The Influence of some Additives to Growing Indices and Meat Quality for One Summer Common Carp (Cyprinus Carpio L.)

Florin Molnar, Aurel Şara, Erol-Florian Gabor, Mihai Benţea

USAMV Cluj-Napoca, 400372 Cluj-Napoca, Str. Manastur Nr.3-5, România

Abstract

The aim of this research was to evaluate the use of additives in fodders for common carp (*Cyprinus carpio* L.). The experiment was carried out for a period of 257 at the fish farm from Mărtineşti in the county Cluj. The fish ware divided in 6 groups, LM-control group and 5 experimental groups; the fodder for the experimental groups was supplemented with Allzyme SSF (L1E), Bio-Mos (L2E), Allzyme SSF and Bio-Mos (L3E), Allzyme SSF and Sel-Plex (L4E) and Allzime SSF, Bio-Mos and Sel-Plex (L5E). Each batch contained 100 fish divided as it fallows: 50 common carp from Lausitz var. and 50 common carp from Galitian var. The average weight for both varieties of common carp was 1.5 g/ specimen. The groups were distributed in 6 cages with 150 mp. The best results regarding growing indices for Galitian var. ware obtained by L4E group with medium weight (MW) of 791.73±35.05g and the survival rate (SR) of 94%, compared with LM group (MW=743.37±39.20g and SR= 88%). In the case of Lausitz var. the best MW was obtained by L1E with 908.36±34.33g compared with LM (MW= 794.66±26.61g) and the best survival rate was obtained by L4E and L5E with SR=94% compared with LM (SR= 76%). The results reveal that the supplementation of fodder for both varieties of common carp (Lausitz and Galitian var.) carp with used additives determined a better growing rate and a better survival rate.

Keywords: Allzyme SSF, Bio-Mos, common carp, fodder additives, SelPlex, survival rate.

1. Introduction

A way to grow the nutritive value of fodder is the supplementation with fodder additives witch allow an increase of bioproductive performances of species with economical interest. The supplementation with fodder additives allow an increase of fodder consumption degree by use specie witch determine an increase of production indices. The utilization of enzymes as fodder additives in fish nutrition was first tested by using enzymatic extract from animal origins by Dabrovski [1] and Dabrovska [2] witch obtained positive results on carp. The most used enzyme is the phytase because the biggest amount of phosphorus from plant origin is as fitat , witch can not be digested by enzymes from fish guts. The phytase was introduced in fodders for fish species as carp [3, 4], channel catfish [5], tilapia, trout and other species. Jakson et. all.[6] in an experiment on channel catfish over a perioud of 10 weeks registred a decrease of phosphorus discarded in whater due to increase of bioavalability of phosphorus. The introduction of enzymatic complex Allzyme SSF before pelleting can increase availability of sugars, phosphorus and soluble nitrogen [7]. The positive effect of Allzyme SSF was demonstrated by Filler K. [8] in an experiment on Nile tilapia (*Oreochromis niloticus*) to witch obtained a positive effect ($P<0.01$) on weight gain.

Bio-Mos it is a mannanoligosacharidae derived from outer cell of Saccaromyces cerevisiae, from

* Corresponding author: Florin Molnar, Tel: +40745765968, Email: florinmolnar2000@gmail.com

Alltech Inc. USA. The effects of Bio-Mos are well documented on animal husbandry nutrition and recently being introduced in fish nutrition. The main effect of Bio-Mos, is the capacity of binding or agglutinate a series of bacteria, preventing their installation on guts and indirectly body infestation [9]. By his action on bacteria, the prebiotic Bio-Mos allows the uniform growing of microvili and increasing by this the absorption surface for nutrients and indirectly fodder use and health witch give a better body growth [10, 11]. The also reduce mortality rate, increase nonspecific immunity by lysozyme increase level [12].

