ABAH BIOFLUX
Animal Biology & Animal Husbandry
International Journal of the Bioflux Society

# Impact of some forage additives on growth of carps in foothill areas

[1]Simion M. Moldovan, [2]Ioan Bud

[1] Forestry Department Cluj, Cluj-Napoca, Romania; [2] Faculty of Animal Husbandry and Biotechnology, University of Agricultural Sciences and Veterinary Medicine from Cluj-Napoca, Romania. Corresponding author: S. M. Moldovan, msimarian@yahoo.com

**Abstract**. Currently the carp (*Cyprinus carpio*) is the most widespread reared fish species in our country's farms, so that almost all water basins exploit this species, only exceptions being the salmon breeding units. Being a less demanding species to oxygen content of the water and with a remarkable plasticity, presents a permanently growing spread, including areas where was not possible until recently. As more and more wishful breeder, calls for growing technologies in colder areas, in this paper we have approached the growth of this species in the sub-mountainous area, using beside classic forages, forage additives as well, in several versions, to see which one of this seems to be the optimal. In this regard, we used BIO-MOS and NU-PRO probiotics in different concentrations, from Alltech U.S. firm. Basic feed was the SAPROFISH 25/12, and additive supplied variants were: group I – 0.2% BIO-MOS and 2%NU-PRO; group II – 0.4% BIO-MOS and 4% NU-PRO and group III – 0.6% BIO-MOS and 6% NU-PRO. The experiment was performed in four basins, of which one control and three experimental. Following investigations it was found that variant II, with 0.4% BIO-MOS and 4% NU-PRO was the only effective, under a reduced period of production cycle, and lower water temperatures. Our research demonstrated the possibility of carp growth in sub-mountain areas if forage additive supplies are given following the proportions of the variant II.
**Key Words**: *Cyprinus carpio*, probiotics, sub-mountainous area, forage aaditives.

**Introduction**. Fish farming, with products or by-products in aquaculture, should be treated more respectfully, while the animal protein derived from aquatic environment has an important role in developing and maintaining human health. Recent research has shown that the unsaturated fatty acids such as omega-3, obtained from different fish species, acts in blood in different ways, helping to strengthen the organism and minimizing the risk of disease of any kind (Bud & Mireşan 2008; Csép 2011).

From an economic point of view, fish farming offers the possibility of capitalization the land found by obtaining in a short time a large amounts of fish per unit area, all this for a low cost price (Billard 1999; Bud et al 2004; Bud et al 2010; Bura et al 1995; Horvath 2002; Păsărin & Stan 2003).

With the new trends of global warming, one of the most important guidelines in carp farming is expansions in various types of ponds at increasingly large altitudes.

In this framework encompasses our work, which aims to test some forage additives, as feeding supplies in carp feeding, growth in ponds with lower temperature, located at foothills.

**Material and Method**. The biological material was represented by common carp (*Cyprinus carpio*), from Ineu-Arad fish farming unit, with 88-95 g weight, forming four groups with 500 individuals each, assigned in four ponds with a total surface of 10,000 $m^2$.

The water depth of the ponds was 1.8-2.0 m, and the feeding flow 1.5 L $sec^{-1}$. The experiments were conducted at a private farm, located in Someşul Rece, Cluj County, Romania, during 17 May 2008 - 17 September 2009.

For this experiment we used three different experimental feed variants and a control, as follows: group I – control, with no forage additive supplement; group II -

0.2% BIO-MOS and 2% NU-PRO; group II – 0.4% BIO-MOS and 4% NU-PRO, and group III – 0.6% BIO-MOS and 6% NU-PRO.

The forage additives are made by Biotechnology Center Alltech – USA, and the basic forage used were SAPROFISH 25/12 STANDARD S.P. type.

Our research aimed to test the two forage additives at low temperatures and establish their impact on growth performance of common carp (Blaut 2002; Boirivant & Strober 2007). The pursued objectives were: impact of forage additives on the growth of carp at lower temperatures; influence of additives on resistance to wintering; additive effect on meat quality, and development of new technologies to grow common carp under nonspecific conditions.

**Results and Discussion**. Monitoring the environmental parameters allowed us to see that the temperature during biological cycle (May - September) was between 14.0 and 20.7°C, with an average of 18.18 °C, value which is generally lower with 4-6 °C than in traditional units, which adversely affects the ability of forage capitalization. Also, the biolgical cycle is reduced with approx. 60 days against hill and lowland areas (Table 1) (Bud et al 2004; Bud et al 2010; Bura et al 1995).

