

# Potato resistance to water and nitrogen stress: beneficial effects of rye and soybean pre-crops

## Problem

Both water and nitrogen stress in crops is a problem for agriculture across Europe and beyond. If irrigation cannot be scheduled, dry seasons lead to water stress in potato crops, resulting in yield losses and lower tuber quality. Furthermore, nitrogen stress can also cause similar problems on yields and lower tuber quality for potato crops. Nitrogen stress and deficiency in crops can be caused by excessive irrigation and heavy rains, because of nutrient leaching. The latter can also potentially contaminate local and ground water.

## Solution

Pre-crops are used to improve soil structure and fertilization for the subsequent crops planted in the same field area. Using adequate pre-crops require less water and nitrogen fertilizer input. In west Switzerland, rye and soybean pre-crops for following potato crops have been tested, in very sandy, well-draining soils, where water use efficiency can be low. It was observed that yield losses were minimized with the pre-crops planted before. With rye as a pre-crop, water stress lessened the yield loss from 25% in comparison with 36% after soybean. However, yield loss after nitrogen stress amounted to 4.8% after soybean and 12% after rye. These results, together with weather and soil conditions, guide the choice of a suitable pre-crop for enhanced yield performance of potato.

## Benefits

Choosing to use pre-crops can bring multiple benefits to farmer. Soil cover and organic matter can be thereby increased, while roots provide adequate structure and porosity. Additionally, water is a limited resource. With pre-crops, less water needs to be applied. In some circumstances, pre-crops, such as soybean, can provide some livestock grazing.

With improved nitrogen and water availability in soils due to pre-crops, financial costs of nitrogen fertilizer and tillage can be reduced. This, in conjunction with minimized yield losses, increases gross margins for farmers.

## Applicability

### Theme

reduced water and nutrient use - potato

### Agronomic conditions

Average temperature 17.2°C (min., cumulated precipitation between planting and harvest 213.2mm, soil type loam (clay 13.1%, loam 38.8%, sand 48.8%)

### Application time

previous year

### Required time

One year before potato

### Period of impact

succeeding crop

### Equipment

sowing machine, harvester

### Best in

Before potato, on soil that drains water quickly (sandy, rocky).



Figure 1. Top: dual irrigation system to generate water stress, 22.05.19 (Geoffrey Darbon, AGROSCOPE). Bottom: 2020 potato field in Conthey, CH (Gaétan Riot, AGROSCOPE)

## Practical recommendation

In case of frequent water stress:

We recommend planting winter rye (*Secale cereale*) as a rotation crop to lower following potato yield losses caused by dry periods. We used the variety Matador© which usually performs well in Switzerland. We recommend using any variety that does well under your climate. Generating a dense root system is a key feature to create an enhanced water retention capacity of the soil, which potato will benefit from during drought periods. The rye was sown mid-October at the recommended density of 1.2kg/ha with 0.25m line spacing.

In order to lower nitrogen input:

We recommend using soybean (*Glycine max*) to lower nitrogen inputs during potato growth without suffering from yield losses. We used the variety Galec©, but believe that any variety with good nitrogen-fixing capacity will produce the same effect. Soybean was sown mid-May at the recommended density of 121kg/ha with 0.5m line spacing.



Figure 2: rye and soybean precrops, 30.07.20 (Gaétan Riot, AGROSCOPE)

## Further information

### Weblinks

[soybean variety](#)

[rye variety](#)

## About this practice abstract and SolACE

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Domaine de compétences plantes et produits d'origine végétale

Route de Duillier 50, CP 1012, 1260 Nyon 1 /Suisse

**Authors:** Geoffrey Darbon, Gaétan Riot

**Contact:** geoffrey.darbon@agroscope.admin.ch

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**Project website:** [www.solace-eu.net](http://www.solace-eu.net)

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