THE STRUCTURE OF THE YIELD OF CRAMBE (*CRAMBE ABYSSINICA* HOCHST.) IN RELATIONSHIP TO WEED INFESTATION AT DIFFERENT SOWING RATE AND NITROGEN FERTILIZATION*

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In field trials conducted at two different sites in the years 1994 to 1997 weed spectrum and effect of weeds were studied as affected the yield structure of crambe. Inter-species competition was tested at two different sowing rates of crambe (V_1 – 160 germinating seeds per m^2, V_2 – 240 germinating seeds per m^2) and two doses of N fertilization in industrial fertilizers: without N fertilization and at the N rate of 80 $kg.ha^{-1}$. The total number of weeds in conversion into area was lower at the site with better weather conditions in Prague-Ruzyně (on average 70.8 $plants.m^{-2}$) compared with cooler and moister site at Lukavec near Pelhřimov (234.9 $plants.m^{-2}$). In Ruzyně we found average dry matter of weeds 62.2 $g.m^{-2}$, at Lukavec it was 76.4 $g.m^{-2}$. Higher values found at Lukavec are given by high number of weeds per area, as well as by the fact that crambe stands here were thinner (Ruzyně 145, Lukavec 215 $plants.m^{-2}$). The numbers of weeds found had significantly negative impact on the grain yields of crambe only on N-untreated plots and also on the plots with higher sowing rate of crambe. No significant relationship has been found between the number of weeds and other studied parameters (1000-kernel weight, number of crambe plants per area, yield of crambe total phytomass). In addition, it is evident from correlations, that higher sowing rate of crambe reduced number of weeds and the growth of weight of their phytomass, what had a positive effect on the increase of seed yield. When compared the plots treated with suitable herbicides with identical untreated plots, we found a decrease on the yield of crambe seeds on average by 16.4 % against similar herbicide-treated plots. The following sequence of the rate of the effect of different factors on composition of species spectrum, number and production of weed dry matter in descending order from the strongest effect to the weakest one, can be established from the results achieved: year – site – N fertilization – sowing rate.

weeds; crambe; N fertilization; sowing rate; inter-species competition

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INTRODUCTION

Inter-species competition between weeds and crop is still a subject of extensive study. For example Z i m d h a l (1980) quotes in his study more than 500 contribution, in which their authors deal with different weed communities and cultural plants. Our authors studied the tasks of mutual relationship between different weeds and crops, e.g. R á c z (1950). Other authors studied the effect of stand density and fertilization (V r k o č, 1972; M a j e r í k o v á, Š i m o n, 1983; S t r a š i l, S k a l a, 1997) and crop rotations (L é g e r e et al., 1997) as affected the relationships between weeds and crops etc.

In the world crambe (*Crambe abyssinica* Hochst.) belongs to the so-called alternative oil crops. A great attention has been paid in our days to crambe mainly in the USA (F á b r y et al., 1990), as well as in Western Europe (S e e h u b e r, 1987). In the Czech Republic more attention was devoted to this crop before in the past (F á b r y et al., 1990), when it was cultivated with success on relative large areas in all production regions (H a n i c h, 1967).

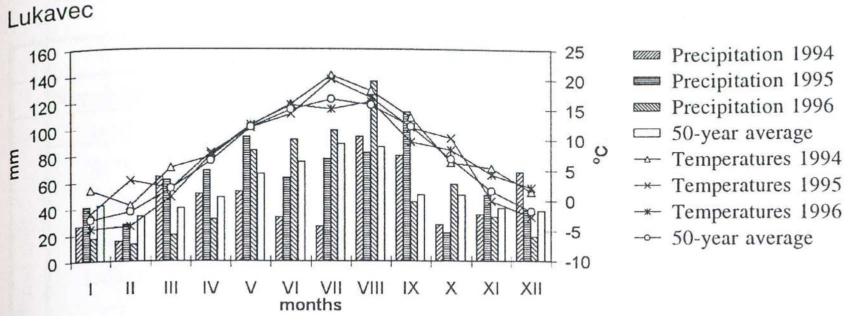
Nowadays, a great attention has been paid to crambe, as a new alternative crop intended for industrial or energy utilization, in the world and in the Czech Republic as well. During field trials conducted at the Research Institute of Crop Production, Prague-Ruzyně, the crambe was compared together with other crops within the research project "Cultivation of non-traditional energy and industrial plants" (S t r a š i l, 1997). Our study has been concentrated on, except production aspects, the study of the effect of soil and climatic conditions, amount of sowing rate and different N fertilization of crambe and weed infestation of the stand. Furthermore, we studied how the competition between the given crop and weeds is reflected in some elements of the structure of yields and final seed yield of crambe.

