# Aspects Regarding the Influence of Growth Technology Concerning the Performances Production of the Rainbow Trout (*Oncorhynchus Mykiss*)

**Daniel Cocan, Vioara Mireşan, Camelia Răducu, Iulia Feştilă, Aurelia Coroian, Radu Constantinescu, Octavian Negrea, Rareş Ranga**

*University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Faculty of Animal Science and Biotechnologies, 400372-Cluj-Napoca, Manastur, 3-5, Romania*

**Abstract**

Experiments were conducted throughout 2009 and 2010. At the beginning of experiments, both in 2009 and in 2010, were formed two groups (M-control group; E-experimental group), each group far 600 rainbow trout (*Oncorhynchus mykiss*). Control group M has been exploited in the Fiad trout farm, Bistriţa-Năsăud County, and the experimental group E was operated in a recirculating system arranged in Cluj-Napoca. Experiments were conducted over 210 days, both in 2009 and in 2010. Initial body weight of the specimens was 22.70±0.40 g – group M, and 22.68±0.39 – group E, in 2009. In the second experimental series (2010), the initial body weight of the rainbow trout specimens was 22.69±0.28 g – group M, respectively 22.56±0.31 g – group E. As factors which influencing directly the growth dynamic of rainbow trout, were monitored the physico-chemical parameters of water from the two locations, and feed consumption. Production performances of the trout from the two experimental groups, were assessed using as indicators total weight gain (TWG) and specific growth rate (SGR). In 2009, TWG=370.92±4.37 g – group E vs. 79.59±1.09 g – group M ($p<0.001$), and SGR=1.55±0.01 g/day – group E vs. 0.33±0.005 g/day – group M ($p<0.001$). In 2010, TWG=377.85±3.97 g – group E vs. 103.78±1.28 g – group M ($p<0.001$), and SGR=1.57±0.01 g/day – group E vs. 0.43±0.005 g/day – group M. Analyzing the two indicators (TWG and SGR), we can conclude that due to optimal environmental conditions provided by the recirculating system, the production performances of rainbow trout in both experimental series, were significantly higher in group E compared with group M.

**Keywords**: environmental conditions, growth technology, rainbow trout, specific growt rate, total weight gain

## 1. Introduction

Rainbow trout (Oncorhynchus mykiss) subjected over time to various processes of selection and improvement, is characterized by a intensively. growing body In this regard, however, specialized literature quoted values vary widely, influenced by several factors, including: environmental conditions existing in various salmonid farms, construction methods adopted, the structure of feed and feeding frequency [1] and not least , genetic heritage of biological material exploited [2]. Trout growth and development requires knowledge of the minimum and maximum values of environmental parameters specific to each species fished. To get the best results you need to know the conditions of comfort, the intensity of physiological processes expressed by growth and development, record as the highest [3]. Also, breeding technology adopted largely influences growth and production performance of rainbow trout. The technical solutions and construction related control systems can ensure optimal growth environment, which directly influence feed consumption and indirectly trout growth and development.

*Corresponding author: Vioara Miresan,
Email: vmiresan@yahoo.com

## 2. Materials and methods

Experiments were conducted throughout 2009 and 2010. In early experiments, both in 2009 and in 2010 were formed two groups (control group M, E, experimental group) of 600 copies each rainbow trout (Oncorhynchus mykiss). Control group M has been exploited in the trout Fiad Nasaud county, and the experimental group E was operated in a recirculating system equipped in Cluj-Napoca. Range where experiments have been conducted from February to September in both 2009 and 2010. The experiment was 210 days in both 2009 and 2010.
The biological material studied was the rainbow trout in nursery salmonid complex Fiad-Telcişor, Nasaud County. The organization of experiments in both series (Series 2009, Series II 2010) was considered as a body weight of fish to be almost identical. Initial body weight of the specimens was 22.70±0.40 g (group I) and 22.68±0.39 g (group E) in 2009. In the second experimental series (2010), initial body weight of rainbow trout specimens was 22.69±0.28 g (group I) and 22.56±0.31 g (group E). Total length of specimens of the first test series, at the onset of the experiment (February 2009) was 12.79±0.08 cm (group I) and 13.00±0.09 cm (group E), and the series experimental 2010, the total length of specimens was 12.88±0.06 cm (group I) and 12.77±0.07 cm (group E).
As factors that directly influence the dynamics of rainbow trout growth were monitored physic-chemical parameters of water [4] of the two farms and feed structure given (Table 1).

