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TEMBOTRIONE: A NEW POST- EMERGENCE HERBICIDE FOR CONTROLLING WEEDS IN MAIZE

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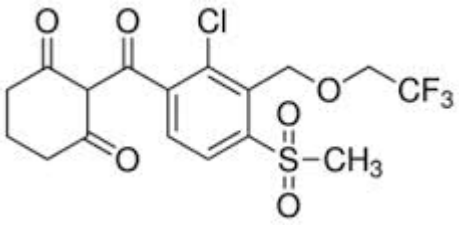
Tembotrione was discovered in 1997 and launched as a commercial herbicide in 2007/2008 in Austria, Hungary, USA and Brazil. When tembotrione is applied to the foliage, a very high percentage of the applied compound is rapidly absorbed. In cases where the herbicide comes in contact with the soil, only small amounts enter the plants via the roots. Accordingly, this herbicide acts after post-emergence application predominantly via the foliage. Tembotrione is mobile both in the plant symplast (phloem) and in the apoplast (xylem). Its **chemical name is** 2- [2-chloro-4- (methylsulfonyl) -3- [(2,2,2- (trifluoroethoxy) methyl] benzoyl]-1,3 cyclohexanedione and belongs to chemical class Triketone. In the market it is sold under the trade name of Laudis.

Chemical formula:



Application Sites: Tembotrione is registered as a selective, post-emergence herbicide developed for the control of a broad spectrum of broadleaf and grassy weeds in corn

.**Type of Formulations:** Technical grade manufacturing use product (96.2% tembotrione) and liquid end use product (34.5% tembotrione).

Application Methods and Rates: The application rate is 0.082 lbs a.i./acre (0.092 kg a.i./ha) followed 14 days later by a second treatment at the same application rate, if needed. Applications take place between crop emergence to the V8 (more than 8 visible leaves) developmental stage of corn. Tembotrione is broadcast applied using flat-fan nozzles that provide medium to coarse spray droplets.

Laudis® OD is a new herbicide for the selective control of broadleaved weeds and annual grasses in corn (maize). The active ingredient of Laudis OD is tembotrione, a member of the triketone class of herbicides. The toolbox for weed control in corn contains an impressive variety of herbicides acting by different molecular modes of action. Long time proven molecules such as atrazine, dicamba, or metolachlor have been more recently supplemented with products such as nicosulfuron, rimsulfuron and foramsulfuron. Most recently triketone herbicides isoxaflutole, mesotrione, sulcotrione and topramezone were added. The application of a triketone herbicide results in rapid bleaching and quick elimination of susceptible weeds. The outstanding weed control offered by bleachers

resulted in a rapid adoption of this technology by corn growers. Laudis OD is a "ready-for-use-product"which contains 44 g/L tembotrione and 22 g/L isoxadifen-ethyl. Both components are formulated as oil dispersion (OD) together with the entire adjuvant system, which ensures best performance.

Active ingredient

Tembotrione, the active ingredient of Laudis OD, marks the latest state of the art in the well proven bleacher technology. The compound is the youngest member of the triketone herbicide family. The introduction of the innovative $O\text{-}CH_2\text{-}CF_3$ substituent into the triketone ring system results in a herbicide with solubility properties that permit easy passage of hydrophilic (aqueous) and lipophilic (waxy, fatty) barriers on the way from the spray deposit on the weed surface to the sites of molecular action inside the plant cells. The addition of isoxadifen-ethyl, a pro-prietary safener of Bayer Crop Science, protects corn from herbicide stress and ensures crop tolerance even under very challenging growing conditions.

Mode of action

Tembotrione, like all other triketone herbicides, inhibits the enzyme 4-hydroxy phenylpyruvate dioxygenase (HPPD). As a result the formation of carotenoids is disrupted. Depletion of carotenoids deprives chlorophyll, the sites of photo- synthesis, of its protection against an overdose of light resulting in chlorophyll oxidation. The molecular chain of events manifests itself in visible bleaching of sensitive weeds and plants turn progressively white. The development of bleaching starts at the youngest tissues of the aerial plants parts. Bleached plants then wilt and develop extensive necroses before they finally die. This process is rapid, as the herbicide exerts its full effect within a few days.

Mechanism of Action

Tembotrione is a broad-spectrum early and mid-postemergence herbicide that belongs to the triketone class of herbicides. It acts by inhibiting 4-hydroxyphenylpyruvate dioxygenase (HPPD), which leads to chlorophyll destruction by photooxidation and causes bleaching of emerging foliar tissue. In mammals, HPPD is a key enzyme in the catabolism of tyrosine. It catalyzes the conversion of 4-hydroxyphenylpyruvate (HPP) to homogentisate. Inhibition of HPPD leads to a reconversion of HPP to tyrosine and a consequent increase in blood tyrosine concentrations (tyrosinemia).

Environmental Fate Characterization

Tembotrione is not persistent in the environment except when present in loamy sands, degrading primarily through biodegradation in soil and water. Tembotrione appears to be stable to hydrolysis at environmental pH (pH range 5–9) but may be susceptible to photolysis in soil and water. Due to its vapor pressure and Henry's Law constant, volatilization from water and soil is not expected to be an important environmental fate process. Tembotrione has a high mobility in soil and the potential to leach into ground water. However, its relatively rapid rate of biodegradation may attenuate this process. The primary step in the metabolism of tembotrione is the hydroxylation (oxidative pathway) of the cyclohexyl ring of the molecule. It appeared that degradation was dependent on pH and occurred more rapidly under acidic and neutral conditions, leading predominantly to the

formation of a xanthenedione type compound by intramolecular cyclisation with loss of HCl.

References:

Santel H.J. 2009. Laudis® OD – a new herbicide for selective post-emergence weed control in corn (*Zea mays* L.). *Bayer Crop Science Journal* **62**: 95-108.

https://en.wikipedia.org/wiki/4-hydroxyphenylpyruvate_dioxygenase_inhibitor