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Taifun Soy Info

Taifun Zentrum für Sojaanbau

Specialist information for soy producers and processors

Cold germination test for soybean seeds

Introduction

In years with a cold or wet-cold spring after sowing it is of paramount importance that the soybean seeds have a high germination power. Otherwise, a low field emergence will inevitably be the result. When calculating the seed rate, usually only the germination capacity (as indicated on the label) is used and the germination power is disregarded. As standard (ISTA method), the germination capacity of a seed lot is tested in sand at 25 °C for 8 days under optimum and standardized conditions.

These temperatures are far away from the 8 - 10°C soil temperature as they can occur in practice. In order to adapt the test to reality, the so-called cold germination test (test of germination power) was developed. Previously the test has been used mainly for cold-sensitive maize. This test under difficult conditions does not only measure the germination capacity under optimal conditions, but also tests the germination behavior at low temperatures. However, this test is not legally required for seed multipliers. The legally required minimum germination capacity is determined by the germination test under optimum conditions. In comparison to the germination capacity values obtained by the standard method, the cold test values are usually lower and more comparable to the observed field emergence (Voit et al. 2012). According to this study, however, the yield at the end of the season is more dependent on the entire vegetation process than only on the germination power of the seeds. In organic farming, on the other hand, uniform emergence and rapid youth development are essential to prevent weed growth later on!

Performance in the laboratory

Following the ISTA handbook for maize (ISTA 1995), the cold germination test was developed at the Freising Seed Laboratory. In the test 4 x 100 seeds are brought to germination in soil at 10 °C for 7 days. This is followed by a "warm phase" with light and 25 °C for a further 7 days. The soil used should be from an extensively cultivated field with medium-heavy soil. After the warm phase the test is evaluated like a standard germination test. Usually the results, expressed by the number of germinated seeds, are mostly below those of the standard test for germination capacity. Additionally, the results can vary from laboratory to laboratory due to the type of soil, pH value, humus content and pathogen infestation.

Laboratories and costs

ISTA accredited laboratories in Germany, which also perform the cold germination test for soy, are the LTZ Augustenberg (Baden-Wuerttemberg) and the LfL Freising (Bavaria). The LTZ charges 27.50 EUR plus VAT for a cold germination test, the LfL charges 26.00 EUR. As the cold test is not a standard test for soy and both laboratories are state-run, the tests can only be carried out by arrangement and prior notification.

Cold germination test in practice

Field tests by the Taifun-Tofu GmbH have confirmed the results of the study by Voit et al (2012). The cold germination tests always showed lower results than the standard tests for germination capacity. Seed lots that already had a very poor germination capacity also performed poorly in the germination power test - on average the germination rate was about 50% lower (see Table 1).

Table 1: Comparison of results of germination and motive force test of the same sample

Sample	Germination capacity (standard test)	Germination capacity (cold test)
Sample 1	66 %	28 %
Sample 2	58 %	33 %
Sample 3	70 %	36 %
Sample 4	49 %	16 %

Figure 1: Cold test of soybean seeds with high germination power (LfL Bayern, 2015).

Figure 2: Cold test of soybean seeds with low germination power (LfL Bayern, 2015).

Background knowledge: Germination of soybeans

Germination of soybeans occurs in two phases - the swelling phase, during which water is absorbed very quickly, and the osmotic phase, in which water absorption is slower (Leopold, 1980).

Cold temperatures impair germination, especially in the first of these two phases, as the absorbed water is needed to remoisten the cotyledons and the embryo and to bring the cell membranes back into a functional state. Cold temperatures prevent the membranes from being humidified and thus disturb their functionality.

If the soil temperature at sowing is already below 10 °C, damage is more likely to occur than if the soil cools down 24 hours or more after sowing. At soil temperatures below 5 °C the germination process does not start at all or leads to the die off of the seedlings. The longer the seed remains in the soil at warm soil temperatures before a cold phase occurs, the better the chances that no damage occurs. This is why it is that important to observe the weather forecast during sowing to be able to exclude a cold spell at least for the next days.

In the second phase of germination, the fully functional cell membranes create an osmotic situation in which water penetrates the living cells. At cooler temperatures, the osmotic water uptake slows down and there is very little direct damage to the seedling - but the rate of growth is generally slowed down (University of Nebraska-Lincoln, 2014).

Sources

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Author: Kristina Bachteler

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Bebelstraße 8 | 79108 Freiburg | Tel. 0761 152 10 13

soja@taifun-tofu.de

Taifun Zentrum für Sojaanbau

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