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ECONOMICS OF DIFFERENT WEED CONTROL MANAGEMENT ALONG IRRIGATIONAL CHANELS IN EASTERN CROATIA

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ABSTRACT

Different measures of control unwanted plants from banks and slopes of irrigation channels were investigated on the Watermanagement enterprise "Brana" from Virovitica. Several herbicidal treatments (triclopyr; atrazine and clopyralid + mecoprop; glyphosate) were applied after the clearing of channel to find out the most adequate and economically the most acceptable variant. During the three years of investigation the best results were obtained by using triclopyr and with combination of atrazine and clopyralid + mecoprop. Those herbicides succesfully destroyed unwanted broad-leaved herbaceous and woody plants, and cover values of desirable plants like *Arrhenatherum elatius* were satisfied. Floristic analysis shows that two year weed control management (treated-regeneration) is not acceptable. Furthermore, introduction of three year management (treated-treated-regeneration) cut the costs and led to successful weed control. Application of glyphosate was not acceptable because it significantly decreased cover values of grasses and also undesirable broad-leaved species, and it opens at the same time the possibility of erosion of channel.

Key words: economics, irrigation channels, weed management

SAŽETAK

EKONOMIKA RAZLIČITIH NAČINA SUZBIJANJA KOROVA PORED KANALA ZA NAVODNJAVANJE U ISTOČNOJ HRVATSKI

U sjeverozapadnom dijelu Slavonije (istočna Hrvatska) na području Vodoprivrednog poduzeća "Brana" iz Virovitice vršena su trogodišnja ispitivanja različitih mjera kontrole nepoželjnih korova na bankinama, pokosima i dnu kanala. U pokusu je primjenjeno različito kemijsko suzbijanje (triklopir, atrazin + (klorpiralid + mekoprop), glifosat) nakon krčenja kanala s ciljem da se utvrdi najučinkovitija ekonomski prihvatljiva varijanta. Primjenom triklopira te kombinacijom atrazina + (klorpiralida + mekopropa) postignuti su najbolji rezultati jer je ostvareno potrebno povečanje poželjnih travnih vrsta osobito *Arrhenatherum elatius*, dok je značajno smanjena pokrovnost širokolisnih zeljastih i drvenastih korovnih vrsta.

IZVLEČEK

EKONOMIKA RAZLIČNIH NAČINOV ZATIRANJA PLEVELA OB NAMAKALNIH KANALIH V VZHODNI HRVAŠKI

Triletno proučevanje različnih načinov zatiranja nezaželenih plevelov ob namakalnih kanalih, na brežinah in na dnu kanalov smo opravili na območju Vodnogospodarskega podjetja Brana iz Virovitice v severozahodnem delu Slavonije (vzhodna Hrvaška). Primerjali smo različno kemično zatiranje (triklopir, atrazin in klopiralid+mekoprop, glifosat) po krčenju kanalov s ciljem, da bi ugotovili, katera varianta je najbolj sprejemljiva in ekonomična. V vseh letih proučevanja smo najboljše rezultate dosegli s kombinacijo atrazina in klopiralida+mekopropa, saj smo dosegli povečanje zastopanosti zaželenih travnih vrst, še posebno *Arrhenatherum elatius,* ob hkratnem zmanjšanju zastopanosti širokolistnih zelnatih in olesenelih rastlin. Rezultati floristične analize kažejo, da z uvajanjem dvoletne oskrbe (tretirano-regeneracija) ne

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dosežemo zadovoljivih rezultatov, ki pa jih daje triletna (tretirano-tretirano-regeneracija) kontrola plevelov ob hkratnem zmanjšanju stroškov. Uporaba glifosata je bila nezadovoljiva zaradi značilnega zmanjšanja pokrovnosti, tako zaželenih trav kot nezaželenih rastlin, zaradi česar pride do golitve preseka kanala in se poveča možnost erozije.

Ključne besede: ekonomika, namakalni kanali, zatiranje plevela

1 INTRODUCTION

The net of irrigation channels in the Republic of Croatia is longer than 30000 km (Tomić, Maričić, 1983). Weed control along channels is an important issue in their management. They cover the banks and slopes of the channels and impaires the flow of water through them (Madjar, 1983). Potentially, weeds can also infestate the neighboring fields. Beside mechanical weed control which is expensive and time consuming , controling the weeds chemically with herbicide very intensively comes into use. Unfortunatelly, the application of so many herbicides is big burden for environment. Only with the smart weed management we can protect the environment and cut the costs of weed control at the same time.