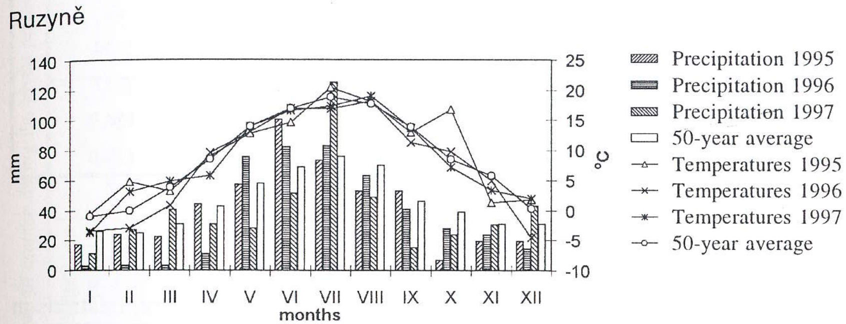
MATERIAL AND METHOD

The weed infestation was studied in the period 1995 to 1997 at two different sites (Lukavec near Pelhřimov and Prague-Ruzyně). Site conditions on different plots are presented in Table I. The weather pattern in the given experimental period at different sites is in Fig. 1.

Cultural practices of the crop

Cereal was a forecrop for crambe at all sites and in all years of the study (Table II). Traditional herbicides were used to the forecrop against weeds (Table II). Common cultural practices were done for crambe at all sites. Stubble ploughing and medium-deep tillage followed after forecrop at all sites. Pre-sowing treatment was accomplished in spring at Ruzyně by compactor, at Lukavec vibration harrow plus rammer were used.





1. Occurence of precipitation and air temperatures for the period under study at different sites

In autumn P and K fertilization was applied at all sites, identical for all variants (60 kg P_2O_5 in superphosphate and 60 kg K_2O per hectare in potassium salt). The following nitrogen fertilization was chosen: N_0 – without nitrogen fertilization, N_1 – 80 kg.ha^{-1} (fertilization at two rates – the first rate 40 kg.ha^{-1} in ammonium sulphate before sowing and the second rate 40 kg.ha^{-1} in potassium nitrate with limestone at the beginning of the phase of lengthening in crambe).

The crambe was sown at two different sowing rates, V_1 – 160 germinating seeds per m^2, V_2 – 240 germinating seeds per m^2. The seed grain in different years was used from authors' sources - from reproduction of the stock-seed cultivated at different sites from the previous year. Other data on cultural practices and vegetation investigation of crambe for the given period at different sites are presented in Table II.

I. Site conditions of experimental sites

Parameter	Experimental site	
	Lukavec u Pacova	Praha-Ruzyně
Latitude	49°37’	50°04’
Longitude	15°03’	14°26’
Altitude (meters above sea level)	620	350
Soil texture	sandy loam	clay loam
Great soil type	cambisol	luvisol
Average annual air temperature (°C)	6.8	7.7
Average annual sum of precipitation (mm)	686	517
Agrochemical properties of topsoil:		
Humus content (%)	3.32	3.00
pH (KCl)	6.11	5.57
P (Mehlich II, $mg.kg^{-1}$ of soil)	131.0	124.9
K (Mehlich II, $mg.kg^{-1}$ of soil)	166.0	126.0

Analysis of weed infestation

Weeds and the crop were taken together at all sites in three replications in variants: N_0V_1, N_0V_2, N_1V_1, N_1V_2. At the onset of anthesis of crambe, weed and the crop were sampled in each replication simultaneously from four sampling areas in each variant of the size 0.25 m^2. Different weed species and their number, fresh mass and dry matter were ascertained from taken samples (number-weight method). The nomenclature of quoted weed species is presented after D o s t á l (1989).

