

PROBIOTICS AND HERBS IN CARP (*CYPRINUS CARPIO* L.) POND AQUACULTURE – IMPACT ON FISH GROWTH, HEALTH AND PRODUCTION EFFICIENCY

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PROBIOTICI I LEKOVITO BILJE U UZGOJU ŠARANA (*CYPRINUS CARPIO* L.) U ZEMLJANIM BAZENIMA - UTICAJ NA PRIRAST RIBE, ZDRAVLJE I PROIZVODNE REZULTATE

Apstrakt

Cilj ovog rada je da prikaže rezultate ishrane šarana tradicionalnom smešom žitarica (tritikale + pšenica) sa dodatkom probiotika i/ili lekovitog bilja.

Kao probiotik korišćen je koncentrat EmFarma, koji je obezbedio „ProBiotics Polska” iz Poljske. Ova smesa sadrži skup sledećih mikroorganizama, bakterija i gljivica: *Bifidobacterium animalis*, *Bifidobacterium bifidum*, *Bifidobacterium longum*, *Lactobacillus acidophilus*, *Lactobacillus bulgaricus*, *Lactobacillus casei*, *Lactobacillus delbrueckii*, *Lactobacillus plantarum*, *Lactococcus diacetyllactis*, *Lactococcus lactis*, *Streptococcus thermophilus*, *Bacillus subtilis* var *natto*, *Saccharomyces cerevisiae* and *Rhodospseudomonas palustris*. Koncentrat probiotskih mikroorganizama dodat je u mleveni kukuruz u količini od 2 litra preparata na 1 tonu hraniva. Pre dodavanja hranivima probiotski preparat je razređen u vodi. Količina dodate vode bila je oko 10% od težine hrane. Posle mešanja probiotika sa kukuruzom, hranivo je ostavljeno dva sata da nabubri.

Lekovito bilje sastojalo se od praha *Terminalia chebula*, *Phyllanthus emblica*, *Andrographis paniculata*, *Tinospora cordifolia* i *Boerhaavia diffusa*. Biljni preparat dobijen je od kompanije Farmwet iz Poljske. Mešavina bilja dodata je u količini od 3 kg na tonu kukuru-
zne prekrupe. Bilje u prahu pomešano je sa prekrupom, zatim navlašeno vodom u količini od oko 10% od doze hrane i ostavljeno dva sata da nabubri.

Ispitivanje je vršeno na šest hranidbenih grupa:

- I - samo prirodna hrana (kontrolna grupa)
- II - smeša sa kukuruznom prekrupom
- III - smeša sa kukuruznom prekrupom obogaćena probioticima
- IV - smeša sa kukuruznom prekrupom obogaćena lekovitim biljem
- V - smeša sa kukuruznom prekrupom obogaćena probioticima i lekovitim biljem
- VI - peletirana hrana Aller Aqua (referentna grupa)

Ekperimentalne smeše korišćene su za ishranu šaranske mladi (C1), dvogodišnjaka za dalji uzgoj (C2) i konzumnih šarana (C3). Gustine nasada šarana bile su sledeće:

- za C1– 20000 jedinki/ha
- za C2– 5000 jedinki/ha
- za C3–1500 jedinki/ha

Sledeći parametri su mereni i analizirani:

- završna telesna masa (g/jedinka)
- prinos (kg/ha)
- stopa preživljavanja (S)
- stopa konverzije hrane, FCR (kg)
- Fultonov koeficijent (F)
- broj parazita (*Trichodina–Trich.*, *Chilodonella–Chil.*, *Epistylis–Epist.*, *Costia.*)
- nivo lizozima (mg/l)
- nivo gama globulina (g/l)

Ključne reči: šaran, tradicionalan uzgoj u bazenima, održivost, probiotici, bilje

Tabela 1. Rezultati ishrane šaranske mladi (C1) smešom žitarica sa dodatkom probiotika i/ili lekovitog bilja

Grupa	Težina g/jed.	S (%)	FCR (kg)	F	Prinos kg/ha	<i>Trich.</i>	<i>Chil.</i>	<i>Epist.</i>	<i>Costia</i>	Lisozyme	Gama globulini
I	29	42	0	1,68	241	18	28	22	17	2,3 ^b	9,6 ^b
II	66	45	2,6	1,71	594	17	22	19	33	2,6 ^{ab}	6,9 ^a
III	66	64	2,4	2,18	845	16	11	9	12	1,8 ^a	7,1 ^{ab}
IV	66	50	2,3	1,93	660	5	5	6	10	2,4 ^{ab}	10,0 ^b
V	64	63	2,7	1,82	806	8	11	11	11	3,2 ^b	8,7 ^{ab}
VI	75	83	0,7	2,01	1245	0	1	0	0	3,1 ^b	10,4 ^b

U okviru kolona, podaci obeleženi različitim slovima značajno se razlikuju ($P < 0,05$), a obeleženi istim slovima nalaze se u istoj homogenoj grupi.

