



## Evaluation of Foramsulfuron and Nicosulfuron Combination with Ammonium Sulfate on Lamb's-quarters (*Chenopodium album* L.) Control

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### Introduction

Maize (*Zea mays* L.) is a major crop in Iran and ranks third, behind wheat and rice. Grain yield in maize can be severely reduced by competition with weeds (Mosavi, 2001). A broad spectrum of grasses and broadleaved weeds infests maize fields. *Amaranthus* spp. (pigweed), *Chenopodium album* L. (common lambs quarters), *Abutilon theophrasti* Medik. (Velvetleaf), *Cirsium arvense* (L.) Scop. (Canada thistle), *Convolvulus arvensis* L. (field bindweed), *Sorghum halepense* (L.) Pers. (johnsongrass), *Echinochloa crus-galli* (L.) Beauv. (Barnyardgrass), *Cyperus rotundus* L. (purple nutsedge), *Digitaria sanguinalis* (L.) Scop. (Large crabgrass) and *Setaria* spp. (foxtail) are among the most common and problematic weeds in maize in Iran (Zand *et al.*, 2009). Today, high-yielding agriculture heavily depends on herbicides, as they constitute a vital and integral component of weed management practices (Zand *et al.*, 2008). Tank mixing two or more herbicides is a common practice that is increasingly used in most agronomic crops to control a wide spectrum of weeds, reduce production cost, and/or prevent the development of herbicide-resistant weeds (Zand *et al.*, 2008). Herbicides may interact, before or after entering the plants, and the outcome of the interaction can be synergistic, additive, or antagonistic. It would be ideal to select herbicide combinations that have synergistic effects on weeds and/or antagonistic effects on crops. Additives, compounds that to facilitate the mixing application or influence herbicide add to herbicide formulation or tank sprayer, in other words additives can increase the effects of herbicides to reduce their consumption (Streibig *et al.*, 1998). Foramsulfuron and nicosulfuron are among the newly released dual purpose sulfonylurea herbicides. The use of these herbicides offers the opportunity for a new mode of action for weed management in maize. These herbicides act through inhibition of acetolactate synthase, the first enzyme in the pathway in the biosynthesis of branched-chain amino acids, valine, leucine and isoleucine in chloroplasts. They first affect meristemic tissues where growth ceases soon after treatment. Chlorosis and the necrosis of these tissues soon follow, with dieback to the mature parts of the plant taking a further 3–4 week. These herbicides have been reported to be very effective on grasses, broadleaved weeds, and rhizomatous perennial temperate weeds in maize. Another priority of these herbicides over those currently used on maize is that they act at very low doses. This will reduce the environmental safety concerns lie back behind application of herbicides (Nurse *et al.*, 2007; Prostko *et al.*, 2006).

### Materials and Methods

In order to evaluate the effect of foramsulfuron and nicosulfuron combination without and with ammonium sulfate as an adjuvant on lamb's-quarters (*Chenopodium album* L.) control in maize, a study was conducted in three separate experiments, in Ferdowsi University of Mashhad during 2011-2012. For this purpose, 4 plants of Lamb's-quarters (*Chenopodium album* L.) and 2 maize crops was planted in separate pots and were sprayed in 4-leaf stage. The first experiment was conducted separately for each of weeds lamb's quarters to determine the dose for foramsulfuron and nicosulfuron in greenhouse conditions, based on the dose-response experiments. The second experiment conducted to evaluate the effect of different combination ratio of two herbicides (75% foramsulfuron+ 25% nicosulfuron, 50% foramsulfuron+ 50% nicosulfuron, 25% foramsulfuron+ 75% nicosulfuron) based on the results of the first experiment. The third experiment included the second experiment treatments plus ammonium sulfate as adjuvant.

### Results and Discussion

Results showed that both herbicides without ammonium sulfate and at high doses lamb's-quarters control.

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Combination ratio with equal doses of two herbicides (50% foramsulfuron +50% nicosulfuron) increased lamb's-quarters damage more than other ratios. In other words, the combination of these two herbicides had synergistic effects on lamb's-quarters control. Also combination of them with ammonium sulfate had synergistic effects on lamb's-quarters control, so that in this experiment among different mixing ratios of the two herbicide, mixing ratio of 50% foramsulfuron +50% nicosulfuron dry matter reduce lamb's-quarters compared to other ratios increased mixing. It should be mentioned that mixing these two herbicides with and without the additive ammonium sulfate had no adversely affect maize crop.

### Conclusions

It can be concluded that the combination of herbicides foramsulfuron and nicosulfuron with and without additive ammonium sulfate not only has antagonism effect in the mix, but also synergism effects are observed in the mixture of two herbicides with better efficiencies additive combination of two herbicide.

**Keywords:** ALS herbicides, Ammonium sulfate, Herbicide combination, Lamb's-quarters (*Chenopodium album* L.), Maize