Numbers of plants per area were determined in annual, biennial and perennial weeds (Table III). With respect to relative earliness of sampling dates of weeds, it was possible to identify even hard-determinable different species as individual plants, such as wild oat or silky bent grass. In perennial stoloniferous weeds, where individual species can be identified (e.g. couch grass) with difficulties, different stems, culms etc. were considered as an individual plant for simplification.

The number of plants, fresh mass and dry matter were determined in crambe in a similar way. On sampling dates the condition of the crambe to weed infestation was studied (evenness of the stand, its density, uniformity of weed infestation etc.). Furthermore, other parameters were established for crambe on all sampling plots, such as TKW (1000-kernel weight), seed yield,

II. Basic data on cultural practices and vegetation investigations of crambe during the given period at different sites

Site	Experimental year	Date			Vegetation period sowing-sampling (days)	Forecrop	Herbicide to forecrop	Dose per 1 hectare
		sowing	emergence	weed sampling				
Lukavec	1994	20.4.	3.5.	7.7.	78	winter barley	Syntop 80 WP	1.0 kg
	1995	21.4.	7.5.	29.6.	69	spring barley	Agritox 50 SL + Starane 250 EC	1.5 l + 0.5 l
	1996	22.4.	30.4.	27.6.	66	winter barley	Glean 750 F + Dicuran 80 WP	15 g + 1.0 kg
	1997	–	–	–	–	–	–	–
Praha-Ruzyně	1995	20.4.	4.5.	28.6.	69	winter wheat	Glean 75 DF	15 g
	1996	19.4.	30.4.	17.6.	59	winter wheat	U 46 M Fluid	2.0 l
	1997	9.4.	14.5.	20.6.	72	winter wheat	U 46 M Fuid + 46 M Fluid	2.0 l + 1.0 l

III. Average numbers ($plants.m^{-2}$), phytomass dry matter ($g.m^{-2}$), representation of weed species and seed yields ($t.ha^{-1}$), yields in total of harvested phytomass ($t.ha^{-1}$) and some yield-forming components of crambe at different sites for the period under study

Site:		Lukavec			Ruzyně		
Sampling date:		7.7. 1994	29.6. 1995	27.6. 1996	28.6. 1995	17.6. 1996	20.6. 1997
Annual spring weeds							
Anagallis arvensis L.	scarlet pimpernel				1.0		
Avena fatua L.	wild oat				9.0		2.5
Fallopia convolvulus (L.) Á. Löwe	buckwheat	14.5	9.5	23.0	56.0	5.8	1.5
Galeopsis pubescens Besser	common hemp-nett	0.7	3.0	0.7	4.0		
Cardaria draba (L.) Desv.	pepperweed whitetop						
Polygonum aviculare L.	knotgrass					2.5	2.0

Sinapis arvensis L.	yellow charlock				1.0		
Spergula arvensis L.	lousy grass	0.7		1.7			
Raphanus raphanistrum L.	wild radish	0.7					
Late spring annual weeds							
Tithymalus helioscopia (L.) Scop.	sun spurge		2.0	0.7	1.0		
Chenopodium album L.	common lambsquarters	9.5	29.8	19.2	1.0	1.0	8.5
Persicaria lapathifolia (L.) S.F.Gray	pale persicaria				4.5	1.0	
Persicaria maculate (Rafin.) S.F.Gray	redshank	2.0		4.0			
Sonchus oleraceus L.	smooth sowthistle		2.4		2.0		2.0
Annual winter weeds							
Alsinula media L. Dost.	common chickweed	1.3	109.2	16.3	2.0		2.0
Apera spica-venti (L.) Beauv.	silky bent grass			6.7			
Capsella bursa-pastoris (L.) Medik.	shepherd's purse	2.9	4.4	16.0			
Fumaria officinalis L.	common fumitory			1.3	3.5		
Galium aparine L.	cleavers	9.5	2.0	26.5	8.0	3.5	18.5
Hyoscyamus niger L.	black henbane						3.5
Lamium album L.	white dead-nettle				1.0		
Lamium amplexicaule L.	henbit dead-nettle		1.6	34.6	13.0		
Lamium purpureum L.	read dead-nettle			21.8	4.0	2.8	6.0
Medicago sativa L.	lucerne					1.0	
Lycopsis arvensis L.	bugloss				2.0		
Matricaria maritima L.	scentless mayweed	5.7	1.5	34.2			
Myosotis arvensis (L.) Hill	common forget-me-not	0.7	1.4	4.8			
Poa annua L.	annual bluegrass	6.2	39.9	13.0			
Thlaspi arvense L.	field penny-cress	1.0	2.5	49.2	1.0		

