

# Chemical Control of Curled Dock (*Rumex crispus* L.) and Other Weeds in Noncropped Areas

Tsvetanka Dimitrova<sup>1</sup> and Plamen Marinov-Serafimov<sup>2</sup>

<sup>1</sup>*Institute of Forage Crops, 89, Gen. Vladimir Vazov Str., 5800 Pleven, Bulgaria*

<sup>2</sup>*Institute of Forage Crops, Pavlikeni branch 61 Ruski Str., 5200 Pavlikeni, Bulgaria  
(plserafimov@abv.bg)*

## SUMMARY

*Rumex crispus* L. is an invasive species widespread in our country and in particular in the region of North Bulgaria. It is characterized by high biological and ecological plasticity. Owing to its great reproductive potential, the weed has been assigned to the list of economically most important weeds in the country.

With the purpose of studying the possibility of chemical weed control in noncropped areas with heavy natural background infestation with *R. crispus* L. and other dicotyledonous weeds, two field trials were carried out. A ready-to-use herbicide mixture 2,4-D 140.2 g/l<sup>-1</sup> + Triclopyr 144 g/l<sup>-1</sup>, trade product Genoxon 3X (X0050), was tested at two doses of active ingredient, 3552 and 2842 ml/ha<sup>-1</sup>. It was found that: (1) population density of *Rumex crispus* L. can be successfully reduced by treatment at the stage of early stem formation; herbicide efficacy with 3552 and 2882 ml/ha<sup>-1</sup> doses on the 21<sup>st</sup> day after treatment was 100% and 90.5%, respectively, at the end of vegetation 94.4 and 85.7%, respectively; (2) herbicidal efficacy was lower when *R. crispus* L. was treated at the 5 - 6 leaf stage, being 100 - 94.1% and 80 - 76.5% respectively for the indicated doses and time of recording; (3) at the studied doses the herbicide controlled both annual dicotyledonous weeds (*Amaranthus* spp., *Chenopodium album* L., *Portulaca oleracea* L.) and perennial dicotyledonous ones (*Cirsium arvense* L., *Sonchus arvensis* L., *Convolvulus arvensis* L., *Carduus acanthoides* L.), but it was not toxic to monocotyledonous weeds.

**Keywords:** *Rumex crispus* L.; Genoxon 3X (X0050); Chemical control; Noncropped areas

## INTRODUCTION

*Rumex crispus* L. is an invasive species, widespread in our country and in particular in the region of North Bulgaria. Tonev (2000) has listed it in a group of one hundred economically most important weeds char-

acterized by high biological and ecological plasticity. In crop rotation of lucerne and winter grain cereal, 64% of the weed survive after every ploughing (Pino, 1995). The importance of successful control of this species has attracted the attention of many researchers (Humphreys et al., 1999; Benvenuti et al., 2001;

Van Eekeren and Jansonius, 2005; Van Eekeren et al., 2006). The chemical method has an important role in its control. Treatment with Asulam at the dose of 2400 g/l<sup>-1</sup> has been found to kill 88-100% of dock species in lucerne (Prodanov, 1980). More than two decades has passed since the registration of this product, which necessitates a search for new options.

The objective of this study was to test a ready-to-use herbicide mixture, 2,4-D 140.2 g/l<sup>-1</sup> + Triclopyr 144 g/l<sup>-1</sup> (trade product Genoxon 3X (X0050), as a means of chemical control of *Rumex crispus* L. and other weeds in noncropped areas.

## MATERIAL AND METHODS

The study included two field trials carried out in a noncropped area with a heavy natural background infestation with *Rumex crispus* L. (trial 1) and other undesired dicotyledonous weeds (trial 2). The trials were laid out in a block design with four replications and plot size of 10 m<sup>2</sup>. The study was conducted with a ready-to-use herbicide mixture of 2,4-D 140.2 g/l<sup>-1</sup> + Triclopyr 144 g/l<sup>-1</sup> as the trade product Genoxon 3X (X0050) in doses of 3552 and 2842 ml/ha<sup>-1</sup> active ingredient. Asulam 400 g/l<sup>-1</sup> was used as a standard in trial 1. Efficacy was recorded in permanent 1 m<sup>2</sup> sampling plots by the quantitative method and according to a 9-score scale of EWRS (0-100% killed weeds = score 9-1). The herbicides were applied with 500 l<sup>-1</sup>/ha<sup>-1</sup> working solution.