**Table 1**. Composition and nutritive value of the administered fodder

| ISSUE | FODDER TYPE | | |
|---|---|---|---|
| | Aller PERFORMA 1.5 mm | Aller ON TOP Floating 3 mm | Aller ON TOP Floating 4.5 mm |
| Crude protein % | 48.00 | 45.00 | 45.00 |
| Crude fat % | 21.00 | 20.00 | 20.00 |
| NFE % | 14.50 | 16.00 | 16.00 |
| Ash % | 7.50 | 8.00 | 8.00 |
| Fiber % | 1.00 | 2.00 | 2.00 |
| Total phophorus (%) | 1.10 | 1.10 | 1.10 |
| Copper (mg/kg) | 0.00 | 3.00 | 3.00 |
| Crude energy (Kcal/MJ) | 5171/21.60 | 4924/20.50 | 4924/20.50 |
| Convertible energy (Kcal/MJ) | 4145/17.30 | 3887/16.20 | 3887/16.20 |
| Vitamin A (UI/kg) | 3.700,00 | 2.500,00 | 2.500,00 |
| Vitamin D3 (UI/kg) | 750.00 | 500.00 | 500.00 |
| Vitamin E (mg/kg) | 225.00 | 150.00 | 150.00 |
| Etoxiquin | * | * | * |

Were followed: the dynamics of body mass, total gain and average daily growth SMZ and ST. Analysis tools of physical and chemical water parameters were: Hanna Hi 9143 oximeter (+ automatic calibration temperature), pH meter Hanna HI 991404 Gro'Chek Combo (monitoring, pH, temperature, TDS, total dissolved solids, EC-conductivity) and pH meter Hanna HI 9813-6 portable (pH, temperature, TDS, total dissolved solids, EC-conductivity). For laboratory analysis of samples was used UVmini-1240 Shimadzu spectrophotometer. The results obtained were processed statistically using Microsoft Excel software, IBM SPSS and GraphPad Instat.

## 3. Results and discussion

Water is the living environment of the fish and it is therefore necessary to know its quality irrespective of the growth. To this end, one of the objectives envisaged to conduct our experiments in 2009-2010, was to monitor the values of main physical-chemical and biological water. Thus, all along the experiments were aimed temperature, dissolved oxygen, pH, hardness, ammonia, nitrates, nitrites and water transparency. All data obtained were processed and presented in Tables 2 and 3.

**Table 2.** Mean values of the main physico-chemical parameters of water from the two systems (2009)

| ISSUE | LOT | UM | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|
| Temperature* | M | $^oC$ | 1.55 | 3.60 | 6.15 | 8.39 | 11.00 | 17.85 | 20.75 | 17.50 |
| | E | $^oC$ | 13.82 | 14.14 | 14.40 | 15.43 | 16.50 | 17.02 | 17.18 | 16.33 |
| Dissolved oxygen* | M | mg $O_2$/l | 10.10 | 9.70 | 9.30 | 8.90 | 8.40 | 7.50 | 6.30 | 6.80 |
| | E | mg $O_2$/l | 9.90 | 9.80 | 9.40 | 9.40 | 9.40 | 9.50 | 9.70 | 9.80 |
| pH* | M | - | 7.3 | 7.2 | 7.1 | 7.2 | 7.4 | 7.3 | 7.2 | 7.3 |
| | E | - | 6.9 | 6.9 | 6.8 | 7.0 | 6.9 | 7.0 | 6.8 | 6.8 |
| Hardness** | M | $dH^o$ | 8.13 | 8.11 | 7.98 | 8.05 | 7.55 | 7.63 | 7.65 | 8.34 |
| | E | $dH^o$ | 8.68 | 8.44 | 8.35 | 8.13 | 7.69 | 8.10 | 7.89 | 8.45 |
| Ammonia** | M | mg/l | 0.006 | 0.007 | 0.009 | 0.009 | 0.010 | 0.009 | 0.010 | 0.009 |
| | E | mg/l | 0.070 | 0.070 | 0.080 | 0.080 | 0.090 | 0.090 | 0.100 | 0.080 |
| Nitrates** | M | mg $NO_3$/l | 0.17 | 0.15 | 0.14 | 0.17 | 0.17 | 0.15 | 0.16 | 0.17 |
| | E | mg $NO_3$/l | 0.21 | 0.21 | 0.23 | 0.20 | 0.23 | 0.22 | 0.20 | 0.19 |
| Nitrites** | M | mg $NO_2$/l | 0.03 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.03 | 0.03 |
| | E | mg $NO_2$/l | 0.05 | 0.04 | 0.04 | 0.05 | 0.05 | 0.06 | 0.04 | 0.05 |
| Water transparency** | M | m | 0.70 | 0.66 | 0.64 | 0.68 | 0.61 | 0.68 | 0.66 | 0.58 |
| | E | m | 0.59 | 0.61 | 0.61 | 0.59 | 0.58 | 0.60 | 0.62 | 0.63 |

