

Cinmethylin – a new herbicide for cereals: Mode of action and biokinetic properties

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Summary The necessity of a new mode of action to combat herbicide resistant weeds raised the interest in the dormant molecule cinmethylin as a new solution for the control of weedy grasses in cereals. To elucidate its mode of action we applied a novel chemoproteomic pull-down approach. Three potential target proteins belonging to the same family of fatty acid thioesterases (FAT) bound to cinmethylin with high affinity. FAT enzymes play a crucial role in plant lipid biosynthesis by mediating the release of fatty acids (FA) from their site of synthesis in the plastids for subsequent formation of glycerolipids and very long chain fatty acids at the endoplasmic reticulum. By GC/MS analysis we could show that cinmethylin treatment leads to depletion of both saturated and unsaturated free FAs in the plant, emphasising that FA release for subsequent lipid biosynthesis is the primary

target of cinmethylin. Furthermore, we demonstrated that physiological effects and downstream metabolic changes induced by cinmethylin differ substantially from other lipid biosynthesis inhibitor herbicides. Our results therefore suggest FAT inhibition by cinmethylin as a new mode of action and powerful tool for weed resistance management. The biokinetic properties of cinmethylin i.e., uptake, distribution, and degradation, were investigated in crops and monocotyledon weeds when applied at both pre-emergence and early post-emergence timings. The relationship of the biokinetic properties of cinmethylin and its efficacy and crop safety will be discussed.

Keywords Cinmethylin, mode of action, fatty acid thioesterases, lipid biosynthesis, uptake, distribution.