## RESULTS AND DISCUSSION

*R. crispus* L. density was 15 to 21 plants/m<sup>2</sup> in the trial area, which was a prerequisite for real assessment of efficacy (Table 1). Toxic action caused epinastic curvatures of petioles and stems, growth inhibition and subsequent plant death. A high initial effect was observed in the recording 21 days after treatment at both stages. Completely killed plants reached 100% at 3552 l<sup>-1</sup>/ha<sup>-1</sup> mixture dose and 400 g/l<sup>-1</sup> of the standard Asulam. Herbicide efficacy was lower at 2842 ml/ha dose, the completely killed weeds being 90.5-94.1%. A characteristic biological feature of the weed is its high regenerative ability. At the end of vegetation the regenerated plants reached 5.6-14.3% for treatment at the weed stage of early stem formation and 5% for the standard. Regeneration was considerably higher, 20.0-23.5%, for treatment at the 5-6 leaf stage, and 9.5% for the standard. Therefore, control of *R. crispus* L. was more successful when the weed was treated at the stage of early stem formation with the higher dose of the product.

The results presented in Table 2 show that the studied herbicide possesses a wide spectrum of action with regard to dicotyledonous weeds. An ideal herbicide efficacy (score 1) against *Amaranthus* spp., *Chenopodium album* L., *Portulaca oleracea* L., *Cirsium arvense* L., *Sonchus arvensis* L. and *Carduus acanthoides* L. and good efficacy (score 3) against *Convolvulus arvensis* L. were achieved with the higher dose. The product was not toxic to monocotyledonous weeds.

Population density of *Rumex crispus* L. in noncropped areas can be successfully reduced by treatment with the ready-to-use herbicidal mixture of 2,4-D 140.2

**Tabela 1.** Efficacy of herbicide mixture of 2,4-D 140.2 g/l<sup>-1</sup> + Triclopyr 144 g/l<sup>-1</sup> (Genoxon 3X (X0050) against *Rumex crispus* L.

**Table 1.** Efikasnost mešavine herbicida 2,4-D 140,2 g/l<sup>-1</sup> + triklopir 144 g/l<sup>-1</sup> (Genoxon 3X (X0050) za *Rumex crispus* L.

Herbicide – Herbicid	Dose – doza ml/ha	Plant number/m <sup>2</sup> Broj biljaka/m <sup>2</sup>			Killed plants,% Smrtnost biljaka, %	
		1*	2**	3***	2	3
5-6 leaf stage – stadijum 5-6 listova						
2,4-D 140.2 g/l <sup>-1</sup> + Triclopyr 144 g/l <sup>-1</sup>	3552	15	-	3	100.0	80.0
2,4-D 140.2 g/l <sup>-1</sup> + Triclopyr 144 g/l <sup>-1</sup>	2842	17	1	4	94.1	76.5
Asulam 400 g/l <sup>-1</sup> (Standard)	2400	21	-	2	100.0	90.5
Stage of early stem formation – stadijum početnog razvoja stabljike						
2,4-D 140.2 g/l <sup>-1</sup> + Triclopyr 144 g/l <sup>-1</sup>	3552	18	-	1	100.0	94.4
2,4-D 140.2 g/l <sup>-1</sup> + Triclopyr 144 g/l <sup>-1</sup>	2842	21	2	3	90.5	85.7
Asulam 400 g/l <sup>-1</sup> (Standard)	2400	20	-	1	100.0	95.0

1\* – before treatment; 2\*\* – 21 days after treatment; 3\*\*\* – at the end of vegetation

1\* – pre tretmana; 2\*\* – 21 dan nakon tretmana; 3\*\*\* – kraj vegetacije

**Tabela 2.** Effect of the herbicide mixture 2,4-D 140.2 g/l<sup>1</sup> + Triclopyr 144 g/l<sup>1</sup> (Genoxon 3X (X0050) on weed composition in a noncropped area (according to EWRS scale\*)

**Table 2.** Delovanje mešovine herbicida 2,4-D 140,2 g/l<sup>1</sup> + triklopir 144 g/l<sup>1</sup> (Genoxon 3X (X0050) na sastav korova u oblasti bez useva (prema skali EWRS\*)

