### Influence of Separate and Tank-mixed Application of Some Broadleaf Herbicides on Sugarbeet Weeds and Their Effects on Crop Productivity

N. Panjehkeh and L. Alamshahi

Department of Plant Protection, Faculty of Agriculture, University of Zabol, Iran.

**Abstract:** Weeds, particularly broadleaves, are one of the main constraints to sugarbeet production worldwide. Weeds decrease sugarbeet quality and quantity where they are not properly controlled. The use of herbicides has become the most common method of controlling weeds due to their good control effects. The impacts of 15 treatments comprising 13 broadleaf herbicides applied separately or as tank-mixed and two controls, hand weeding and no hand weeding, were investigated in the template of a completely randomized block design with three replicates. The treatment effects were measured on sugarbeet leaf dry weight, beetroot dry weight and beetroot yield. The treatment effects were significant (P ≤ 0.01) on all of the measured traits. However, the effectiveness of the efficient herbicides was in the following order: 1. Chloridazon + Phenmedipham, 2. Clopyralid + Desmedipham, 3. Desmedipham + Metamitron, 4. Betanal Progress AM + Phenmedipham, 5. Desmedipham + Chloridazon, 6. Chloridazon + Betanal Progress AM and 7. Clopyralid + Betanal Progress AM. The combination of Phenmedipham and Chloridazon was the most effective mixture on sugarbeet broadleaf weeds. Its effect was similar to hand weeding. It was less detrimental to leaves and beetroot, therefore, resulted in production of more leaf dry weight and beetroot yield.

**Key words:** Sugarbeet Broadleaf Weeds, Herbicides, Chloridazon, Phenmedipham, Desmedipham, Betanal Progress AM, Metamitron, Clopyralid, Tank-mix, Triflusulfuron.

### INTRODUCTION

Sugarbeet cannot extremely compete weeds (Hall, 2000). Weeds are the major constraints to sugarbeet production worldwide (Morishita, 2000), and compared to other pests render the highest damage to the product (Anonymous, 2001). Weeds, suppress product quantity, quality, harvest, and pest diversity and antagonistic organisms (Anonymous, 2000). The damages arisen from the broadleaf weeds to the sugarbeet are as twice as the grass weeds. Weed damages to sugarbeet exceed 80% (Gupta, 2001).

In spite of hazards such as air contamination and resistance of weeds to herbicides arisen from herbicide application, the chemical compounds cannot be eliminated from weed management program (Kearney, 1976). As each herbicide lonely controls a limited number of weed species, a mixture of herbicides is applied (Lajos, 2000). The efficiency of applying some broadleaf herbicides such as Phenmedipham, Desmedipham, Ethofumesate, Triflusulfuron (Deveikyte, 2006; 13, 10), and Glyphosate and Pronamide (Morishita, 2008) on sugarbeet broadleaf weeds as separate or tank-mixture has been investigated.

The main objective of the project was to investigate the influence of some broadleaf herbicides as separate or tank-mixture on the sugarbeet broadleaf weeds.

### MATERIALS AND METHODS

The efficiency of tank-mixed combinations of the following herbicides on sugarbeet broadleaf weeds was examined using 15 treatments in the template of a completely randomized block design with three replicates. The treatments were (1) Chloridazon + Phenmedipham, (2) Chloridazon + Triflusulfuron, (3) Chloridazon + Betanal progress AM, (4) Chloridazon + Desmedipham, (5) Phenmedipham + Metamitron, (6) Desmedipham + Triflusulfuron, (7) Betanal Progress AM (Desmedipham + Phenmedipham + Autoformiset), (8) Triflusulfuron + Betanal Progress AM, (9) Betanal Progress AM + Phenmedipham, (10) Clopyralid + Desmedipham, (11) Betanal Progress AM + Clopyralid, (12) Metamitron, (13) Betanal Progress AM + Metamitron, (14) Control 1, just hand weeding of weeds and (15) Control 2, no hand weeding and no chemical control of weeds.
Spraying was carried out twice starting treatment 1 at four foliage stage, and the other treatments at post emergence of sugarbeet. The next spray was performed three weeks later. Chloridazon, Phenmedipham, Tiflusulfuro, Desmedipham, Metamitron, Betanal progress AM and Clopyralid were applied at 5 kg/hec, 6 lit/hec, 30 g/hec, 2 lit/hec, 4.5 kg/hec, 4 lit/hec and 0.5 lit/hec, respectively.

