

WARM-WATER FISH FARMING AFTER SOIL REMEDIATION



M. Ćirković, B. Kartalović, D. Ljubojević, M. Pelić, M. Živkov Baloš, V. Đorđević,
N. Novakov

Scientific Veterinary Institute “Novi Sad”

INTRODUCTION

- Until now there has not been a lot of data in the literature relating to the construction of a pond on the land which served as a landfill and where remediation was performed
- It is particularly important that the water used for the pond has optimal physical and chemical characteristics for fish breeding and that there is enough water during the whole growing season
- Fish meat and fish products represent a valuable source of nutrients of great importance for a diverse and healthy diet.
- Adequate health care and appropriate intervention aims to preserve and improve fish production

THE AIM OF THIS PAPER IS TO SHOW THAT IT IS POSSIBLE TO PRODUCE FISH ON LAND WHERE REMEDIATION HAS BEEN DONE, WHICH IS A SIGNIFICANT CONTRIBUTION TO ENVIRONMENTAL PROTECTION AND RURAL DEVELOPMENT

MATERIAL AND METHODS

- The experiment was conducted within the meat industry in Kukujevci. **The land where pond was built was used as a village landfill.**



MATERIAL AND METHODS

- Construction of the fish pond started by **removing a soil layer with a thickness of 1 m**. 12000 m³ of excavated land was transported and disposed of, 12000 m³ was dug up and used, and 6000 m³ was brought from the site outside of the landfill. **Production took place in an area under the water of 5 ha**



MATERIAL AND METHODS

- Before starting the fish production, agricultural limestone was applied to the bottom of empty pond in an amount of 2000 kg/ha.



MATERIAL AND METHODS

- Filling of the fish pond with water was completed from two wells with a depth range of 75 to 95 meters, using a pumps capacity of 1000 l / min for each well.



MATERIAL AND METHODS

- Aeration was conducted using aerators (mud pumps) with a capacity of 2000 l/min spraying the water 5m above the surface. The flow of the water was 10 sec L/ha.



MATERIAL AND METHODS

- One-and two-year old common carp were stocked in the fish pond and the total stocking density was 600 kg/ha, with a ratio of 400 kg/ha for two-year old and 200 kg/ha for one-year old carp. The average weight of an one year old carp was **60 g** and a two-year old carp was **600 g**.
- During the production, commercial **extruded and pelleted fish feed**, with **32%** of proteins and **10%** of fat, were given to fish.
- Food obtained in a slaughterhouse as by-products of slaughterhouse industry (spleen, liver, lungs) with the addition of cereals (20% of soybean meal, 10% of sunflower meal (44% protein), 2%, of yeast, wheat and maize) was added. This mixture contains a total of 45% protein and 9% fat in dry matter.
- Feeding was carried out **twice a day** in 8 am, and the 3 pm.

MATERIAL AND METHODS

- During the production season continuous monitoring of the basic environmental conditions was undertaken twice a week, particularly the amount of **dissolved oxygen, biological oxygen demand, chemical oxygen demand, quantification of consumption of permanganate, amount of nitrite, nitrate, chloride, total phosphorus, ammonium ions and ammonia and pH.**
- The use of hydrated lime was **1000kg/ha** in April, May and June, while in July, August, September and October was **2000 kg/ha.**
- During the growing season the **health status and condition** of the carp was regularly controlled at least **twice a month.**

RESULTS

- **AVERAGE WEIGHT** of the two-year old carp was 900 g, and 3.8 kg for a three-year old carp.
- **PLANNED DENSITY** was about 5000 kg/ha.
- **CONVERSION** was 0.9 for formulated feed and 0.8 for additional mixtures counting in the dry matter.
- **MORTALITY** ranged from 5% in two-year old carps, and 10% in one-year old carps.
- During the health status of fish monitoring **erythrodermatitis** was diagnosed. The disease appeared from the middle of August with **prevalence of 25%**. After treatment with **flumequin in pelleted feed**, the symptoms of disease disappeared.

RESULTS

Table 1. Quality of well water and pond water before and after addition of lime, the range of maximum and minimum concentration of tested parameters

The tested parameter	Unit	Method	Before addition of lime	After addition of lime	Well water
pH		SRPS H.Z1.111:1987	7.4-7.9	7.8-8.4	7.5-7.7
COD	mgO ₂ /l	SRPS ISO 6060:1994*	20-26	5-10	2.83-3.81
BOD	mg O ₂ /l	H1.002*	6-9	<4	<4
KMnO ₄	mg/l	SRPS EN ISO 8467:2007*	30.8-35.6	21-26	1.53-1.80
Dissolved Oxygen	mg/l	SRPS ISO 5814:1994	5.8-6.2	7.56-7.94	5.0-5.6
Total N	mgN/l	Computing	2.20-2.90	1.21-1.72	2.07-2.71
Ammonia	mgN/l	SRPS ISO H.Z1.184:1974*	0.7-1.50	0.42-0.522	<0.02
Nitrate	mgN/l	SRPS ISO 7890-3:1994*	0.37-0.42	0.43-0.46	1.60-1.82
Nitrite	mgN/l	SRPS EN 26777:2009*	0.04-0.060	0.03-0.057	0.003
Chloride	mg/l	SRPS ISO 9297:1997 SRPS ISO 9297-1:2007	20-26	18-22	8-10
Phosphate	mgP/l	SRPS EN ISO 6878:2008*	0.035-0.042	0.011-0.013	0.026-0.031
Orthophosphate	mgP/l	SRPS EN ISO 6878:2008*	0.021-0.029	0.006-0.012	0.015-0.021
Metals					
Iron	mg/l	EPA 7000b*	<0.068	<0.068	<0.068
Zink	mg/l	EPA 7000b*	<0.011	<0.011	0.021-0.025
Arsenic	µg/l	EPA 7010*	2.06-2.75	<1.37	<1.37

