, i.e. a temperature of 4 °C for long-term storage and 6-7 °C for a short period of time, and a relative humidity of 90-95%. Below 8 °C, some of the starch turns into reducing sugars. It is also essential to choose a variety with long dormancy. Two conservation solutions are approved for organic potatoes: mint oil and ethylene. Those products have proved to be effective and help to avoid having to set storage temperatures too low.

In both organic and conventional farming, all available means (agronomy, genetics, biological control agents, decision support tools based on a diagnosis, physical control, natural chemical control, biocontrol, trap plants...) should be used to manage various issues during the season. Only such a high level of commitment can ensure productivity and quality.

(1) According to Agence Bio (the French Agency on Organic Agriculture)

(2) According to figures from the National Interprofessional Potato Committee (CNIPT)

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There are two main haulm destruction techniques in organic farming

Arvalis tested various solutions*. Mechanical and thermal haulm destruction are available to organic producers. Haulm chopping is the most commonly used technique. It has seen useful technical improvements such as front-end chopping, that releases residue between ridges and achieves a much greater throughput (around 2 ha/h).

Thermal destruction involves burning the haulm with various fuels (natural gas, vegetable oil or fuel oil). Less commonly used but very effective, a haulm puller can come into play after chopping. This technique, which greatly reduces the risk of regrowth, helps to prevent tuber contamination with rhizoctonia. This solution is particularly useful for organic seed producers.

(*) For more information, see the article "Potato: Alternatives to Chemical Haulm Destruction" from Perspectives Agricoles n° 460, November 2018

	Bioaggressors	Action levers
Pests	Colorado beetles	<ul style="list-style-type: none"> • <i>Bacillus thuringiensis tenebrionis</i> strain on larvae <5 mm (treatments 4-5 days apart) • Blower • Destruction of primary infestation sources by lifting or burning
	Cyst nematodes (<i>Globodera rostochiensis</i> and <i>G. pallida</i>)	<ul style="list-style-type: none"> • Varietal choice • Previous crop: mustard (glucosinolates)
	Aphids	<ul style="list-style-type: none"> • Encourage the presence of natural biological control agents (hedges, flower strips)
	Wireworms	<ul style="list-style-type: none"> • Summer cultivation • Do not grow potatoes in contaminated fields (place traps in the field) • Spray Spinosad in the row
	Slugs	<ul style="list-style-type: none"> • Ploughing • Ferric phosphate
Soil diseases	Black scurf (<i>Rhizoctonia solani</i>)	<ul style="list-style-type: none"> • Long rotation with cereals, avoid preceding crops that encourage it (sugar beet, buckwheat) • Certified seed • Planting in warm soil (> 10 °C) • Harvest within appropriate interval after haulm destruction (less than 3 weeks) • Antagonistic fungi (<i>Trichoderma viride</i> and <i>T. virens</i>) • Avoid high humidity during the tuber growing period • Avoid fresh organic matter residue
	Tuber mildew	<ul style="list-style-type: none"> • Varietal tolerance
	Common scab (<i>Streptomyces sp.</i>)	<ul style="list-style-type: none"> • Avoid root crops as preceding crops (beetroot, carrot, etc.) • Varietal choice • Avoid fresh organic matter residue
	Silver scurf (<i>Helminthosporium solani</i>)	<ul style="list-style-type: none"> • Varietal choice • Cleaning and disinfecting the storage premises • Storage at a temperature below 5 °C • Do not harvest more than 3 to 4 weeks after haulm destruction