Table 1

Mean values of the physico-chemical parameters of the water at 17.05-17.09.2008 period

| *Parameter* | *May* | *June* | *July* | *August* | *September* | *Average* | *Limits** |
|---|---|---|---|---|---|---|---|
| pH | 7.77 | 7.90 | 7 | 7.54 | 7 | 7.44 | 5-8 |
| Temperature ($^oC$) | 16.8 | 19.0 | 20.4 | 20.7 | 14.0 | 18.18 | 15-28 |
| $O_2$ (mg $L^{-1}$) | 9.9 | 8 | 7.7 | 8.7 | 10.2 | 8.9 | 4-8 |
| CCO-Mn (mg $L^{-1}$) | 0.98 | 2.9 | 1.76 | 2.17 | 1.52 | 1.86 | - |
| Ammonium (mg $L^{-1}$) | 0.04 | 0.07 | 0.01 | 0.07 | 0.02 | 0.04 | 0.5-1.5 |
| Nitrites (mg $L^{-1}$) | 0.01 | 0.03 | 0.02 | 0.03 | 0.01 | 0.02 | 0.1-1 |
| Nitrates (mg $L^{-1}$) | 1.21 | 1.38 | 1.35 | 1.24 | 1.24 | 1.28 | 0.5-1.5 |
| Phosphates (mg $L^{-1}$) | 0.58 | 0.45 | 0.35 | 0.2 | 0.31 | 0.37 | 0.1-0.5 |
| Calcium (mg $L^{-1}$) | 17.2 | 21.85 | 21.24 | 33.27 | 26.45 | 21.00 | - |
| Magnesium (mg $L^{-1}$) | 6.38 | 9.82 | 8.02 | 5.35 | 7.04 | 7.32 | - |
| Iron (mg $L^{-1}$) | 1.08 | 1.2 | 2.15 | 2.2 | 2.1 | 1.74 | 1-4.5 |
| Chlorides (mg $L^{-1}$) | 4.07 | 4.91 | 6.79 | 5.44 | 6.5 | 5.54 | 5-10 |
| Sulphates (mg $L^{-1}$) | 8.7 | 6.94 | 6.74 | 8.08 | 8.74 | 7.84 | 2-30 |

*Limits are taken from Bud et al (2004).

Following the evolution of growth of II summer old carp, depending of adopted forage, we find, as can be seen from the Table 2, that the differences between the 4 groups are high, exclusively determined by the used feeding variant. Thus, although the production cycle is shorter than in the conventional technology (Billard 1999; Bud et al 2004; Bura et al 1995), carp reaches growth between 295.69 and 492.82 g, obtaining the most favorable values from group II, with 0.4% BIO-MOS and 4% NU-PRO, to which the other variants recorded significantly lower performance.

Table 2

Growth evolution of the two summer old carp depending on the administrated feeds

| *Specification* | *Control* | *Group I* | *Group II* | *Group III* |
|---|---|---|---|---|
| Initial weight (g) - 17.05.2008 | 91.85 | 94.50 | 88.20 | 95.00 |
| Final weight (g) - 17.09.2008 | 340.84 | 362.20 | 492.82 | 295.69 |
| Difference against control (g) | - | +21.36 | 151.98 | -45.15 |
| Body weight gain (g) | 248.99 | 268.30 | 404.62 | 200.69 |
| Average daily gain (g) | 2.00 | 2.15 | 3.25 | 1.61 |
| Survival rate (%) | 100 | 100 | 100 | 100 |
| Quantity of fish (kg) | 170 | 181 | 246 | 147.5 |

Regarding body weight gain, at group II this indicator reach the maximal value (404.62 g), followed by the group I (268.30 g), then by control (248.99 g), and at final by the group III (200.69 g). Following the body weight gain, there also the average daily weight gain is highest at group II (3.25 g), followed by the other three groups with values under 2.2 g. To be noted that due to water quality and administered forage, this ponds had no losses by mortality.

Compared to classic performances of carp growth, we note that the most performant variant (group II), aproach at a distance of 100–300 g the clasic technology, value which we consider particularly good if we take into account the possibility of capitalization of some basins with net lower possibilities than the classic ones (Horvath 2002; Oprea & Georgescu 2000; Păsărin & Stan 2003).