The researches regarding the activity of Bio-Mos in common carp nutrition are limited. Staykov et. all [13] carried out an experiment on common carp in order to determine the effect of Bio-Mos prebiotic on growth, feed conversion and survival rate. The supplementation of fodder with Bio-Mos for common carp led to a 13% increase in body weight in the experimental group compared with control group, 17% increase of weight gain and 17.75% of feed efficiency. Regarding the health status of common carp, supplementation of fodder with Bio-Mos led to a decrease of mortality and an improvement of nonspecific immune system. Similar results ware reported by Culjak et all [14] after supplementing fodders with 0.6% Bio-Mos, obtaining 31.23g mean body weight for control group and 38.7g for experimental group. He also reported an increase with 24% of weight gain ($P<0.01$), a decrease of feed conversion ratio from 2.06:1 to 1.60:1 ($P<0.05$) and a decrease of mortality rate from 50% to 16.7%($P<0.01$).

Organic selenium maintains fish health and improves meat quality, growing, decrease mortality, increase hatching percent and decrease feed conversion ratio [15]. The supplementation with 0.5 mg/kg SelPlex of fodder for Prusian carp (*Carassius gibelio*) led to a 100% survival rate and to a 13.55% higher growth rate in the experimental group, compared to the control group [16]. The aim of this research was to determine the effects of fodder additives (Allzyme SSF, Bio-Mos and SelPlex) on growth and consumption indices, meat quality and survival rate in common carp (*Cyprinus carpio*) Lausitz and Galitian varieties.

2. Materials and methods

The experiments were carried out in Mărtineşti fish farm, Cluj County. The experiment took place over a period of 262 days divided in 2 stages as follows: first stage of 126 days (01.jul.2009-03.nov.2009) and the second stage of 136 days (03.may.2010-15.oct.2010). The research was conducted on a number of 600 fish (*Cyprinus carpio*) divided in 6 groups: one control group (M) and 5 experimental groups (100 fish/group), each group being consisted of 50 fish from Lausitz var. and 50 fish from Galitian var. At the beginning of the experiment the fishes were 1.5g in weight, 2cm in length and were at the age of 45 days. The fishes were raised in an 900 m^2 earth pound divided in 6 compartments (150m^2/compartment).

The fodder used had 38% crude protein, 7% crude fat and 4% cellulose content. The base fodder was supplemented with 0.02% Allzyme SSF for group L1E, 0.2% Bio-Mos for group L2E, 0.02% Allzyme SSF +0.2% Bio-Mos for group L3E, 0.02% Allzyme SSF + 0.03% SelPlex for group L4E and 0.02% Allzyme SSF + 0.2% Bio-Mos +0.03% SelPlex for group L5E. During the experiment, the body mass evolution, weight gain, growth rate and the feed conversion ratio were recorded. At the end of the experiment, the slaughter yield, crude chemical composition of meat, the Selenium content of the meat and the survival rate were determined.

Data has been statistically analyzed using GraphPad InStat® Software, using the ANOVA method.

Water parameters were recorded throughout the experimental period. The water samples were analyzed in the Zoohygiene Laboratory, from USAMV Cluj-Napoca. Dissolved oxygen content and pH were determined on site.

During 2009, temperature fluctuations were recorded in the first decade of July an in the third decade of August, followed by a sudden temperature drop at the end of September (table 1). The dissolved oxygen concentration was below the physiological limit [17] in July, August and September. The organic substance in the water showed increased values during July and August (table 1).

Table 1. Physical and chemical parameters of the water in the rearing pond, recorded in 2009

Month	Mean monthly temperature [°C]	Oxygen [mg/l]	pH	Nitrates mg/l	Nitrites mg/l
July	20.9	5.2	7.4	9.5	0.05
August	26.2	3.8	7.5	9.4	0.04
September	20.0	4.6	7.6	0	0
October	12.7	7.2	7.5	0	0
November	10.5	7.8	7.4	0	0

Table 2. Physical and chemical parameters of the water in the rearing pond, recorded in 2010

Month	Mean monthly temperature [°C]	Oxygen [mg/l]	pH	Nitrates mg/l	Nitrites mg/l
May	16,6	8.51	7.47	0	0
June	20,4	7.82	7.59	0	0
July	24,7	7.32	7.69	0	0.01
August	25,2	6.98	7.5	3	0.01
September	23,2	7.2	7.43	4	0

The sudden variations in temperature, the low O2 concentration and the high quantity of organic matter in the water led to a decrease of the water quality, having a negative effect on the fish feeding and, as a consequence, on the growth performance.

