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Plant biostimulants - Claims - Part 3: Tolerance to abiotic stress resulting from the use of a plant biostimulant

Biostimulanzien für die pflanzliche Anwendung - Angaben - Toleranz gegenüber abiotischem Stress infolge der Verwendung eines Biostimulans für die pflanzliche Anwendung

Biostimulants des végétaux - Allégations - Partie 3 : Tolérance au stress abiotique résultant de l’utilisation d’un biostimulant des végétaux

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English Version

Plant biostimulants - Claims - Part 3: Tolerance to abiotic stress resulting from the use of a plant biostimulant

Biostimulants des végétaux - Allégations - Partie 3 : Tolérance au stress abiotique résultant de l'utilisation d'un biostimulant des végétaux

Biostimulanzien für die pflanzliche Anwendung - Angaben - Toleranz gegenüber abiotischem Stress infolge der Verwendung eines Biostimulans für die pflanzliche Anwendung

This draft Technical Specification is submitted to CEN members for Vote. It has been drawn up by the Technical Committee CEN/TC 455.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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European foreword

This document (FprCEN/TS 17700-3:2021) has been prepared by Technical Committee CEN/TC 455 “Plant biostimulants”, the secretariat of which is held by AFNOR.

This document is currently submitted to the Vote on TS.

The CEN/TS 17700 series, *Plant biostimulants - Claims*, consists of the following parts:

— *Part 1: General Principles*;

— *Part 2: Nutrient use efficiency resulting from the use of a plant biostimulant*;

— *Part 3: Tolerance to abiotic stress resulting from the use of a plant biostimulant*;

— *Part 4: Determination of quality traits resulting from the use of a plant biostimulant*;

— *Part 5: Determination of availability of confined nutrient in the soil or rhizosphere*.

Introduction

This document has been developed to provide guidance for a consistent approach to justify the claims associated with the use of plant biostimulants in agriculture.

The definition of plant biostimulants to be used in the regulation on fertilizing materials is claims-based. For this reason, demonstrating that a product is indeed a *bona fide* plant biostimulant depends on a demonstration of its effect.

The placing of a plant biostimulant on the market is not to be considered to guarantee effectiveness under all conditions, as many factors may influence the performance of a plant biostimulant in the field.

Plant Biostimulants used in agriculture are applied in multiple ways: on soil, on plant, as seed treatment, etc. This document is applicable to all application types of plant biostimulants in agriculture.

1 Scope

This document provides guidance for justifying abiotic stress tolerance claim of plant biostimulants used in agriculture.

This document is aimed primarily at manufacturers, laboratories, companies which will put the products on market, notifying authorities, notified bodies, and market surveillance authorities).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CEN/TS 17700-1:—[1], *Plant biostimulants - Claims Part 1: General Principles*

CEN/TS 17724:—[2], *Plant biostimulants - Terminology*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in CEN/TS 17700-1:—, CEN/TS 17724:— and the following apply.

3.1
tolerance to abiotic stress
ability to endure abiotic stress

3.2
abiotic stress
negative impacts of non-living factors on the plant in a specific crop environment

Note 1 to entry: Crop tolerance to abiotic stress is addressed to one or more (multiple or combined) of the following stress categories:

1) thermal stress,

2) light stress,

3) mechanical stress,

4) water stress,

5) chemical stress.

3.3
thermal stress
negative impact of temperature (supra-optimal and sub-optimal temperature) on the plant in a specific crop environment

EXAMPLE heat stress or cold stress such as chilling and freezing stress

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1 Under preparation. Current stage is: FprCEN/TS 17700-1:2021.

2 Under preparation. Current stage is: FprCEN/TS 17724:2021.

3.4
light stress
negative impact of light intensity and/or spectrum on the plant in a specific crop environment

EXAMPLE high irradiance or low irradiance, UV radiation

3.5
mechanical stress
negative impact of a mechanical force on the plant or the root zone in a specific crop environment

EXAMPLE wind, hail, agricultural operations

3.6
water stress
negative impact of water or high solutes concentrations (supra-optimal and sub-optimal water level) or excessive transpiration on the plant in a specific crop environment

EXAMPLE drought, high air vapour pressure deficit, flooding

3.7
chemical stress
negative impact of chemicals (supra-optimal or sub-optimal chemical compounds or presence) on the plant in a specific crop environment

EXAMPLE salt stress, mineral toxicity induced by heavy metals or excessive application of mineral nutrients, adverse pH conditions, ozone stress, phytotoxic effects of xenobiotics

3.8
xenobiotic
chemical substance found within an organism that is not naturally produced or expected to be present within the organism

EXAMPLE heavy metals, pesticides, ozone

4 Terminology of the claim

The type of claim(s) included in the Technical Specification can be addressed to one or more of the above defined abiotic stress(es) – see 3.3 to 3.7.

For instance, a plant biostimulant can improve plant tolerance to a single abiotic stress factor such as heat stress or to multiple abiotic stress factors such as heat stress and salt stress in one or more target crop(s).

Label shall clearly indicate that the plant biostimulant is addressed to improve tolerance to abiotic stress with a clear indication of the type of abiotic stress(es) and the crop(s) on which the effect is demonstrated according to CEN/TS 17700-1:—.