Veronica agrestis L.	field speedwell	6.0				4.0	7.0
Veronica persica Poir. in Lam.	Byzantine speedwell	6.2	3.4	20.3			
Viola arvensis Murray	field pansy	6.2	55.7	23.2	2.0	1.3	17.0
Biennial to perennial weeds with vegetative propagation							
Plantago lanceolata L.	buckhorn plantain	1.1	5.0	10.6			
Perennial weeds, where vegetative propagation prevails							
Perennial weeds, shallow rooting							
b) With strong tough stolons							
Elytrigia repens (L.) Desv.	couch grass	0.7*	18.5*	6.2*			
c) Species with softer	finer stolons						
Stachys palustris L.	marsh woundwort		0.7*				
Perennial weeds, deeper rooting							
a) Herbal species	forming stolons						
Cirsium arvense L. Scop.	creeping thistle			2.7*			1.0*
Weed infesting							
Hordeum vulgare L.	spring barley				2.0		
Dry matter of weeds during sampling ($g.m^{-2}$)		95.6	85.9	47.8	80.5	19.4	86.6
Number of weeds during sampling ($plants.m^{-2}$)		75.6	292.5	336.7	118.0	22.9	71.5
Yields of seeds, total harvested phytomass and some yield-forming components of crambe							
Number of plants during sampling ($plants.m^{-2}$)		137	116	393	221	130	84
Dry matter of plants during sampling ($g.m^{-2}$)		404.7	129.2	236.2	353.5	271.3	291.4
TKW (g)		7.45	7.65	7.15	6.22	6.85	7.64
Grain yield ($t.ha^{-1}$)		1.585	1.329	1.125	1.820	2.295	1.200
Dry matter yield of total phytomass ($t.ha^{-1}$)		3.673	2.892	3.696	7.035	5.572	3.659

*number of stems, culms, shoots

weight of total aboveground phytomass and number of plants per area. The effect of weed infestation on the given parameters was studied as well. The results were statistically evaluated by linear correlations.

RESULTS AND DISCUSSION

The representation of different weed species, their number and weight of the total aboveground dry matter at experimental sites for the studied period is presented in Table III. Underlined names of weeds are those classified into the category of dangerous species (K o h o u t et al., 1996). 35 weed species in total were identified in crambe stands for the studied period, 31 of it were annuals (percentage representation of species: spring weeds 25.9%, late autumn 16.2%, winter weeds 58.9%) and four biennials to perennial species. 26 weed species were found in Lukavec (spring 18.2%, late spring 18.2%, winter 63.3%), four species of it were biennials to perennial. 23 species in total were found at Ruzyně, 22 of it were biennial (spring weeds 27.3%, late spring 18.2%, winter 54.5%). Only one species (creeping thistle) was classified in perennial weeds.

The majority of weed species was at both sites. The highest number of weed species, compared with the other sites, which grew each year, was found at the site in Lukavec. High number of individual plants was found at common chickweed (49.2 plants.m^{-2} on average), field pansy (28.4 plants.m^{-2}), annual meadow grass (19.7 plants.m^{-2}), common lambsquarters (19.5% plants.m^{-2}).

The occurrence of buckwheat (21.1% plants.m^{-2} on average), cleavers (10.0 plants.m^{-2}) and field pansy (6.8% plants.m^{-2}) was dominant at Ruzyně.

The total number of weeds in conversion into area was lower at the site with better soil-climatic conditions at Ruzyně (70.8 plants.m^{-2} on average) compared with cooler and moister site in Lukavec (234.9 plants.m^{-2}). V r k o č and K ř i š ť a n (1974), e.g., indicated also higher occurrence of weeds in worse soil-climatic conditions. The given phenomenon is attributed mainly to moister conditions and higher supply of weed seeds in soil at the Lukavec site.