3. Results and discussion

The mean values of the body weight recorded in one summer old common carp (Lausitz and Galitian varieties) at the end of the experimental period are presented in table 3.

Table 3. Mean values of the body mass in one summer old common carp (Lausitz and Galitian varieties) at the end of the experimental period (2010)

group (n=30)	Mean body weight				X ± Sx	Minimum body weight	Maximum body weight	V%
	initial		final					
	g	%	g	%		g	g	
MLausitz	1.6	100	794.66	100	794.66±26.61	387	1163	20.64
1ELausitz	1.6	100	908.36	114.308	**908.36±34.33**	454	1438	24.49
2ELausitz	1.6	100	825.61	103.8947	825.61±17.49	589	1055	14.05
3ELausitz	1.6	100	859.6	108.172	859.60±26.57	583	1357	20.74
4ELausitz	1.6	100	887.47	111.6792	887.47±27.46	474	1400	21.21
5ELausitz	1.6	100	904.23	113.7883	**904.23±25.74**	469	1370	19.51
MGalitian	1.6	100	743.37	100	743.37±39.64	550	844	15.08
1EGalitian	1.6	100	790.37	106.32	**790.37±39.20**	602	961	14.03
2EGalitian	1.6	100	786.44	105.79	786.44±40.52	546	903	15.46
3EGalitian	1.6	100	784.75	105.57	784.75±30.31	630	925	10.92
4EGalitian	1.6	100	782.12	105.21	782.12±42.97	605	975	15.54
5EGalitian	1.6	100	791.73	106.51	**791.73±35.05**	561	930	14.68

P>0.05

At the end of the experimental period, the highest value of the body mass was recorded in group 1E, Lausitz variety, fed on 0.02% Allzyme SSF containing diet. Group 1E Lausitz shows a greater weight gain compared with all the other groups. At the end of the experimental period, group 1E Lausitz showed a mean body weight of 908.36g, 14.36% greater than the Lausitz control group (794.66g). The additives mix administered to group 5E Lausitz had a favorable influence on the body weight gain. The final body mass recorded in group 5E Lausitz was 904.23g, 13.85% greater than the Lausitz control group (794.66g).

Regarding the Galitian variety, the highest body mass value was recorded in group 5E Galitian

(791.73g), fed on fodders supplemented with the additives mix (0.02% Allzyme SSF + 0.2% Bio-Mos +0.03% SelPlex), 6.46% greater than the Galitian control group (743.37g). Allzyme SSF supplementation had also a positive effect on growth; group 1E Galitian showing a mean value of 790.37g, 6.33% greater than the Galitian control group.

These results show the positive effect of the used fodder additives on growth, results similar to those reported by Tran Ngoc Thien Kim and La Thanh Hung [18], who administered 0.02% Allzyme SSF in fodders for tilapia, which led to an improvement of the main productive indices.

From the data in table 3, a slight improvement of body mass can be seen in Lausitz groups compared to the Galitian groups; the differences recorded were statistically insignificant.

Based on the growth performances, the effects on the growth and consumption indices were determine for the additives used. The values for the growth and consumption indices are presented in table 4 (Lausitz variety) and table 5 (Galitian variety).

Table 4. Growth and consumption indices recorded in common carp, Lausitz variety, at the end of the experimental period

Group	Weight gain		Growth rate		FCR
	g	%	g/day	%	kg fodder/ kg body mass
MLausitz	793.06	100.00	3.06	100.00	2.67
1ELausitz	906.76	**114.34**	3.50	**114.34**	2.51
2ELausitz	824.01	103.90	3.18	103.90	2.52
3ELausitz	858	108.19	3.31	108.19	2.45
4ELausitz	885.87	111.70	3.42	111.70	**2.43**
5ELausitz	902.63	113.82	3.49	113.82	2.51

The results on production indices recorded at the end of experimental period show a positive influence on growth of additives supplemented in fodder (0.02% Allzyme SSF and 0.2%Bio-Mos) and of mixes administrated (0.02% Allzyme SSF + 0.2%Bio-Mos, 0.02% Allzyme SSF + 0.03%SelPlex and 0.02% Allzyme SSF + 0.2%Bio-Mos+ 0.03%SelPlex). The highest results regarding weight gain were registered by 1E Lausitz group(906.76g) with 14.34% higher compared with Lausitz control group(793.06g). The 1ELausitz group was followed by 5ELausitz with 13,82%, 4E Lausitz with 11,70 %, 3E Lausitz with 8,19% and 2E Lausitz with 3,90% higher weight gain compared with Lausitz control group.