Weeds – Korovi	2,4-D 140.2 g/l <sup>1</sup> + Triclopyr 144 g/l <sup>1</sup> (Genoxon 3X)			
	2842		3552	
	Killed weeds, % Smrtnost	Score Ocena	Killed weeds, % Smrtnost	Score Ocena
Annual dicotyledonous – Jednogodišnji dikotiledoni				
<i>Amaranthus</i> spp.	100	1	100	1
<i>Chenopodium album</i> L.	100	1	100	1
<i>Portulaca oleracea</i> L.	100	1	100	1
Annual monocotyledonous – Jednogodišnji monokotiledoni				
<i>Setaria</i> spp.	0	9	0	9
<i>Panicum crus-galli</i> L.	0	9	0	9
Perennial dicotyledonous – Višegodišnji dikotiledoni				
<i>Cirsium arvense</i> L.	90	5	100	1
<i>Sonchus arvensis</i> L.	95	4	100	1
<i>Convolvulus arvensis</i> L.	75	6	98	3
<i>Carduus acanthoides</i> L.	90	5	100	1
Perennial monocotyledonous – Višegodišnji monokotiledoni				
<i>Sorghum halepense</i> (L.) Pers.	0	9	0	9
<i>Cynodon dactylon</i> (L.) Pers.	0	9	0	9

\* According to the EWRS scale: 9-score scale (0–100% killed weeds = score 9–1)

\* Prema skali EWRS: skala sa 9 ocena (0-100% smrtnosti korova; ocena 9-1)

g/l<sup>1</sup> + Triclopyr 144 g/l<sup>1</sup> (trade product Genoxon 3X (X0050) at the dose of 3552 ml/ha<sup>1</sup> at the weed stage of early stem formation. Twenty-one days after treatment the killed plants reached 100% and there was only 5.6% weed regeneration at the end of vegetation.

The herbicide controlled annual and perennial dicotyledonous weeds, but it was not toxic to monocotyledonous weeds.

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# Hemijsko suzbijanje štavelja (*Rumex crispus* L.) i drugih korova u oblastima bez useva

## REZIME

*Rumex crispus* L. je invazivna vrsta koja se nalazi širom naše zemlje, a naročito u području severne Bugarske. Karakteriše ga visoka biološka i ekološka plastičnost. Zbog svog velikog reproduktivnog potencijala, ovaj korov je stavljen na listu ekonomski najznačajnijih korova u zemlji.

U cilju proučavanja mogućnosti hemijskog suzbijanja korova u oblastima bez useva, sa velikom pozadinskom prirodnom infestacijom *R. crispus* L. i drugim dikotiledonim korovima, izvedena su dva poljska ogleđa. U ispitivanju je korišćena gotova mešavina herbicida 2,4-D 140,2 g/l<sup>-1</sup> + triklopir 144 g/l<sup>-1</sup> u obliku preparata Genoxon 3X (X0050), i to u dve doze aktivne materije: 3552 i 2842 ml/ha<sup>-1</sup>. Doneti su sledeći zaključci: (1) gustina populacije *Rumex crispus* L. može se uspešno smanjiti tretmanom u stadijumu početnog razvoja stabljike; efikasnost herbicida u dozama od 3552 i 2882 ml/ha<sup>-1</sup> 21. dana nakon tretmana bila je 100% i 90,5%, respektivno, a na kraju vegetacije 94,4 i 85,7%; (2) efikasnot herbicida bila je niža kada je vrsta *R. crispus* L. tretirana u stadijumu 5-6 listova i iznosila je 100-94,1% i 80-76,5% za ispitivane doze u navedeno vreme ocenjivanja; (3) primenjene doze herbicida suzobile su jednogodišnje dikotiledone (*Amaranthus* spp., *Chenopodium album* L., *Portulaca oleracea* L.) i višegodišnje dikotiledone korove (*Cirsium arvense* L., *Sonchus arvensis* L., *Convolvulus arvensis* L., *Carduus acanthoides* L.), ali herbicid nije pokazao toksičnost za monokotiledone korove.

**Ključne reči:** *Rumex crispus* L.; Genoxon 3X (X0050); hemijsko suzbijanje; oblasti bez useva