

## 2025 AOSA Rule Proposal #6

### Evaluating Geotropic Responses Rule Proposal

**PURPOSE OF RULE PROPOSAL:** The purpose of this proposal is to revise section **3.5.6 Negative Geotropism** of Volume 4, to clarify the differences in geotropic responses between seedling shoots and roots, and the correct evaluation of each.

#### **PRESENT RULE:**

**3.5.6 Negative geotropism.** Negative geotropism is caused by a physiological disorder usually characterized by root structures that grow upward. Seedlings with negative geotropism must be classified as abnormal. However, the germination analyst must make certain that the condition is not caused by poor laboratory conditions. "Apparent" negative geotropism may occur with artificial substrata if adverse moisture conditions are present or if the substrata contain phytotoxic substances. Also, if seeds are planted in tightly packed soil or if the soil surface becomes dry, seedlings may appear to have negative geotropism. If test conditions are suspected to be the cause of negative geotropism, the sample should be retested under favorable conditions, including retests made in sand, or soil, or organic growing media.

#### **PROPOSED RULE:**

**3.5.6 Geotropism.** Geotropism (more commonly referred to as gravitropism) is the directional growth of plant structures, including those of seedlings, to gravity. Positive geotropism is growth towards the gravitational field, while negative geotropism is growth away from the gravitational field. For seedling roots, positive geotropism (growth downwards towards gravity) is normal, while negative geotropism is to be evaluated as abnormal. In contrast, negative geotropism of seedling shoots (growth upwards away from the gravitational field) is normal, while positive geotropism is abnormal. For a seedling to be evaluated as normal, the root should have a positive geotropic response, and the shoot should have a negative geotropic response. In most abnormal cases, either a seedling's shoot or root will exhibit an abnormal geotropic response, but rarely both. Therefore, in describing abnormal responses, it is recommended to note whether the geotropic abnormality is that of roots or shoots (or specific shoot structures).

However, the germination analyst must make certain that the condition is not caused by **test conditions**. "Apparent" negative geotropism **of the roots** may occur with artificial substrata if adverse moisture conditions are present or if the substrata contain phytotoxic substances. Also, if seeds are planted in tightly packed soil or if the soil surface becomes dry, seedling **roots** may appear to have negative geotropism. "**Apparent**" positive geotropism of the shoots is commonly the result of overcrowding, light availability, or tightly rolled towels. "Correction" of growth orientation is usually a good indicator of absence of a truly abnormal geotropic response. If test conditions are suspected to be the cause of **abnormal geotropism of many seedlings within single replicates**, the sample should be retested under favorable conditions, including retests made in sand, or soil, or organic growing media.



## **HARMONIZATION AND IMPACT STATEMENT:**

The Federal Seed Act, Canada M&P, and ISTA Rules do not have a detailed explanation contrasting positive and negative geotropism.

## **SUPPORTING EVIDENCE:**

While reviewing the Seedling Evaluation Surveys results, many seedlings were incorrectly evaluated as abnormal due to geotropic response. Results indicated that negative geotropism is understood to mean an incorrect direction of growth (downwards for shoots and upwards for roots), rather than a description of growth away from gravity. Consequently, some analysts would label positively geotropic root responses and negatively geotropic shoot responses as abnormal due to “negative geotropism.” Section 3.5.6 of Vol. 4 of AOSA rules (Negative Geotropism) is probably the source of this confusion, as only negative geotropism is described and evaluated as an abnormality. Current ISTA rules and Canadian M&P, like the AOSA rules, only address negative geotropism of the roots as an abnormality. In practice, most apparent and real geotropic responses are those of the shoot. The revised text of section 3.5.6 emphasizes that both negative and positive geotropism can be normal or abnormal, depending on the seedling structure being evaluated and the possible effect of test conditions.

## **REFERENCES:**

- Molas, M.L., and J.Z. Kiss. 2009. Phototropism and gravitropism in plants. *Adv. Bot. Res.* 49: 1-34. [https://doi.org/10.1016/S0065-2296\(08\)00601-0](https://doi.org/10.1016/S0065-2296(08)00601-0).
- Morita, M.T. 2010. Directional gravity sensing in gravitropism. *Ann. Rev. Plant Biol.* 61: 705-720. <https://doi.org/10.1146/annurev.arplant.043008.092042>

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