Some weeds, e.g. wild radish, common hemp, marsh woundwort (Lukavec), scarlet pimpernel, wild oat, pale persicaria, black henbane (Ruzyně), were found only at one site, what is partially connected with biology of the given species and their reaction to soil and climatic conditions. Other weeds were identified at the site only in single year, what can be particularly attributed to different weather conditions and different sowing dates of the studied crop. Numbers of weeds, neither representation of different species was in crambe too different from the number and representation

of weeds, which were finding in the stands of false flax (spring form) in the same period (S t r a š i l et al., 1999).

As to the total production of dry matter of weeds, during samplings we found the value 62.2 g.m^{-2} at the site in Ruzyně and 76.4 g.m^{-2} on average in Lukavec. Higher values of dry matter found in Lukavec are given by high number of weeds per area and by the fact that crambe stands here were thinner (Ruzyně 145, Lukavec 215 plants.m^{-2}). Owing to it, greater space was formed which allowed the growth of more robust weed plants (Table III).

Higher number of weeds by 8.1% on average over the years was found on fertilized plots in Lukavec and greater mass of their phytomass produced per area compared with unfertilized variants. In similar way in Ruzyně, we found higher weight of dry matter of phytomass by 118.3% on fertilized variants against unfertilized variants. Numbers of weeds in Ruzyně were, on the contrary, against Lukavec lower by 66.4% on average in fertilized variants compared with unfertilized variants. Numbers of weeds and production of their dry matter was significantly higher in fertilized variants in the years 1995 and 1997 when was much more precipitation during winter (Fig. 1) than in 1996. For example V r k o č, K ř i š ť a n (1972) or M a j e r í k o v á, Š i - m o n (1983) came to similar conclusions, when studying weeds in cereals or S t r a š i l et al. (1999) in false flax stands.

As to the effect of different crambe density on the number and production of weed dry matter, we found in Lukavec at higher sowing rate a lower number of weeds by 14.2% and a lower weight of weeds by 19.9% compared with lower sowing rate. In Ruzyně for two-year period lower number of weeds by 40.9% was found at higher sowing rate, but higher weight of weed dry matter by 10.3% compared with lower sowing rate.

The effect of stand density on the number of weeds in crambe was similar to the false flax stands, when for example in the false flax stands in the same period at lower sowing rate on average higher numbers of weeds (by 17%) were found together with higher production of phytomass dry matter (by 24%) against thicker stands (S t r a š i l et al., 1999). It is evident from the above that adequate increase of sowing rate can have a positive influence on the decrease of the numbers of weeds.

The sequence of the rate of effect of different factors as affected the composition of species spectrum, number and production of dry matter of weeds. The investigated factors can be grouped in descending order from strongest effect to the weakest one as follows: year – site – N fertilization – sowing rate.

In addition, we were finding how the number and weight of weeds (their competitiveness) were manifested in final yield of seeds and some yield-forming components of crambe. Average values of different studied parame-

IV. Correlation between number of weeds and different studied parameters at different sowing rate and fertilization in crambe

Parameter	V_1	V_2	N_0	N_1
Number of plants	0.525	0.503	0.544	0.404
Dry matter during sampling	−0.429	−0.695*	−0.327	−0.486
TKW	0.212	0.091	0.243	0.125
Seed yield	0.137	−0.632*	−0.718*	0.147
Seed + straw yield	−0.250	−0.654*	−0.593	−0.446

V_1 – at sowing rate 160 germinating seeds per square meter
V_2 – at sowing rate 240 germinating seeds per square meter
N_0 – without N fertilization in fertilizers
N_1 – at the rate 80 kg.ha^{-1} N
* $P < 0.05$, ** $P < 0.01$

V. Correlation between phytomass dry matter of weeds and different studied parameters at different sowing rate and fertilization in crambe

