

Effects of IMI Herbicides in Controlling *Orobanche* In Sunflower fields

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Abstract

IMI herbicides are widely utilized in controlling *Orobanche* in sunflower fields, especially in Mediterranean countries. They are marketed by the German Company BASF as “Clearfield Technology”. They have a broad spectrum control of broad-leaf weeds. They are widely utilized in controlling weeds in soybean fields in China. They inhibit acetolactate synthase inhibiting plant growth. IMI resistant sunflower is non-GMO, developed by traditional hybrid breeding methods, like endogenous gene mutation/crossing/field selection technologies. IMI herbicides can kill *Orobanche*, but not IMI resistant sunflower. First of all, sunflower absorbs the sprayed IMI herbicides. After imbibing the IMI herbicides from the roots of the sunflower, *Orobanche* will die. IMI herbicides have relatively short residual effect in the soil, especially Imazamox; it has a residual effect of less than 12 months. IMI herbicides have passed patent protection time; they are generic now. Application methods of IMI herbicides are: IMI herbicides are sprayed on sunflower at 4-8 leaf stage. Using Imazamox as an example, it is a 4% concentration, used at 1.5 liter/ha, active ingredient of 60 g/ha. BASF’s recommendation is 50 g/ha. IMI herbicides need to be uniformly sprayed on sunflower. There are two ways to controlling sunflower *Orobanche*. One way is by utilizing IMI herbicides, for example, NC#1 hybrid. Another way is by introducing *Orobanche* resistant genes in sunflower, for example, NC#2 hybrid. NC#1 hybrid was developed by Wulaateqianqi New Century Seeds LLC. The breeding started in 2014 by a cross between USDA sunflower germplasm “IMISUN” with domestic parental lines. It is currently commercially available. The NC#1 hybrid was experimentally tested at two regions of Inner Mongolia, Wulaateqianqi and Siziwangqi. At Wulaateqianqi, the maturity was 93 days, the yield was 3,795 kg/ha, 292

seeds/50g, and the *Orobanche* infected rate was 5%, while at Siziwangqi, the maturity was 97 days, the yield was 3,660 kg/ha, 285 seeds/50g, and the *Orobanche* infected rate was 7%. In conclusions, IMI herbicides are very effective in controlling *Orobanche* in sunflower fields. The NC#1 sunflower hybrid is an IMI resistant and *Orobanche* resistant satisfactory confection sunflower hybrid commercially available for sale in the Chinese market.

Key words: IMI herbicides, Clearfield technology, *Orobanche* resistance

咪唑啉酮类除草剂在防治向日葵列当中的应用

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摘要

咪唑啉酮类除草剂已广泛被应用于向日葵列当防治，特别是在地中海国家。咪唑啉酮类除草剂最早由德国巴斯夫公司研发并被命名为“净田技术”，属广谱性除草剂，能够杀死阔叶草。在中国已广泛被应用于控制大豆田杂草。此除草剂是通过抑制植物的乙酰乳酸合成酶来抑制植物的生长。

耐咪唑啉酮类除草剂的向日葵不是靠转基因技术，而是通过传统杂交育种比如内源基因诱变，杂交，田间筛选等培育成功的。咪唑啉酮类除草剂可以杀死列当，但杀不死特定选育出来的耐咪唑啉酮类除草剂向日葵。首先，向日葵吸收被喷洒的咪唑啉酮类除草剂，当列当从根部吸收向日葵营养时也因吸收咪唑啉酮类除草剂而死亡。咪唑啉酮类除草剂在土壤中的残留时间相对较短，特别是甲氧咪草烟，在土壤里的残留时间低于 12 个月。咪唑啉酮类除草剂已过专利保护期，可以通用。

咪唑啉酮类除草剂的使用方法为，首先，要在向日葵 4-8 叶子时喷洒咪唑啉酮类除草剂。以甲氧咪草烟为例，4%的浓度，1.5 升/公顷，有效成分为 60 克/公顷。巴斯夫推荐量为 50 克/公顷。咪唑啉酮类除草剂要均匀地喷洒到向日葵上。

防治列当的方法有俩种，一种为利用咪唑啉酮类除草剂，例如：新世 1 号杂交种。另一种是利用抗列当基因，例如：新世 2 号杂交种。

新世 1 号杂交种是由乌拉特前旗新世纪种业有限责任公司培育成功的。新世 1 号杂交种的育种起始于 2014 年，是通过美国农业部向日葵研究所的“ImiSun”和国内向日葵亲本杂交培育而成。新世 1 号向日葵耐咪唑啉酮类除草剂，所以抗列当。新世 1 号向日葵杂交种已通过了中国农业部的认证，现已在市场上销售。在 2017 年分别在

内蒙古两个旗，乌拉特前旗 和四子王旗，试种，并获得如下试验结果：在乌拉特前旗新世 1 号的成熟期为 93 天，产量为 3795 公斤/公顷，292 粒/50 克，列当感染率为 5%。在四子王旗新世 1 号的成熟期为 97 天，产量为 3660 公斤/公顷，285 粒/50 克，列当感染比例为 7%。

综上所述，咪唑啉酮类除草剂在防治向日葵列当方面是很有效的。新世 1 号作为耐咪唑啉酮类除草剂抗列当的良好食葵杂交种子现已在中国市场上销售。

关键词：IMI 除草剂、Clearfield 技术、列当抗性