Objective of this investigation is to determine the most appropriate method of weed control regarding economics and environment.

2 MATERIALS AND METHODS

The investigation was conducted on two irrigation channels in "Virovitica -Podravina " county: Budančica and Koševina from 1989 to 1991. The experiment was placed in banks, slopes and bottoms at both sides of the channels with following herbicide variants:
H1 Cidokor (48% glyphosate) 8 l/ha
H2 Cidokor (48% glyphosate) 10 l/ha
H3 Radazin T-50+Lontrel 418C (50% atrazine, 1,6% clopyralid+33% MCPP) 3+6 l/ha
H4 Garlozor 4E (33% triclopyr) 6 l/ha
C control without herbicide application

All plots consist of 300 m^2 in the first year of experiment, but each additional year on treated plots was left 100 m^2 of untreated area in order to let the vegetation regenerated. Therefore, in the second year of experiment it was possible to determine regeneration of weed flora after one treated season, (treated-regeneration) and in the third year, regeneration after two treated seasons (treated- treated- regeneration).

The method used to describe the vegetation was relevés according to Zürich-Montpellier school (Braun-Blanquet, 1964). The data on the increase or decline the wanted and unwanted species were calculated as percent of total cover values. Economic analysis was calculated at the level of variable costs (herbicides, machinery and labor cost) according to Däumler and Grabe (1985).

3 RESULTS AND DISCUSSION

The net of irrigation channels was constructed in the west part of Slavonia region, in area of Virovitica to improve the quality of soils by drainage the superflous water. Reconstructed channels and the new ones become very soon infested with vegetation (Pitra, 1987). In channels Budančica and Koševina of Watermanagement enterprise

"Brana" from Virovitica the biggest problem represent the woody plants (Pitra *et al.*, 1992). Therefore, the significant attention is paid to adequate maintenance of banks, slopes and bottoms of channels trying to destroy the unwanted vegetation and leave desirable grass species. With their roots grasses connect the soil and prevent the erosion.

Herbicide application significantly changed the cover values of weed vegetation in both investigated chanels compared to untreated control (Figure 1).

Application of glyphosate at rate 8 and 10 l/ha was not acceptable in all investigated cases. This herbicide significantly represses after one treated season (treated - regeneration) and two treated seasons (treated - treated- regeneration) almost all desirable grass species, but at the same time control of unwanted broadleaved plants was not satisfied. After three years of consecutive application glyphosate succeeded to eliminate unwanted plants, and almost completely destroyed desirable grass species. Therefore, this herbicide can not be recommended neither for short run nor for long run weed control management.

Combination of atrazine and clopyralid + MCPP and triclopyr applied in all three years represents better choice in preserving grasses and they are still effective in controlling broadleaf weeds. Furthermore, analysis shows that triclopyr is more effective in special three year management (treated-treated-regeneration) on both channels, and combination of atrazine and clopyralid + MCPP was satisfied only in Koševina channel.

Taking into consideration ecological and economical aspect of weed control simultaneously, it is obvious that third treatment could be dropped while keeping the weed infestation under control. The costs for weed management with one, two and three years of herbicides treatment are shown in Table 1.

Table 1. Variable costs for different weed management* šknĆ

	T-N-N	T-T-N	T-T-T
Cidokor 8 l/ha	2553	5106	7659
Cidokor 10 l/ha	2666	5332	7998
Radazin T-50 + Lontrel 418C 3+6 l/ha	2423	4846	7269
Garlozor 4E 6 l/ha	3420	6840	10260