Parameter	V_1	V_2	N_0	N_1
Number of plants	−0.199	−0.289	−0.333	−0.262
Dry matter during sampling	−0.228	−0.372	−0.327	−0.341
TKW	−0.223	0.018	0.795**	0.760**
Seed yield	0.952**	−0.668*	−0.762*	0.760*
Seed + straw yield	−0.616*	−0.447	−0.670*	−0.701**

* $P < 0.05$, ** $P < 0.01$

ters of crambe and weeds in the period of observation 1994 to 1997 are presented in Table III. Correlation between given parameters is in Tables IV, V. It is apparent from the results that the numbers of weeds found had on average a significantly negative effect on crambe grain yields only on N-unfertilized plots with higher sowing rate of crambe (Table IV). A negative significant correlation was found also between the total weight of dry matter of crambe aboveground phytomass during sampling in the period of onset of anthesis and the number of weeds on plots with higher crambe sowing rate (V_2). In remaining studied parameters we did not find significant relationship between the number of weeds and investigated parameters.

Insignificant correlation between the number of weeds and grain yield of crambe at lower sowing rate V_1 can be attributed to the fact that lower number

of weeds as well as crambe did not lead to such competition in space, water and nutrients that should be manifested up to the significant influence of final yield of crambe seeds.

Without respect to the site, we found a significant influence of N fertilization and sowing rate on crambe grain yields (Table V) between weight of dry matter of phytomass of weeds and different studied parameters. On plots N-unfertilized or those with higher sowing rate negative values of correlation coefficients were found. On plots N-fertilized and with lower sowing rate positive, values of coefficients between weight of phytomass dry matter and presented parameters were found.

Positive correlations were also found between 1000-kernel weight and weight of dry matter of weed phytomass on unfertilized plots and those with lower sowing rate of crambe. In remaining studied parameters we did not find significant influence between weight of phytomass dry matter of weeds and studied parameters.

It is clear from correlations presented in Tables IV and V that under the given situation without respect to the studied parameters, numbers of weeds found out and particularly their weight (size) had generally negative impact mainly on crambe straw yields. This was also evident at lower sowing rate and when N fertilization was applied and when phytomass of weeds increased together with grain yield, though straw was reduced.

Increased phytomass of weeds at lower sowing rate had a negative impact on the seed yield, and not 1000-kernel weight, probably in connection with the fall of number of crambe seeds per plant.

When N fertilization was applied, increased value of phytomass dry matter of weeds had not negative influence on crambe seed yield, what is manifested by the correlation values in seed yield and 1000-kernel weight (Table V), because owing to fertilization higher crambe seed yield, higher number of seeds per plant, and higher 1000-kernel weight were also gained here.

Furthermore, it is apparent from correlations presented in both tables that higher sowing rate of crambe reduced number of weeds as well as increase of weight of their phytomass, what had was positively reflected in seed yields increase.

To compare competitiveness, herbicides were applied on a part of plots at both sites in the trials. It can be said that in comparison of plots treated with suitable herbicides with identical untreated plots under given conditions and weed spectrum, the numbers of weeds found had negative impact on crambe seed yields. 16.4% decrease on average of the seed yield of crambe was found against similar herbicide-treated plots.

It is evident from the results that application of suitable herbicides was always economically favourable, because the competitiveness of crambe against weeds has not been again fully manifested in most cases.

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Struktura výnosu katránu habešského (*Crambe abyssinica* HOCHST.) ve vztahu k zaplevelení při různém výsevku a hnojení dusíkem.

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V polních pokusech na dvou odlišných stanovištích bylo v letech 1994 až 1997 sledováno plevelné spektrum a vliv plevelů na strukturu výnosu katránu habešského. Stanovištní ukazatele na jednotlivých pokusných místech jsou uvedeny v tab. I. Výskyt srážek a teplot vzduchu za sledované období na jednotlivých stanovištích je na obr. 1. Základní údaje o agrotechnice a vegetačních pozorováních katránu za dané období na jednotlivých stanovištích jsou uvedeny v tab. II. Mezidruhová konkurence byla ověřována při dvou různých výsevcích katránu (V_1 – 160 klíčivých semen na m^2, V_2 – 240 klíčivých semen na m^2) a dvou stupních hnojení dusíkem v průmyslových hnojivech, a to bez hnojení dusíkem a při dávce 80 $kg.ha^{-1}$ N.