The experiment was performed in the agricultural and natural resources centre of Khorasan Razavi, Iran, in 2006, and was repeated in 2007. Each experimental unit was a plot consisting of four rows of sugarbeet where the row lengths and the spaces between the rows were 10 m and 50 cm, respectively. Each plot was divided into two parts where half of it was sprayed and its other half was left unsprayed as control. A plastic barrier was used to prevent dispersal of herbicides onto unsprayed plants. An electronic knap-sack sprayer with Teejet nazle was used to spray the herbicides. The herbicides were sprayed at 2-2.5 bar. The sprayer was calibrated based on 200-300 lit/hec. After beetroot maturation and before leaf yellowness, two quadrates of 0.5×0.5 m were separately placed in the sprayed, unsprayed and control plots. The sugarbeets located in the quadrates were separately collected and transferred to the laboratory to separate their leaves and beetroots. The entire leaves of a quadrate and the entire beetroots of two quadrates were separately used for the leaf dry weight, beetroot dry weight and beetroot yield experiments.

Data analysis was done using Mstat-C and excel software, and mean comparison was basedon Dankan’s test.

**Results:**

**Leaf Dry Weight:**

The highest sugarbeet leaf dry weight was observed in the plots where the weeds were mechanically controlled. Among the chemically controlled plots, leaf dry weight was higher in the plots sprayed with the mixture of Phenmedipham and Chloridazon (Figure 1). The lowest sugarbeet leaf dry weight took place in the plots where the weeds were controlled with the mixture of Metamitron and Phenmedipham. The sugarbeet leaf dry weight was 168.4 g (in 0.25 m²) where their weeds were mechanically controlled, while it was 15.23 g in uncontrolled plots. The sugarbeet leaf dry weight of the plots sprayed with the mixture of (1) Clopyralid + Desmedipham, (2) Chloridazon + Betanal Progress AM, and (3) Metamitron + Betanal Progress AM revealed the second position among the controlled plots (Figure 1).

**Beetroot Dry Weight:**

The highest beetroot dry weight was observed in the mechanically controlled plots, followed by the plots sprayed by the mixtures of Chloridazon + Phenmedipham, and Chloridazon + Desmedipham, and Metamitron lonely (Figure 2). The effective herbicides demonstrated low side effects on beetroot.

**Beetroot Yield:**

Beetroot yield in uncontrolled plots was 40000 kg/hec. The sugarbeet yield in the chemically controlled plots with Metamitron + Desmedipham, and Chloridazon + Phenmedipham was 80000 kg/hec which was as twice as the uncontrolled plots. These mixtures revealed the least burning effect, and consequently the lowest disorder on the photosynthesis. The lowest yield (45000-50000 kg/hec), in the controlled plots, was observed in the plot sprayed with the mixture of Betanal progress AM + Phenmedipham, and Betanal progress AM + Triflusalfuron.

**Discussion:**

To improve the quantity and quality of sugarbeet, the sugarbeet weeds have to be controlled. In the research, the effectiveness of broadleaf herbicides on sugarbeet broad leaves was assessed through measuring sugarbeet leaf dry weight, beetroot dry weight and beetroot yield. The hand-weeding and non-controlled plots were used as indexes. The highest results, in the three experiments, were achieved in the plots where their weeds were mechanically controlled. Among the chemically controlled plots, leaf dry weight was higher in the plots sprayed with the mixture of Phenmedipham and Chloridazon. This implies that leaf areas and/or leaf numbers were more in the plots controlled with the mixture. As a common rule, the more the leaf area of a productive plant, the more the photosynthetic substances and consequently its product (Britton, 1989). The highest amount of the beetroot dry weight and also beetroot yield was obtained in the plots sprayed with this mixture. Vencil (2002) reported that the mixture of Chloridazon and Phenmedipham profitably controlled sugarbeet broadleaf weeds. The influence of Chloridazon + Phenmedipham, and Chloridazon + Desmedipham on sugarbeet broadleaf weeds has been reported by Paradowski (1998).
Although, the sugarbeet leaf dry weight was low in the plots sprayed with Metamitron lonely (Figure 1), the beetroot dry weight was high in the plots sprayed with this herbicide (Figure 2). The mixture of Desmedipham and another herbicide was more effective on sugarbeet yield in comparison to the mixtures lacking Desmedipham (Figure 3). This result was in compatibility to the result achieved in 2004 by Adollahi and Ghadiri (2004). In conclusion, the mixture of Phenmedipham and Chloridazon in all experiments, in the used dosages, considerably controlled the sugarbeet broadleaf weeds as the measured factors were higher in comparison to other mixtures or the lonely used broadleaf herbicides.

Fig. 1: Efficiency of tank-mixed herbicides on sugarbeet leaf dry weight.

Fig. 2: Efficiency of tank-mixed herbicides on beetroot dry weight.

Fig. 3: Efficiency of tank-mixed herbicides on beetroot yield.
Conclusion:
Thirteen chemical treatments using broadleaf herbicides were performed to control sugarbeet broadleaf weeds. Two herbicides were sprayed lonely and 11 treatments were combinations of two herbicides applied as tank-mixed. The combination of Phenmedipham and Chloridazon was the most effective mixture on sugarbeet broadleaf weeds, followed by the mixtures of Clopyralid + Desmedipham, and Desmedipham + Metamitron.

REFERENCES