M – control group (Fiad farm); E–experimental group (recirculating system); *-monitored daily; **-monitored montly

**Table 3.** Mean values of the main physico-chemical parameters of water from the two systems (2010)

| ISSUE | LOT | UM | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|
| Temperature* | M | $^oC$ | 2.04 | 3.85 | 6.28 | 9.16 | 12.50 | 17.71 | 19.23 | 14.34 |
| | E | $^oC$ | 14.06 | 14.38 | 14.69 | 15.50 | 16.92 | 17.34 | 17.60 | 16.96 |
| Dissolved oxygen* | M | mg $O_2$/l | 10.00 | 9.70 | 9.40 | 8.90 | 8.70 | 7.70 | 6.50 | 8.30 |
| | E | mg $O_2$/l | 9.80 | 9.80 | 9.70 | 9.40 | 9.50 | 9.50 | 9.80 | 9.50 |
| pH* | M | - | 7.2 | 7.2 | 7.0 | 7.1 | 7.2 | 7.3 | 7.1 | 7.1 |
| | E | - | 6.8 | 6.9 | 6.9 | 7.1 | 6.9 | 6.9 | 6.8 | 7.0 |
| Hardness** | M | $dH^o$ | 8.15 | 8.21 | 8.04 | 8.16 | 7.88 | 7.82 | 7.51 | 7.95 |
| | E | $dH^o$ | 8.59 | 8.47 | 8.50 | 8.28 | 7.93 | 8.26 | 7.91 | 8.11 |
| Ammonia** | M | mg/l | 0.005 | 0.006 | 0.006 | 0.007 | 0.008 | 0.008 | 0.008 | 0.008 |
| | E | mg/l | 0.080 | 0.090 | 0.090 | 0.100 | 0.080 | 0.110 | 0.100 | 0.100 |
| Nitrates** | M | mg $NO_3$/l | 0.16 | 0.15 | 0.16 | 0.14 | 0.15 | 0.17 | 0.15 | 0.15 |
| | E | mg $NO_3$/l | 0.19 | 0.21 | 0.19 | 0.20 | 0.19 | 0.21 | 0.21 | 0.20 |
| Nitrites** | M | mg $NO_2$/l | 0.04 | 0.04 | 0.03 | 0.03 | 0.04 | 0.05 | 0.05 | 0,04 |
| | E | mg $NO_2$/l | 0.06 | 0.04 | 0.06 | 0.06 | 0.05 | 0.05 | 0.06 | 0.06 |
| Water transparency** | M | m | 0.68 | 0.65 | 0.68 | 0.62 | 0.67 | 0.68 | 0.66 | 0.70 |
| | E | m | 0.64 | 0.60 | 0.54 | 0.55 | 0.50 | 0.52 | 0.49 | 0.50 |

M – control group (Fiad farm); E–experimental group (recirculating system); *-monitored daily; **-monitored montly

Mean values of main physical-chemical and biological water from the two farming systems, related both 2009 and 2010 had changes only in the batch M, due to the weather and rainfall, which influences the classical systems. In group E, physic-chemical and biological parameters showed no significant differences monthly.