EXAMPLE “improve tolerance to drought stress on woody perennials”, “improve tolerance to cold stress on tomato”

5 Justification of plant biostimulant claims regarding abiotic tolerance

5.1 Introduction

In open field conditions it can be difficult to fully control specific abiotic stress factors due to their inherent variability and due to the fact, that, often several abiotic stresses may be present at the same time (combinational stresses). Therefore, to fully validate an abiotic stress tolerance claim with both a negative (untreated and unstressed) control and a positive (untreated and stressed) control it should take place under controlled conditions (e.g. growth chamber, growth room, greenhouse).

In controlled conditions or where a negative and positive control can be easily implemented, contrasting, and comparing both these groups, allows a researcher to assess the impact and validity of the stress model. Or in other words, how much damage/growth depression was caused by the stress prior to any intervention (biostimulant application).

Depending on how tangible (easy to control or easy to isolate) the abiotic stress being examined is, sometimes a negative control and a positive control may be implemented in open field conditions. However, as stated previously, in some situations a negative control might not be easily implemented. In this case, the emphasis is placed more on detecting the specific stress by assessing stress specific markers within the plant response to both the environment (growing conditions) and the plant biostimulant application.

In order to justify the claim, these stress markers shall be of agronomic significance (specific to the stress being examined e.g. heat shock proteins created by heat stress). Their relevance may be proved through referencing previous peer reviewed literature that correlated these markers to the stress being examined. Often this stress marker (be it physiological, biochemical or genetic) will cause a plant response (change in phenotype) which will either be promoted or reduced through the use of biostimulants.

Therefore, assessing the stress marker in both the positive control (untreated and stressed) versus the treated (product to be tested) group, will allow a researcher to assess the presence of the stress and how much of a change was caused in the plant response by applying the product, allowing trials without a negative control to validate abiotic stress tolerance.

5.2 Trial design with negative control

For the above reasons, the trial should include at a minimum the following three treatments:

Treatment	Stress conditions	Non-stress conditions
Positive Control, untreated plant (X)	●	
Tested Product, treated plant (Y)	●	
Negative Control, untreated plant (Z)		●

In context with the above table, comparing the positive and negative controls (X vs Z) provided all other variables are held equal will demonstrate that the “abiotic stress” in question is real.

Positive Control (X) and Tested Product (Y) treatments can be compared only if the duration and intensity of abiotic stress is the same. All other factors such as genotype, cultural practices and environmental conditions beyond the selected stress factor shall be the same for all treatments.

In the case of a plant trait (i.e. plant biomass - A) that is reduced with the increase of abiotic stress level, the claim is validated for the tested product when Y_A and Z_A are significantly higher (refer to CEN/TS 17700-1:—, Clause 5) than X_A.

For a plant trait (i.e. leaf damage - B) that is increased with the increase of abiotic stress level, the claim is validated for the tested product when Y_B and Z_B are significantly lower (refer to CEN/TS 17700-1:—, Clause 5) than X_B.

5.3 Trial design without negative control

In the cases listed below where the implementation of a negative control (Z) is not possible in the same growing environment, the trial can be performed using only two treatments (modified design): an untreated stressed positive control (X) and a stressed treatment with application of tested product (Y). In these cases, the emphasis is placed more on detecting the stress in question by assessing a stress marker within the plant response to both the environment (growing conditions) and the plant biostimulant application. Often this stress marker (be it physiological, biochemical or genetic) will cause a plant response (change in phenotype) which will be promoted or reduced through the use of a plant biostimulant.

The cases where the modified design can be used are:

a) thermal stress caused by cold or heat,

b) light stress caused by high/low irradiance, or UV radiation,

c) water stress caused by high air vapour pressure deficit,

d) mechanical stress caused by wind, or hail,

e) salt stress caused by the negative impact of the increase of salt level into the soil and/or irrigation waters.

In these cases, it is mandatory to monitor a stress marker at least in untreated plants (X) before (t_1) and after (t_2) the stress event to demonstrate that the stress event was sufficient to exert a negative effect on crop. It is also highly recommendable to monitor the stress marker even in treated plants (Y) before (t_1) and after (t_2) the stress event to demonstrate that tested product was able to mitigate the stress on plant in comparison with untreated plants (X).

For a stress marker (i.e. relative water content) that is reduced with the increase of abiotic stress level (i.e. air vapour pressure deficit), the stress is considered sufficient when the stress marker measured at t_2 is significantly lower (refer to CEN/TS 17700-1:—, Clause 5) to the value measured at t_1.

For a stress marker (i.e. heat shock protein) that is increased with the increase of abiotic stress level (i.e. heat), the stress is considered sufficient when the stress marker measured at t_2 is significantly higher (refer to CEN/TS 17700-1:—, Clause 5) to the value measured at t_1.

Besides the stress marker, an agronomic marker needs also to be assessed after the stress event (t_2) in both treatments (X, Y).

In the case of an agronomic marker (i.e. plant biomass - A) that is reduced with the increase of abiotic stress level, the claim is validated for the tested product when Y_A is significantly higher (refer to CEN/TS 17700-1:—, Clause 5) than X_A.

For a plant trait (i.e. leaf damage - B) that is increased with the increase of abiotic stress level, the claim is validated for the tested product when Y_B is significantly lower (refer to CEN/TS 17700-1:—, Clause 5) than X_B.