Further following the development of biological material during wintering, we find that although the wintering interval is longer with approx. two months, weight losses are more pronounced than in the classic systems, except group II, where these losses are bellow 10%, which we consider particularly favorable (Table 3).

Table 3

Body weight evolution of the carp groups during wintering

| *Date* | *Control* | | *Group I* | | *Group II* | | *Group III* | |
|---|---|---|---|---|---|---|---|---|
| | $\bar{X}$ | $\pm s_x$ | $\bar{X}$ | $\pm s_x$ | $\bar{X}$ | $\pm s_x$ | $\bar{X}$ | $\pm s_x$ |
| 01.10.2010 before wintering (g) | 340.84 | 8.05 | 362.8 | 8.05 | 492.82 | 14.76 | 295.69 | 8.86 |
| 01.04.2011 after wintering (g) | 306.4 | 6.81 | 308.4 | 6.85 | 445.88 | 9.76 | 256.30 | 7.73 |
| Weight loss | 34.44 | 9.52 | 54.40 | 9.55 | 46.94 | 16.93 | 39.39 | 13.08 |
| Weight loss rate (%) | 10.11 | | 15.00 | | 9.53 | | 13.33 | |

The benefic influence of forage additives can be seen in the survival rate in winter, which reaches maximum values (Balcazar et al 2004; Drinceanu 2000; Moldovan & Bud 2009).

At the and of winter III, the differences between groups widened, detaching the variant of group II with 0.4% BIO-MOS and 4% NU-PRO, which reached an average weight of 1,227.02 g, against which other groups have recorded values did not exceed 908 g (Table 4) differences being significant and assured.

Table 4

Growth evolution of the three summer old carp function of the administrated forages

| *Specification* | *Control* | *Group I* | *Group II* | *Group III* |
|---|---|---|---|---|
| Initial weight (g) 17.04.2009 | 306.40 | 308.40 | 445.88 | 256.30 |
| Final weight (g) 17.09.2009 | 850.26 | 907.82 | 1227.02 | 853.70 |
| Difference from the control group (g) | - | 57.56 | 376.76 | 3.44 |
| Body weight gain (g) | 543.87 | 599.42 | 781.14 | 597.40 |
| Average daily gain (g) | 3.49 | 3.84 | 5.01 | 3.83 |
| Survival rate (%) | 100 | 100 | 100 | 100 |
| Quantity of fish (kg) | 425 | 453.5 | 613.5 | 426.8 |

It should be noted that even in a case of lower temperatures than conventional, the forage additive influence in the group II has led to some unexpected performances, which indicates the appropriateness and timeliness of this experiment (Moldovan & Bud 2009; Şara & Odagiu 2008).

Another point to note is that in the 3rd summer, carp has growth in a water temperature which not exceeded 20°C, achieved an accumulation of body weight of more than 500 g, with the highest value at group II (781.14 g).

The beneficial role of forage additives has been noted regarding achieved average daily gain, which, in all experimental variants was higher than at control group, and at the resistance of the biological material, showing a really high survival rate.

If we analyze the carp's evolution during experiment, significant differences can be noticed between the four groups, these differences were determined on the one hand, by the environmental conditions in each of these ponds, and on the other hand, by the forage additive shares (Table 5). That is why the most favorable option proved to be variant II, leading to performance that can be taken into account by those who want to grow carp in ponds with lower water temperature.

Table 5

Evolution of the four carp populations during experiment

| *Specification* | *Control* | *Group I* | *Group II* | *Group III* |
|---|---|---|---|---|
| Initial weight (g) 17.05.2008 | 91.85 | 94.50 | 88.20 | 95.00 |
| Final weight (g) 17.09.2009 | 850.26 | 907.82 | 1227.02 | 853.70 |
| Difference from control (g) | - | 57.56 | 376.76 | 3.44 |
| Body weight gain (g) | 758.41 | 813.32 | 1138.82 | 785.70 |
| Average daily gain (g) | 1.52 | 1.63 | 2.88 | 1.52 |
| Survival rate (%) | 100 | 100 | 100 | 100 |
| Consumed forage (kg) | 1023.02 | 1075.48 | 958.51 | 890.19 |
| Quantity of fish (kg) | 425 | 453.5 | 613.5 | 426.8 |
| Forage conversion ratio | 2.40:1 | 2.37:1 | 1.56:1 | 2.08:1 |

Mean body weight of 1,227.02 g and body weight gain of 1,138.82 g, recommend variant II for development of new technologies of carp growth in non-specific conditions. Another aspect to be mentioned is related to the quantity of produced fish per pond, where in variant II this exceed 2,000 kg per ha water surface, with a conversion rate of 1.56:1, which we consider as very high.