* T=treated; N=non treated

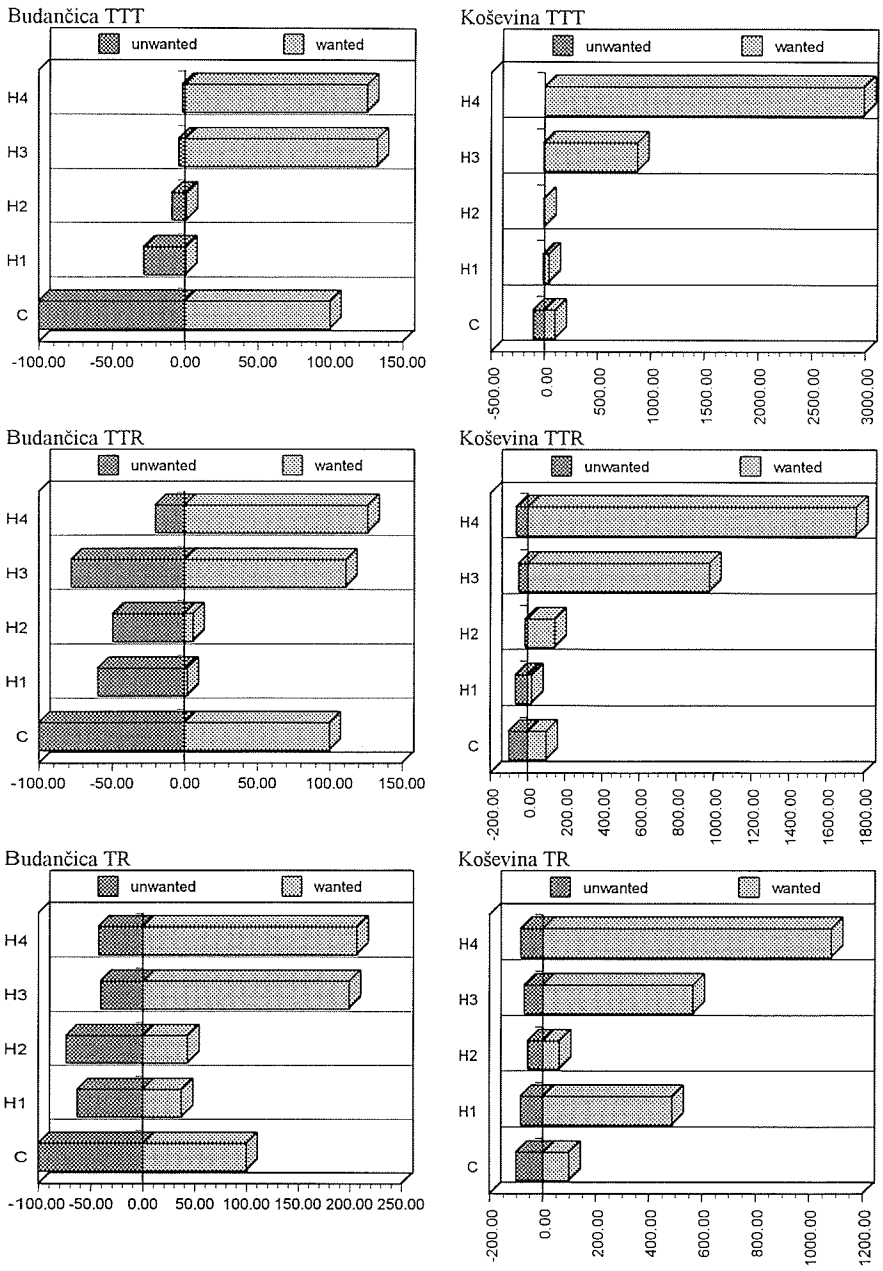

Figure 1. Cover values in different herbicides treatment (C=100)

4 CONCLUSION

The following conclusions could be drawn from this research:

1. Glyphosate at both rates 8 and 10 l/ha could not be recommended in this research because he lead to complete destruction of vegetation. It can not be acceptable because of potential of channel damage by erosion..
2. Better results are obtained with combination of atrazine and clopyralyd + MCPP and with triclopyr. After three years of consecutive use of these herbicides, grasses were still preserved and broad-leaved weeds were successfully suppressed.
3. Control the vegetation with application of triclopyr was very good on both localities already after two years, therefore additional year of application could be dropped from the management. Combination of atrazine and clopyralyd+MCPP had the same result only on Koševina channel.
4. Introduction of sequence treated-treated-regeneration in weed control management has potential to save some funds and protect the environment.

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