In practice implicit in the livestock and fishery, one of the main goals in terms of animal production is shortening the production envisaged can be achieved. Current research in fish husbandry aimed particularly complex issues, to improve farming systems, the growth performance and disease resistance, genetic fish, aquatic toxicology, biotechnology implementation of breeding and feeding fish, on strictly scientific principles. Therefore, data from the literature on growth dynamics of rainbow trout classical systems are very different, taking into account the age of fish material. Thus, Smith [5], stated weight of 100 g trout for 1 year and 300-450 g at the age of three years, while other states are much different authors: 65-100 g at the age of 1.8 years [6], 250-350 g at the age of two years [7] or 175 g at the age of 2.2 years [8]. These differences in values can also be made on account of improved methods applied, as transgenesys [9], induction of polyploidy or obtaining monosex populations [10]. Also, large variability in data from the literature need not be caused by the system of growth and environment parameters which directly influence the growth of rainbow trout. Our research aimed to highlight differences in the dynamics and growth indices of rainbow trout in different farming systems. The results clearly show the importance of ensuring environmental conditions constant and consistent with the biological requirements of rainbow trout. In Tables 4 and 5 present the results obtained in 2009 and 2010 respectively on the dynamics and growth indices of rainbow trout in the two farming systems.

**Table 4.** Mean values and statistical significance regarding the growth dynamics and indices of rainbow trout (*Oncorhynchus mykiss*) - 2009

| ISSUE | GROUP | UM | n | VARIABLES | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | $\bar{X} \pm s_x$ | s | V% | d | semnif |
| Gi | M | g | 100 | 22.70±0,40 | 4.024 | 17.72 | -0,02 | p>0.05 |
| | E | g | 100 | 22.68±0,39 | 3.969 | 17.50 | ns | |
| Gf | M | g | 100 | 102.30±1,49 | 14.909 | 14.57 | 291,30 | p<0.001 |
| | E | g | 100 | 393.60±4,76 | 47.632 | 12.10 | *** | |
| ST | M | g | 100 | 79.59±1,09 | 10.935 | 13.73 | 291,33 | p<0.001 |
| | E | g | 100 | 370.92±4,37 | 43.727 | 11.78 | *** | |
| SMZ | M | g/zi | 100 | 0.33±0.005 | 0.046 | 13.73 | 1,22 | p<0.001 |
| | E | g/zi | 100 | 1.55±0.01 | 0.182 | 11.78 | *** | |

Gi-initial weight; Gf-final weight; ST-total gain; SMZ-average daily gain; M-control group (Fiad farm)
E-experimental group (recirculating system); n-number of individuals; X-mean; **$s_x$**-standard error of mean;
**s**-standard deviation; V%-variability; d-difference; semnif-significance

**Tabel 5.** Mean values and statistical significance regarding the growth dynamics and indices of rainbow trout (*Oncorhynchus mykiss*) - 2010

| ISSUE | GROUP | UM | n | VARIABLES | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | $\bar{X} \pm s_x$ | s | V% | d | semnif |
| Gi | M | g | 100 | 22.69±0.28 | 2.833 | 12.48 | -0.13 | p>0.05 |
| | E | g | 100 | 22.56±0.31 | 3.166 | 14.03 | ns | |
| Gf | M | g | 100 | 126.47±1.55 | 15.566 | 12.31 | 273.94 | p<0.001 |
| | E | g | 100 | 400.41±4.28 | 42,829 | 10.69 | *** | |
| ST | M | g | 100 | 103.78±1.28 | 12,810 | 12.34 | 274.07 | p<0.001 |
| | E | g | 100 | 377.85±3.97 | 39,722 | 10.51 | *** | |
| SMZ | M | g/zi | 100 | 0.43±0.005 | 0.053 | 12,34 | 1.14 | p<0.001 |
| | E | g/zi | 100 | 1.57±0.01 | 0.166 | 10.51 | *** | |

