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WEED DISTRIBUTION IN POTATO INFLUENCED BY FERTILIZATION

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ABSTRACT

Floristic investigation in potato were conducted on Mediterranean part of Republic of Croatia, in Istria using different fertilization treatments: conventional fertilization, reduced mineral nutrition + organic fertilization, organic fertilization and control without fertilization. Density of weeds were increased in all fertilization treatments. Significant differences in dry biomass were also evident between very weedy variants with organic and conventional fertilization compared to reduced mineral fertilization and control variant. The dominant species was *Avena sterilis* ssp. *ludoviciana* (Durieu) Nyman. The nytrophylous species *Polygonum aviculare*, *Chenopodium album* and *Solanum nigrum* etc. were significant for distinguishing the fertilization treatments. Between control and all fertilized variants only quantitative difference appeared.

Key words: fertilization, potato weed distribution

SAŽETAK

DISTRIBUCIJA KOROVA U NASADIMA KRUMPIRA KAO REZULTAT GNOJIDBE

Floristička iztraživanja u krumpiru obavljena su na mediteranskom području Hrvatske u Istri uz primjenu različite gnojidbe koja je utjecala na kvantitativne i kvalitativne odnose u korovnoj zajednici. Gnojidbene varijante uključivale su standardnu gnojidbu, reduciranu mineralnu gnojidbu + organsku gnojidbu, organsku gnojidbu, te kontrolu bez gnojidbe. Gnojidba je u svim varijantama povečala broj izdanaka korovnih vrsta i dala značajne razlike u zakorovljenosti prema vrijednostima suhe biomase korova. Signifikantne razlike u biomasi korova utvrdjene su izmedju vrlo zakorovljenih varijanata s organskom i mineralnom gnojidbom u odnosu na reduciranu gnojidbu kontrolnu, negnojenu varijantu. U korovnoj zajednici krumpira dominirala je jednosupnica *Avena ludoviciana* Dur., a za razdvajanje gnojidbenih varijanata statistički su bile najznačajnije nitrofilne terofitne vrste *Polygonum aviculare* L., *Chenopodium album* L., *Solanum nigrum* L. emend. Miller, i dr. Razlike u zakorovljenosti izmedju negnojene i gnojenih varijanata su pretežno kvantitativne prirode.

IZVLEČEK

DISTRIBUCIJA PLEVELOV V KROMPIRIŠČIH KOT POSLEDICA GNOJENJA

Floristična raziskovanja v krompiriščih smo opravili na mediteranskem področju Hrvaške v Istri z uporabo različnega gnojenja, ki je vplivalo na kvantitativne in kvalitativne odnose v plevelni združbi. Variante gnojenja so bile: standardno gnojenje, reducirano mineralno gnojenje + organsko gnojenje, organsko gnojenje, kontrola brez gnojenja. Gnojenje v vseh variantah poveča število poganjkov plevelnih vrst in daje značilne razlike v zapleveljenosti glede na vrednosti suhe biomase plevelov. Signifikantne razlike v plevelni biomasi so bile med zelo zapleveljenimi variantami z organskim in mineralnim gnojenjem glede na reducirano gnojenje in kontrolno, negnojeno varianto. V plevelni združbi krompirja je prevladovala enokaličnica *Avena ludoviciana* Dur., statistično značilno pa so prevladovale nitrofilne terofitne vrste *Polygonum aviculare* L., *Chenopodium album* L., *Solanum nigrum* L. emend. Miller idr. Razlike v zapleveljenosti med gnojenimi in negnojenimi variantami so pretežno kvantitativne narave.

Ključne besede: distribucija plevelov, gnojenje, krompirišče

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1 INTRODUCTION

It is well known fact that crop plants grow in very hard competition with weeds specially for light, water and nutrient requirements and cause considerable yield losses. In most cases nutrient level is the only environmental factor that can be easily manipulated under field conditions (Alkamper *et al.*, 1975). However, there are only few information available on the interaction between weed infection and distribution due to different fertilization management. The objective of this research was to determine how different fertilization treatments in potato influence the distribution and aggressivity of the weeds in order to define suitable weed management.