RESULTS

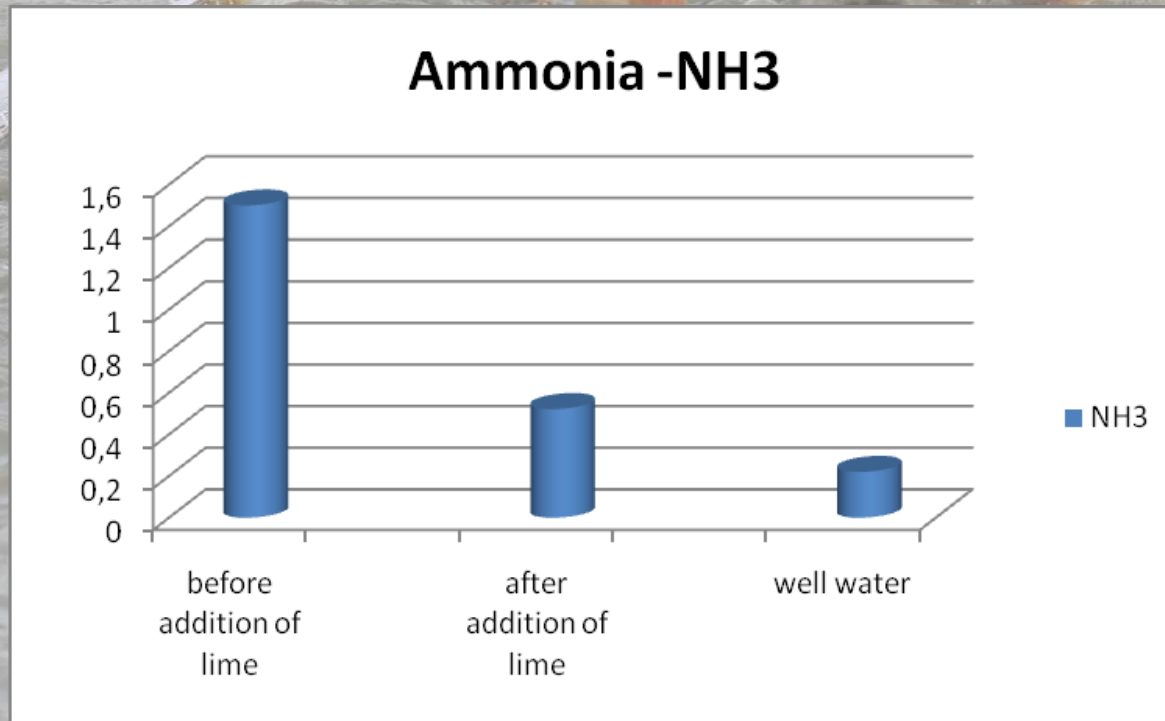
Table 2. Chemical and fatty acid composition of produced carp

Parameter	Carp
Water content (%)	78.36 ±0.24
Protein content (%)	16.21 ±0.12
Fat content (%)	4.42 ±0.17
Ash content (%)	1.02 ±0.02
Fatty acid, %	
PUFA/SFA	1.62 ±0.04
USFA/SFA	2.68 ±0.05
PUFA/MUFA	1.53 ±0.04

(Data are means ±S.E.M. (n = 12). Different superscripts within the same rows differ (P < 0.01), USFA – unsaturated fatty acids, SFA – saturated fatty acids, MUFA – monounsaturated fatty acids, PUFA – polyunsaturated fatty acids)

RESULTS

Graph 1. Level of ammonia in well water and in the pond water before and after addition of lime



DISCUSSION

- It is possible to breed carps in ponds where remediation has been performed and where there is a lot of organic material, which could not be completely eliminate by removing the surface layers of soil.
- **THE FAVORABLE WEIGHT OF THE CARP AT HARVESTING** is the result of good environmental conditions that were based on the use of well water, adequate flow, aeration, use of hydrated lime, quality of complete feed and feed supplements from the slaughter industry.
- The **ACCUMULATION OF CONTAMINANTS** in the fish tissues depends on their
 - ❖ concentration in the water
 - ❖ the lifetime of the fish,
 - ❖ the age and
 - ❖ the amount of body fat of fish

DISCUSSION

- The degree of contamination of water and harvested fish from an ecosystem can indirectly serve as **A BIOINDICATOR OF THE DEGREE OF CONTAMINATION OF THE ECOSYSTEM**
- Despite the removed soil, organic production was high as well as the amount of ammonium, which was balanced with the constantly adding of **HYDRATED LIME** (the amount which is higher than usual)
- **The meat quality of carp fish is very variable and changes under the influence of age, breeding systems and nutrition. The fat content in the carp generally ranges from 2.3 to 16.8%, while the protein content is less variable and generally is in the range of 14 to 18%**
- Fish eating birds were not present in the pond, and therefore have not been taken into account with regards to the fish mortality

CONCLUSIONS

It is possible to produce fish on land where remediation has been conducted.

Continuously monitoring of the environmental conditions during the entire process of production is necessary.

The use of hydrated lime is a limiting factor in fishery production in organic loaded water.

CONCLUSIONS

High production is the result of good nutrition and good environmental conditions. Favorable conversion per kg was the result of quality balanced meals.

The results of chemical composition of carp meat shows that a very high-quality food is produced

Remediation contributes to environmental protection and rational usage of land area.

A large, white fishing net is filled with numerous fish of various colors, including goldfish and koi. The fish are packed closely together, and their scales and fins are visible through the mesh. The background is a dark, slightly murky water. In the center of the image, the text "Thank you for your attention!!!" is written in a bold, black, sans-serif font.

**Thank you for
your
attention!!!**