Gi-initial weight; Gf-final weight; ST-total gain; SMZ-average daily gain; M-control group (Fiad farm) E-experimental group (recirculating system); n-number of individuals; $\bar{X}$-mean; $s_x$-standard error of mean; s-standard deviation; V%-variability; d-difference; semnif-significance

Analyzing the two reveal the overall (total gain and average daily gain), we conclude that during the 210 days of the experiment conducted in 2009, total growth ST for the group E exploited in experimental recirculating system was 370.92 g, and average daily growth SMZ was 1.55 g/day. Experimental group values are significantly higher than the batch M made the trout Fiad exploited, is to increase the total ST 79.59 g, respectively 0.33 g/day for average daily gain SMZ. As mentioned, the two groups studied M and E, were among the same population (there were no differences in genetically) and feed use and feeding rate was identical. Explanation extremely large differences in the growth dynamics of the two groups can be made only on account of two factors: environmental conditions and feed intake (in turn influenced by environmental factors and breeding technology used).

For the year 2010, we conclude that during the 210 days of experiment, total growth for the group E ST exploited in experimental recirculation system was 377.85 g and average daily growth SMZ was 1.57 g/day. Experimental group values are significantly higher than the batch M made the trout Fiad exploited, is 103.78 g total increase ST,

respectively 0.43 g/day for average daily gain SMZ.
Analyzing differences between experimental groups and their significance on total increase ST (Table 6a, 6b), both at the level of 2009 and 2010 is observed in most cases very significant.

**Table 6a**. Statistical significance of the main values of the four groups (experimental series 2009-2010) regarding the total weight gain (ST) of the rainbow trout (*Oncorhynchus mykiss*) (Tukey-Kramer multiple range test)

| ISSUE | VARIABLES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | M1 vs E1 | | | M1 vs M2 | | | M1 vs E2 | | |
| | d | q | sem | d | q | sem | d | q | sem |
| FEB-MAR | 28.19 *** | 54.88 | p<0.001 | 1.87 ns | 3.64 | p>0.05 | 27.58 *** | 53.70 | p<0.001 |
| MAR-APR | 43.46 *** | 109.44 | p<0.001 | 1.63* | 4.10 | p<0.05 | 44.46 *** | 111.96 | p<0.001 |
| APR-MAY | 44.98 *** | 61.10 | p<0.001 | 4.76 *** | 6.46 | p<0.001 | 47.81 *** | 64.95 | p<0.001 |
| MAY-JUN | 19.60 *** | 34.75 | p<0.001 | 2.12* | 3.76 | p<0.05 | 20.03 *** | 35.51 | p<0.001 |
| JUN-JUL | 26.04 *** | 25.44 | p<0.001 | -2.15 ns | 2.10 | p>0.05 | 30.29 *** | 29.59 | p<0.001 |
| JUL-AUG | 58.45 *** | 54.99 | p<0.001 | 4.89 ** | 4.60 | p<0.01 | 59.96 *** | 56.41 | p<0.001 |
| AUG-SEPT | 70.61 *** | 75.52 | p<0.001 | 11.05 *** | 11.82 | p<0.001 | 68.13 *** | 72.87 | p<0.001 |

**Table 6b**. Statistical significance of the main values of the four groups (experimental series 2009-2010) regarding the total weight gain (ST) of the rainbow trout (*Oncorhynchus mykiss*) (Tukey-Kramer multiple range test