2 MATERIALS AND METHODS

The effect of different fertilizers on the density, biomass and distribution of natural weed populations in potato were investigated in the absence of herbicide. The experiment was conducted on red soil near Poreč in Istria from 1992 to 1994 by using following fertilization treatments: F1. conventional fertilization (180+160+240 $N+P_2O_5+K_2O$ respectively and two reinforced nutritions with 185 kg KAN per ha); F2. reduced mineral nutrition (90+80+120 $N+P_2O_5+K_2O$ respectively and one reinforced nutrition with 185 kg KAN per ha); F3. organic fertilization (40 t manure per ha in first year of experiment and each following year 20 t manure per ha); F4. control without fertilization.

Weeds were counted by species in the first decade of June before the cultivation. Fifty 0,5 by 0,5 m quadrats were used per plot at each treatment. Data for weed distribution were analysed using CDA on relative abundance values which were calculated as: (relative density + relative frequency)/2 per plot per species (Derksen *et. al.*, 1994). Statistical differences among treatments were determined by comparing Mahalanobus squared distances, as calculated by SAS, to Chi^2 tables. Weed density and dry biomass data were used to compare total community density and biomass by fertilization treatment using standard errors for the comparison of treatment means. Data from 1994 are presented as representative data from this study.

3 RESULTS AND DISCUSSION

Floristic composition of weed community in potato is shown in Table 1. A relative abundance value for weed populations were calculated as a synthetic importance value in order to overcome the problem of the patchy nature of weed communities (Kent & Coker, 1992).

The dominant weed species in potato during the experiment was *Avena sterilis* ssp. *ludoviciana* (Durieu) Nyman and it represent the major weed in regions with a Mediterranean climate (Fernandez-Quintanilla *et al.*, 19876., 1987, Sanchez Del Arco *et al.*,1995). *Avena ludoviciana* is one of the most troublesome weed with seeds remained dormant in soil for several years (Thurston, 1982). Lack of rainfall and dry soil do not limit the germination and emergence of this grass (Aibar *et al.*, 1991), therefore this is the reason of its high abundance in arid vegetation periods during the experiment. Populations of the summer annuals *Setaria glauca*, *Convolvulus arvensis*, *Polygonum aviculare*, *Anthemis altissima*. *Fumaria officinalis*, *Chenopodium album*, *Daucus carota* and *Sinapis arvensis* were abundant too, and they represented also the

dominant species in first two years of investigation (Knezević et al., 1993, Skender *et al.*, 1994).

Table 1: Species relative abundance values in different fertilization treatments

Scientific name:	Fertilization treatment			
	F1	F2	F3	F4
Avena sterrilis ssp. *ludoviciana* (Durieu) Nyman	43,9	32,1	54,4	45,1
Convolvulus arvensis L.	19,2	8,4	9,9	32,1
Setaria glauca (L.) PB.	4,5	32,9	8,8	4,3
Polygonum aviculare L.	1,6	6,7	4,4	2,0
Anthemis antissima I. emend Spreng.	3,4	4,0	5,0	2,0
Fummaria officinalis L.	7,0	3,7	1,8	1,2
Daucus carota L.	4,6	2,2	3,3	2,0
Chenopodium album L.	5,6	1,5	1,8	2,0
Sinapis arvensis L.	2,1	1,5	1,2	4,1
Fallopia convolvulus (L.) A. Love	1,4	1,5	1,8	-
Legousiaspeculum veneris (L.) Chaix	0,7	-	2,2	-
Cirsium arvense (L.) Scop.	-	-	-	2,8
Matricaria chamomilla L.	2,8	-	-	-
Galium aparine L.	0,7	0,8	1,2	-
Hibiscus trionum L.	-	1,5	-	1,0
Papaver rhoeas L.	0,7	-	0,6	1,0
Viola arvensis Murray	-	0,8	0,6	-
Anagalis arvensis L.	-	-	-	1,0
Senecio vulgaris L.	-	0,8	-	-
Lathyrus pratensis L.	-	0,8	-	-
Reseda lutea L.	0,7	-	-	-
Solanum nigrum L. emend. Miller	0,7	-	-	-

With multivariate techniques, such as canonical discriminant analysis is possible to determine if weed community differ among experimental treatment based on their relative species composition using all weed species present as variables (Jongman *et al.*, 1987). Canonical axis one explains the greatest proportion of variation, thus a separation of treatments along the axis one is of a greater significance than along the axis two (Figure 1).