Na počátku kvetení katránu se na sledovaných variantách prováděl odběr plevelů i samotné plodiny současně. Z odebraných vzorků byly určeny jednotlivé plevelné druhy a stanoven jejich počet na ploše, čerstvá hmotnost a hmotnost sušiny. Počet rostlin, čerstvá hmotnost a hmotnost sušiny byly obdobně stanoveny i u katránu, kde byly následně stanoveny další ukazatele: HTS (hmotnost 1 000 semen), výnos semen, hmotnost sušiny celkové nadzemní fytomasy a počet rostlin na ploše.

Celkový počet plevelů v přepočtu na plochu byl nižší na stanovišti s lepšími půdně klimatickými podmínkami v Ruzyni (v průměru 70,8 $ks.m^{-2}$) oproti chladnějšímu a vlhčímu stanovišti v Lukavci u Pelhřimova (234,9 $ks.m^{-2}$). V Praze-Ruzyni jsme zjistili průměrnou hodnotu sušiny plevelů 62,2 $g.m^{-2}$, v Lukavci 76,4 $g.m^{-2}$ (tab. III). Vyšší hodnoty sušiny zjištěné v Lukavci jsou dány jednak vysokým počtem plevelů na plochu a jednak skutečností, že porosty katránu zde byly řidší (Ruzyně 145, Lukavec 215 $ks.m^{-2}$).

Na hnojených parcelách byl zjištěn v průměru let v Lukavci o 8,1 % větší počet plevelů a o 30,8 % větší hmotnost jejich fytomasy vytvořené na ploše oproti nehnojeným variantám. Obdobně v Ruzyni byla v průměru zjištěna na hnojených variantách o 118,3 % vyšší hmotnost sušiny fytomasy oproti nehnojeným variantám. Počty plevelů v Ruzyni byly naopak oproti Lukavci v průměru na hnojených variantách o 66,4 % nižší oproti nehnojeným variantám. Počty plevelů i tvorba jejich sušiny byly u hnojených variant výrazně vyšší v letech 1995 a 1997, kdy spadlo během zimního období daleko více srážek (obr. 1), než tomu bylo v roce 1996.

Pokud jde o vliv různé hustoty porostu katránu na počet a tvorbu sušiny plevelů, zjistili jsme v Lukavci při vyšším výsevku o 14,2 % nižší počet plevelů a o 19,9 % nižší hmotnost plevelů v porovnání s nižším výsevkem. V Ruzyni byl za sledované období zjištěn při vyšším výsevku o 40,9 % nižší počet plevelů, ale o 10,3 % vyšší hmotnost sušiny plevelů v porovnání s nižším výsevkem.

Zjištěné počty plevelů měly v průměru průkazně negativní vliv na výnosy zrna katránu na parcelách nehnojených N a také na parcelách s vyšším výsevkem katránu.

Nebyl zjištěn průkazný vztah mezi počtem plevelů a dalšími sledovanými ukazateli (hmotnost 1 000 semen, počet rostlin katránu na ploše, výnosem celkové fytomasy katránu) – tab. IV a V. Z korelací je dále patrné, že vyšší výsevek katránu snižoval počet plevelů a také nárůst hmotnosti jejich fytomasy, což se kladně promítlo do zvýšení výnosů semene.

Při porovnání parcel ošetřených vhodnými herbicidy se stejnými parcelami bez ošetření jsme v průměru zjistili snížení výnosu semen katránu o 16,4 % oproti obdobným parcelám ošetřeným herbicidy. Z uvedených výsledků je patrné, že aplikace vhodných herbicidů byla za daných podmínek vždy ekonomicky výhodná, neboť konkurenční schopnost katránu vůči plevelům se ve většině případů již plně neprojevovala.

Z dosažených výsledků lze obecně stanovit pořadí míry vlivu jednotlivých faktorů na složení druhového spektra, počet a tvorbu sušiny plevelů v sestupném pořadí od nejsilnějšího vlivu k nejslabšímu následovně: ročník – stanoviště – hnojení N – výsevek.

plevele; katrán habešský; hnojení N; výsevek; mezidruhová konkurence

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