Tabela 2. Rezultati ishrane dvogodišnjih šarana za dalji uzgoj (C2) smešom žitarica sa dodatkom probiotika i/ili lekovitog bilja

Grupa	Težina g/jed.	S (%)	FCR (kg)	F	Prinos kg/ha	<i>Trich.</i>	<i>Chil.</i>	<i>Epist.</i>	<i>Costia</i>	Lisozyme	Gama globulini
I	86	45	0	1,18	196	35	31	42	21	0,82 ^a	6,6 ^a
II	209	92	2,2	1,56	967	23	39	22	32	0,96 ^a	10,6 ^b
III	216	82	1,8	1,51	891	12	12	6	11	-	-
IV	214	98	1,7	1,52	1043	12	4	8	0	0,78 ^a	16,6 ^c
V	315	85	1,2	1,70	1350	3	4	2	3	1,29 ^b	15,3 ^c
VI	346	98	0,9	2,02	1695	5	0	0	2	1,03 ^{ab}	15,5 ^c

U okviru kolona, podaci obeleženi različitim slovima značajno se razlikuju ($P < 0,05$), a obeleženi istim slovima nalaze se u istoj homogenoj grupi.

Tabela 3. Rezultati ishrane konzumnih šarana (C3) smešom žitarica sa dodatkom probiotika i/ili lekovitog bilja

Grupa	Težina g/jed.	S (%)	FCR (kg)	F	Prinos kg/ha	<i>Trich.</i>	<i>Chil.</i>	<i>Epist.</i>	<i>Costia</i>	Lisozyme	Gama globulini
I	658	67	0	1,32	661	12	18	22	11	1,6 ^a	11,8 ^c
II	1367	100	4,0	1,93	2051	13	14	22	32	2,3 ^b	5,5 ^a
III	1386	100	3,5	1,92	2079	10	15	6	21	2,0 ^{ab}	8,2 ^b
IV	1325	100	3,8	1,97	1988	0	3	2	2	1,7 ^{ab}	9,4 ^b
V	1391	100	3,6	2,02	2087	1	3	4	3	1,9 ^{ab}	9,3 ^b
VI	1749	100	2,0	2,10	2624	2	0	1	0	1,8 ^{ab}	9,9 ^b

U okviru kolona, podaci obeleženi različitim slovima značajno se razlikuju ($P < 0,05$), a obeleženi istim slovima nalaze se u istoj homogenoj grupi.

Korišćenje probiotika i lekovitog bilja imalo je pozitivan efekat na prirast, stopu preživljavanja i ukupni prinos šarana koji su gajeni u zemljanim bazenima i hranjeni tradicionalnom smešom žitarica;

Korišćenje probiotika i/ili lekovitog bilja imalo je pozitivan efekat na uzimanje hrane, a stopa konverzije hrane (FCR) obično je bila smanjena 10% - 15% u grupama u kojima su korišćeni dodaci;

Dodatak probiotika i/ili lekovitog bilja smanjio je broj najčešćih spoljnih parazita kod šarana (*Trichodina*, *Chilodonella*, *Epistylis* i *Costia*);

Probiotici i lekovito bilje kod šarana su pokazali pozitivan efekat na otpornost na bolesti. Tradicionalna smeša žitarica obogaćena probioticima i/ili lekovitim biljem stimulatивно je delovala na povećanje nivoa gama globulina. Pozitivan efekat bio je posebno uočen kada su oba dodatka korišćena zajedno;

Kod šaranske mlađi (C1) probiotici i lekovito bilje ne treba da se primenjuju zajedno jer je u tom slučaju primećen smanjen prirast i nivo gama globulina.

Abstract

The aim of the paper is to present the results of feeding carp with traditional grain diet (triticale + wheat) supplemented with probiotics and/or herbs.

As probiotics, the EmFarma concentrate, provided by ProBiotics Polska, Poland, was used. This preparation contains consortia of the following microbial bacteria and fungi: *Bifidobacterium animalis*, *Bifidobacterium bifidum*, *Bifidobacterium longum*, *Lactobacillus acidophilus*, *Lactobacillus bulgaricus*, *Lactobacillus casei*, *Lactobacillus delbrueckii*, *Lactobacillus plantarum*, *Lactococcus diacetyllactis*, *Lactococcus lactis*, *Streptococcus thermophilus*, *Bacillus subtilis var natto*, *Saccharomyces cerevisiae* and *Rhodopseudomonas palustris*. The concentrate of probiotic microorganisms was added to the ground corn in an amount of 2 liters of preparation per 1 ton of feed. Prior to adding to the feedstuff, the probiotics were diluted in water. The amount of added water was approximately 10% of feed weight. After mixing probiotics with corn, the feed was left for two hours for swelling.

The composition of herbs consisted of powdered *Terminalia chebula*, *Phyllanthus emblica*, *Andrographis paniculata*, *Tinospora cordifolia* and *Boerhaavia diffusa*. The herbal preparation was obtained from the Farmwet company, Poland. The blend of herbs was added in the amount of 3 kg per ton of ground corn feed. The powdered herbs were mixed with grinded corn, moistened with water amounting to approximately 10% of feed dose and left for two hours for swelling.