The axis one, explained by 52,33% of variation differ weed community in variant with conventional, mineral fertilization (F 1) with the association of weed species *Matricaria chamomilla*, *Reseda lutea* and *Solanum nigrum*. Although the populations of *Chenopodium album* and *Polygonum aviculare* are presented in all treatments, they have a greater association on plots with mineral fertilization. They are all nitrophylous species favoured by this kind of fertilization.

The axis two explains further 30,10% of variations and it differ weed community in control plot (F 4) from other plots where fertilization was used. Species *Avena ludoviciana*, *Convolvulus arvensis*, *Anthemis altissima* and *Fallopia convolvulus* were the most significant for the construction of axis two. However, these species were presented in all treatments indicate that distinguishing of the variants along axis two is determined by quantitative relationship in weed community.

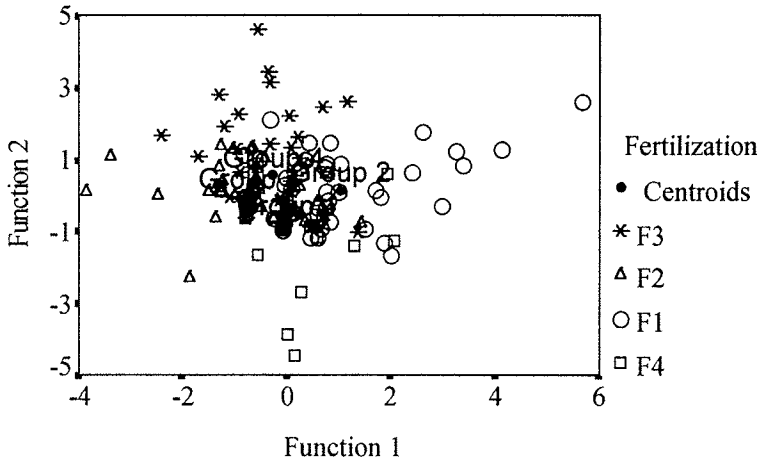

Figure 1: CDA ordination diagram of weed community clusters in different fertilization variants

During the growing season in 1994 the amount of rainfall was low and also unfavourable arranged with high air temperature levels. That was the reason why weeds emerged and germinated very slow showing their low value
s for density and biomass.

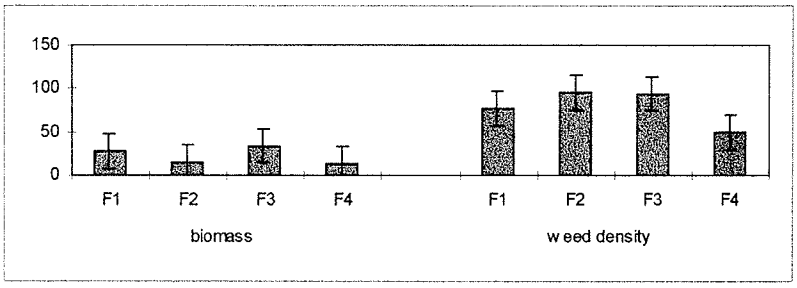

Figure 2: Total weed density and biomass by fertilization treatments

Density of weeds were increased in all fertilization treatments (Figure 2). Also, variants with organic (F3) and conventional mineral fertilization (F1) has significantly higher values of dry biomass compared to reduced mineral fertilization (F2) and control unfertilized variant (F1).

4 CONCLUSION

Floristic investigation in potato under different fertilization treatments give the following conclusions:

1. The dominant weed species was *Avena sterilis* ssp. *ludoviciana* (Durieu) Nyman and it was highly abundant in all treatments.

2. Composition of weed community was changed by different fertilization treatments. Variant with conventional mineral nutrition had greater association of nytrophylous species.

3. With intensive input of nutrition weed controls become an important issue because weeds can significantly increase in density and biomass.

4. Knowing the potentialy changes in weed community under different agronomic practices has practical significance in determing directions for future research in weed management.

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