The best growth rate was recorded in group 1E Lausitz (3.5g/day) compared with Lausitz control group. All experimental groups recorded a higher body weyght gain compared with Lausitz control group (table 4).

FCR values are superior to the experimental groups comparted with the control group, the best results being recorded in group 4E Lausitz (2.43:1) (table 4), confirming the results reported by Filler [8].

Table 5. Growth and consumption indices recorded in common carp, Galitian variety, at the end of the experimental period

Group	Weight gain		Growth rate		FCR
	g	%	g/day	%	kg fodder/ kg body mass
MGalitian	741.77	100.00	2.86	100.00	2.67
1EGalitian	788.77	**106.34**	3.05	**106.34**	2.51

2EGalitian	784.84	105.81	3.03	105.81	2.52
3EGalitian	783.15	105.58	3.02	105.58	2.45
4EGalitian	780.52	105.22	3.01	105.22	**2.43**
5EGalitian	790.13	**106.52**	3.05	**106.52**	2.51

Analyzing the data presented in table 5, all experimental groups show an increase of the body weight gain for the one summer old common carp, Galitian variety, compared with the control group. The best results for the growth rate were recorded in groups 1E Galitian and 5E Galitian, compared with the control group. The lowest FCR was recorded in 4E Galitian (2.43:1) and the highest value in the Galitian control group (2.67:1).

The results obtained regarding the growth and consumption indices in one summer old common carp, Lausitz variety are better than the results recorded in the Galitian variety.

The crude chemical composition of common carp meat, Lausitz variety, is presented in table 6.

Table 6. Crude chemical composition of common carp meat, Lausitz variety(n=30)

group	DM %	CP %	CF %
M	24.64±0.39	18.80±0.35	4.62±0.18
1E	24.07±0.26	17.94±0.12	3.86±0.21
2E	24.13±0.30	18.22±0.46	4.28±0.27
3E	24.20±0.39	18.23±0.48	4.47±0.18
4E	24.23±0.25	18.30±0.40	4.36±0.14
5E	24.33±0.33	18.25±0.43	4.16±0.23

P>0.05

The data presented in table 8 showed a decrease in dry matter content of the meat in all experimental groups. The lowest value was recorded in group 1E Lausitz (24.07%) and the highest in the control group (24.64%).

The crude protein content decreased in all experimental groups; the lowest value was recorded in 1E Lausitz group (17.94%) and the highest in Lausitz control group (18.80%).

The selenium content in common carp, Lausitz variety is presented in table 7.

Table 7. Selenium content in common carp, Lausitz variety (µg Se/kg meat)

	M (n=5)	4E (n=5)
X±sx	131.30 ±7.25	**181.09 ±16.74***
Minimum	116.56	133.85
Maximum	156.45	233.24

*=significant differences, P<0.05

One of the meat quality indicators is the Selenium content of meat. Selenium plays an important role in cancer prevention; his main role in the organism is to stop the free radicals actions. Determining the Selenium content of the meat can point out an increased assimilation of this element in the carp meat.

The Selenium content of meat had higher values in group 4E Lausitz. These values show the cumulative effect of organic Selenium in common carp meat.

The slaughter yield for common carp, Lausitz variety, at the end of the experimental period are presented in table 8.

Table 8. Slaughter yield for common carp, Lausitz variety, at the end of the experimental period

Group	M	1E	2E	3E	4E	5E
%	61,07	62,54	63,08	63,92	60,91	59,78

Results obtained are close to the one that Bud and Miresan [19] reported, the best results being recorded in group 3E Lausitz (63.92%), the lowest being recorded in group 5E Lausitz (59.78%).

The survival rate recorded at the end of the experimental period in one summer old common carp, Lausitz variety, are presented in table 9 and for Galitian variety in table 10.