Six feeding groups were examined:

- I - natural food only (control group)
- II - ground mix of corn
- III - ground mix of corn supplemented with probiotics
- IV - ground mix of corn supplemented with herbs
- V - ground mix of corn supplemented with probiotics and herb
- VI - pelleted feed Aller Aqua (referential group)

Experimental diets were used for feeding carp fingerlings (C1), two-year restocking material (C2) and consumable carps (C3). Stocking densities of carp, were as follows:

- for C1– 20000 ind./ha
- for C2– 5000 ind./ha
- for C3–1500 ind./ha

The following parameters were measured and analyzed:

- final body mass (g/ind.)
- yield (kg/ha)
- survival rate (S)
- FCR (kg)
- Fulton's coefficient (F)
- number of parasites (*Trichodina*–*Trich.*, *Chilodonella*–*Chil.*, *Epistylis*–*Epist.*, *Costia*,)
- level of lysozyme (mg/l)
- level of gamma globulins (g/l)

Key words: carp, traditional pond aquaculture, sustainability, probiotics, herbs

RESULTS

Table 1. The results of feeding carp fingerlings (C1) with grain diet supplemented with probiotics and/or herbs

Group	Weight g/ind.	S (%)	FCR (kg)	F	Yield kg/ha	<i>Trich.</i>	<i>Chil.</i>	<i>Epist.</i>	<i>Costia</i>	Lisozyme	Gamma globulins
I	29	42	0	1.68	241	18	28	22	17	2.3 ^b	9.6 ^b
II	66	45	2,6	1.71	594	17	22	19	33	2.6 ^{ab}	6.9 ^a
III	66	64	2,4	2.18	845	16	11	9	12	1.8 ^a	7.1 ^{ab}
IV	66	50	2,3	1.93	660	5	5	6	10	2.4 ^{ab}	10.0 ^b
V	64	63	2,7	1.82	806	8	11	11	11	3.2 ^b	8.7 ^{ab}
VI	75	83	0,7	2.01	1245	0	1	0	0	3.1 ^b	10.4 ^b

Within columns, data with different letters differs significantly ($P < 0,05$), with the same letters are in the same homogenous group.

Table 2. The results of feeding two-year carp stocking material (C2) with grain diet supplemented with probiotics and/or herbs

Group	Weight g/ind.	S (%)	FCR (kg)	F	Yield kg/ha	<i>Trich.</i>	<i>Chil.</i>	<i>Epist.</i>	<i>Costia</i>	Lisozyme	Gamma globulins
I	86	45	0	1.18	196	35	31	42	21	0.82 ^a	6.6 ^a
II	209	92	2.2	1.56	967	23	39	22	32	0.96 ^a	10.6 ^b
III	216	82	1.8	1.51	891	12	12	6	11	-	-
IV	214	98	1.7	1.52	1043	12	4	8	0	0.78 ^a	16.6 ^c
V	315	85	1.2	1.70	1350	3	4	2	3	1.29 ^b	15.3 ^c
VI	346	98	0.9	2.02	1695	5	0	0	2	1.03 ^{ab}	15.5 ^c

Within columns, data with different letters differs significantly ($P < 0,05$), with the same letters are in the same homogenous group.

Table 3. The results of feeding consumable carps (C3) with grain diet supplemented with probiotics and/or herbs

Group	Weight g/ind.	S (%)	FCR (kg)	F	Yield kg/ha	<i>Trich.</i>	<i>Chil.</i>	<i>Epist.</i>	<i>Costia</i>	Lisozyme	Gamma globulins
I	658	67	0	1.32	661	12	18	22	11	1.6 ^a	11.8 ^c
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III	1386	100	3.5	1.92	2079	10	15	6	21	2.0 ^{ab}	8.2 ^b
IV	1325	100	3.8	1.97	1988	0	3	2	2	1.7 ^{ab}	9.4 ^b
V	1391	100	3.6	2.02	2087	1	3	4	3	1.9 ^{ab}	9.3 ^b
VI	1749	100	2.0	2.10	2624	2	0	1	0	1.8 ^{ab}	9.9 ^b

Within columns, data with different letters differs significantly ($P < 0.05$), with the same letters are in the same homogenous group.

CONCLUSIONS

- the use of probiotics and herbs has had positive effect on growth, survival rate and total yield of carp reared in earthen ponds and fed traditional grain diet;

- the use of probiotics and/or herbs has had positive impact on food intake, food conversion rate (FCR) was usually reduced in 10% - 15% in groups where supplements were applied;

- the addition of probiotics and/or herbs decreased the number of the most common external parasites of carp (*Trichodina*, *Chilodonella*, *Epistylis* and *Costia*);

- probiotics and herbs presented positive effect on carp disease resistance. Supplementation of traditional grain diet with probiotics and/or herbs stimulated higher gamma globulins level. The positive effect was especially observed when both additives are used together;

- in case of carp fingerlings (C1) probiotics and herbs should not be applied together because when used together reduction of fish growth and gamma globulin level was observed.