**Conclusions**. Our research revealed the possibility of carp growth in areas with lower temperatures, if there are proper nutrition technology used, supplemented with some of the most effective forage additives.

During experiment cycle, the water temperature except winter, was between 14 and 22°C, which seriously left its mark the forage intake and growth performances.

Using combinations of BIO-MOS prebiotic and NU PRO probiotic as stimulators for better forage conversion, proved to be beneficial, depending on the applied combinations.

Providing the two forage additives had an extremely beneficial effect on the health of fish, expressed by the coefficient of wintering, due to which the percentage of survival was maximal.

We recommend growth of carps in ponds with lower temperatures, subjected to an adequate forage quality usage and supplemented with forage additives used in group II, which proved to be the most effective.

In conclusion, we note the contribution of forage additives on growth performance of carp in waters with lower temperatures and the possibility of extending the operation of carp production in mountain areas as well, which is a pioneering work for our country.

## References

Balcazar J. L., de Blas I., Ruiz-Zarzuela I., Cunningham D., Vendrell D., Muzquiz J. L., 2004 The role of probiotics in aquaculture. Veterinary Microbiology 114:173-186.

Billard R., 1999 Carp: Biology and Culture. Springer, Berlin, 342 pp.

Blaut M., 2002 Relationship of prebiotics and food to intestinal microflora. Eur J Nutr 41(Suppl 1):11-16.
Boirivant M., Strober W., 2007 The mechanism of action of probiotics. Curr Opin Gastroenterol 23:679–692.
Bud I., Mireşan V., 2008 Contributions concerning the quality indices appreciation in main aquaculture organisms, wich fall under human consumption. AACL Bioflux 1:73-83.
Bud I., Diaconescu Ş., Mudure M., 2004 [Carp and other fish breeding]. Ceres Publishing House, Bucharest, Romania [in Romanian].
Bud I., Vlădău V. V, Nădăşanu M., 2010 [Treaty for fish farming]. Texte Publishing House, Cluj-Napoca, Romania [in Romanian].
Bura M., Grozea A., Cornea I., Gergeni I., 1995 [Carp growth in ponds of different size]. Mirton Publishing House, Timisoara, Romania [in Romanian].
Csép L., 2011 The effect of common sea-buckthorn (*Hippophae rhamnoides* L.), upon productive performances, meat quality and health of carp (*Cyprinus carpio*). PhD Thesis, USAMV Cluj-Napoca, Romania [in Romanian].
Drinceanu D., 2000 [Biotechnology in Animal Nutrition]. Eurobit Publishing House, Timisoara, Romania [in Romanian].
Horvath L., 2002 Carp and Pond Fish Culture. MPG Books LTD, Great Britain.
Moldovan M., Bud I., 2009 Breeding posibilities of carp in lower temperature waters by adding some forage additives. Bulletin USAMV, Animal Science and Biotechnologies 66(1-2):321-325.
Oprea L., Georgescu R., 2000 [Nutrition and feeding of fish]. Technical Publishing House, Bucharest, Romania [in Romanian].
Păsărin B., Stan T., 2003 [Aquaculture]. Karro Publishing House, Iasi, Romania [in Romanian].
Şara A., Odagiu A., 2008 [Availability of probiotics and minerals in organically animal rearing]. ProEnvironment 2:89-93 [in Romanian].

Received: 20 April 2013. Accepted: 28 April 2013. Published online: 09 June 2013.
Authors:
Simion Marian Moldovan, Forestry Department Cluj, Bartok Bela Str., Cluj-Napoca, e-mail msimarian@yahoo.com
Ioan Bud, Faculty of Animal Husbandry and Biotechnology, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Manastur Str., no. 3-5, Cluj,-Napoca, Romania, e-mail ioanbud2000@yahoo.com

How to cite this article:
Moldovan S. M., Bud. I., 2013 Impact of some forage additives on growth of carps in foothill areas. ABAH Bioflux 5(1):94-98.