Table 9. Survival rate recorded at the end of the experimental period in one summer old common carp, Lausitz variety

Group	Initial Number	Final Number	Survival rate %
M Lausitz	50	38	76
1E Lausitz	50	42	84
2E Lausitz	50	44	88
3E Lausitz	50	45	90
4E Lausitz	50	47	**94**
5E Lausitz	50	47	**94**

All the experimental groups showed improved survival rates, compared to the control group. At the end of the experimental period, group 1E Lausitz showed a 10.52% improvement in the survival rate, compared with the control group, which presented the lowest value. The highest value of the survival rate was recorded in group 4E Lausitz and 5E Lausitz (23.68% higher than control group).

Table 10. Survival rate recorded at the end of the experimental period in one summer old common carp, Galitian variety

Group	Initial Number	Final Number	Survival rate %
M	50	38	76
1E	50	40	80
2E	50	42	84
3E	50	45	90
4E	50	45	90
5E	50	47	**94**

The best survival rate was recorded in group 5E Galitian, 23.68% higher than the control group. Also the 3E Galitian and 4E Galitian groups presented an improvement of the survival rate, compared with the control group.

These improvements of the survival rates confirm the positive biological effects of the additives used on the one summer old common carp.

4. Conclusions

- At the end of the experimental period (2010), the highest values regarding the body mass in the carp from Lausitz variety, were recorded in the 1E Lausitz (0.02% Allzyme SSF) and 5E Lausitz (0.02% Allzyme SSF + 0.2% Bio-Mos + 0.03 SelPlex). All the experimental groups showed an increased final body weight compared with the control group.
- At the end of the experimental period (2010), the highest values regarding the body mass in the carp from Galitian variety, were recorded in the 5E Galitian (0.02% Allzyme SSF + 0.2% Bio-Mos + 0.03 SelPlex). All the experimental groups showed an increased final body weight compared with the control group.
- The weight gain showed higher values in groups 1E Lausitz (14.34% higher than the control Lausitz group) and 5E Galitian (6.5% higher than the Galitian control group).
- The use of Allzyme SSF enzyme complex (0.02%) in the diets for one summer old common carp determined an increased growth rate in the experimental groups 1E Lausitz and 5E Galitian

- The best FCR values were recorded in groups 4E Lausitz (2.43:1) and 4E Galitian (2.43:1)
- The highest Selenium content of meat was recorded in group 4E Lausitz, 37.92% higher than the Lausitz control group.
- The best survival rate was recorded in group 4E Lausitz and 5E Lausitz (94%) and 5E Galitian (94%) respectively.

References

1. Dabrowski, K., and Glogowski, J., Studied on the proteolztic enzymes of invertebrates constituting fish food, Hzdrobiologia, 1977, 52,2-3, 171-174
2. Dabrowska, H., Grudniewski, C., and Dabrowski, K., Artificial diets for common carp: Effect of the Addition of enzyme extract, The Progresive Fish-Culturist, 1979, 41, 196-200, doi: 10.157/158-8659(1979)41[196:ADFCC]2.0.CO;2
3. Nwana, L. C., Kolahsa, M., Eisenreich, R., and Schwarz, F. J., Pre-treatment of dietary plant feedstuffs with phytase and its effect on grtale inowth and mineral concentration in common carp (Cyprinus carpio L.), Journal of Animal Physiology and Animal Nutrition, 2008, 92, 6, 677 – 682
4. Sardar, P., Randhawa, H. S., Abid, M., Prabhakar, S. K., Effect of dietary microbial phytase supplementation on growth performance, nutrient utilization, body compositions and haemato-biochemical profiles of Cyprinus carpio (L.) fingerlings fed soyprotein-based diet, Aquaculture Nutrition, 2007, 13, 6, 444-456(13)
5. Eya, J. C., and Lovell, R. T., Net Absorption of Dietary Phosphorus from Various Inorganic Sources and Effect of Fungal Phytase on Net Absorption of Plant Phosphorus by Channel Catfish Ictalurus punctatus, Journal of the World Aquaculture Society, Published Online: 3 Apr 2007, 28, 4, 386 – 391 Jackson, L. S., Meng, H. Li., Edwin H., Robinson, Use of Microbial Phytase in Channel Catfish Ictalurus Punctatus Diets to Improve Utilization of Phytate Phosphorus, Journal of the World Aquaculture Society,27,3, 309 – 313, Published Online: 3 Apr. 2007
6. Filler, K., Nattawade Jantasilia; Navaporn Chauynarong, Influence of Allzyme® SSF on the digestion of aquaculture feed ingredients prior to pelleting, Nutritional Biotechnology in the Feed and Food Industries Proceedings of Alltech's Twenty Third Annual Symposium Edited by TP Lyons, KA Jacques and JM Hower, 2007
7. Filler, K.; Ben L., Schafer; Steven R., Craig; Brian, Hoskins And James L. Pierce, Effects of Allzyme® SSF on the Growth Performance of Nile Tilapia, Aquaculture 2010 - Meeting Abstract(poster), Aquaculture 2010 San Diego, California, Feeds/Nutrition Posters, posted online: http://www.was.org/WasMeetings/meetings
8. Sweetman, J., Dimitrologu, A., Davies, S., and Torrecillas, S., Nutrient Uptake Gut morphology a key to efficient nutrition, International AquaFeed, January-February 2008
9. Torrecillas, S., Makol, A., Caballero, M. J., Montero, D., Robaina, L., Real, F., Sweetman, J., Tort, L., Izquierdo, M. S., Immune stimulation and improved infection resistance in European sea bass (Dicentrarchus labrax) fed mannan oligosaccharides, Fish & Shellfish Immunology , 2007, 23 , 969-981
10. Torrecillas, S., Makol, A., Caballero, M. J., Montero ,D., Robaina, L., Real, F., Sweetman, J., Tort, L., Izquierdo, M.S., Does feeding Bio-Mos® enhance immune system function and disease resistance in European sea bass (Dicentrarchus labrax)?, Izquierdo 3/28/2007
11. Staykov, Y., Spring, P., Denev, S., Sweetman, J., Effect of a mannan oligosaccharide on the growth performance and immune status of rainbow trout (Oncorhynchus mykiss). Aquac. 2007, 15, 153-161
12. Staykov, Y., Denev, S., Spring, P., The effects of mannan oligosaccharide (Bio-Mos) on the growth rate and immune function of common carp (Cyprinus carpio L.). Lessons from the past to optimise the future, Ed. by B. Howell and R. Flos. European Aquaculture Society, Special Publication, 2005, 35, pp. 431-432
13. Culjak, V., Bogut, I., Has-Schon, Milakovic, Z., Canecki, K., Effect of Bio-Mos® on performance and health of juvenile carp. Nutrition and Biotechnology in the Feed and Food Industries: Alltech's 22nd Annual Symposium, 2006, (Suppl. 1 - Abstracts of posters presented) Lexington, KY, USA.
14. Wang, C., Lovell, R. T., Klesius, P. H., Response to Edwardsiella ictaluri challenge by channel catfish fed organic and inorganic sources of selenium., J. Aq. An. Health, 1997, 9, 172-179
15. Yambo, W., Jianzhong, H., Weifen, L., Zirong, X., Effect of different selenium source on groeth performances, glutathione peroxidase activites, muscules composition and selenium conception of alloghynogenetic crucian carp (Carassus auratus gibelio), Feed Science Institute of Zhejiang University, Hangzhou, China , 2006
16. Bud, I., Diaconescu, Ş., Mudure, M., Creşterea crapului şi a altor specii de peşti, Editura Ceres, Bucureşti, 2004
17. Tran Ngoc Thien Kim, Le Thanh Hung, Effect of Allzyme SSF on growth performances and feed utilization in tra and basa catfish fingerlings Pangasius Hypophthalmus and Pangasius Bocourti; Catfish Aquaculture In Asia: Present Status And Challenges For Sustainable Development, 2008
19. Bud, I., Mireşan, V., Contributions concerning the quality indices' appreciation in main aquatic organisms, which fall under human consumption. AACL Bioflux

2008, 1, 73-83. Printed version: ISSN 1844-8143 Online version: ISSN1844-9166 available at: http://www.bioflux.com.ro/docs/vol1/2008.1.73-83.pdf, 008