| ISSUE | VARIABLES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | E1 vs M2 | | | E1 vs E2 | | | M2 vs E2 | | |
| | d | q | sem | d | q | sem | d | q | sem |
| FEB-MAR | 26.32 ooo | 51.25 | p<0.001 | -0.61 ns | 1.18 | p>0.05 | 25.71 *** | 50.06 | p<0.001 |
| MAR-APR | 41.83 ooo | 105.34 | p<0.001 | 1.00 ns | 2.52 | p>0.05 | 42.83 *** | 107.86 | p<0.001 |
| APR-MAY | 40.22 ooo | 54.64 | p<0.001 | 2.83* | 3.84 | p<0.05 | 43.05 *** | 58.48 | p<0.001 |
| MAY-JUN | 17.48 ooo | 30.99 | p<0.001 | 0.43 ns | 0.76 | p>0.05 | 17.91 *** | 31.75 | p<0.001 |
| JUN-JUL | 28.19 ooo | 27.54 | p<0.001 | 4.25* | 4.15 | p<0.05 | 32.44 *** | 31.69 | p<0.001 |
| JUL-AUG | 53.56 ooo | 50.39 | p<0.001 | 1.51 ns | 1.42 | p>0.05 | 55.07 *** | 51.81 | p<0.001 |
| AUG-SEPT | 59.56 ooo | 63.70 | p<0.001 | -2.48 ns | 2.65 | p>0.05 | 57.08 *** | 61.05 | p<0.001 |

Thus, during February-March, both at the level of 2009 and 2010, we see significant differences (p<0.001) when comparing batches, except batch M1-M2 and E1-E2, where differences in growth ST totally insignificant (p>0.05). This indicates that in both experimental series, medical and nutritional conditions are leading to a total increase ST almost identical, it has the obvious characteristic value of each farming system basis. In the next period (March-April), difference in the M1-M2 lots became significant (p<0.05), precisely because there were differences between the two experimental series of environmental parameters, leading to different performance of trout. In the E1-E2 lots, ST difference in total growth remained insignificant (p>0.05) whereas in intensive recirculation systems medial parameters are optimized and constant regardless of season and weather conditions and weather. Move to the next period (April-May), we see a very significant difference (p<0.001) between groups M1-M2, while the E1-E2 lots difference is significant (p<0.05). Among all other groups were highly significant differences (p <0.001). Between May to June, due to different environmental conditions from one year to another, the difference between groups M1-M2 is again significant (p<0.05), while the E1-E2 lots, the difference of total growth ST was not significant (p>0.05). During June-July, we find a significant difference (p>0.05) between total growth of the lot and the lot M1 M2, because in this period, both in 2009 and 2010, environmental conditions have been the same for this time of year, which led to obtaining a total increase ST values close to both experimental years. The differences between the other experimental groups both in 2009 and from 2010 were highly significant (p<0.001). During July-August, M1-M2 difference between groups was distinctly significant (p<0.01) and E1-E2 between groups was significant (p>0.05). The latest range of experimental period (August-September), M1-M2 difference between groups was highly significant (p<0.001), while the E1-E2 lots again this was not significant (p>0.05).

In Table 7a and 7b the differences and their statistical significance of SMZ daily average gain of rainbow trout (*Oncorhynchus mykiss*) from two farming systems and the two test series (2009 and 2010). Since there is a proportional relationship between total growth ST and average daily growth SMZ significance of differences was identical to those presented in Table 6 and discussed above.

**Tabel 7a**. Statistical significance of the main values of the four groups (experimental series 2009-2010) regarding the average daily gain (SMZ) of the rainbow trout (*Oncorhynchus mykiss*) (Tukey-Kramer multiple range test)

| ISSUE | VARIABLES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | M1 vs E1 | | | M1 vs M2 | | | M1 vs E2 | | |
| | d | q | sem | d | q | sem | d | q | sem |
| FEB-MAR | 0.93 *** | 54.28 | p<0.001 | 0.06 ns | 3.50 | p>0.05 | 0.92 *** | 53.69 | p<0.001 |
| MAR-APR | 1.45 *** | 109.78 | p<0.001 | 0.06 ** | 4.54 | p<0.01 | 1.48 *** | 112.05 | p<0.001 |
| APR-MAY | 1.50 *** | 61.15 | p<0.001 | 0.15 *** | 6.11 | p<0.001 | 1.59 *** | 64.82 | p<0.001 |
| MAY-JUN | 0.65 *** | 34.57 | p<0.001 | 0.07* | 3.72 | p<0.05 | 0.66 *** | 35.10 | p<0.001 |
| JUN-JUL | 0.87 *** | 25.50 | p<0.001 | -0.07 ns | 2.05 | p>0.05 | 1.01 *** | 29.61 | p<0.001 |
| JUL-AUG | 1.95 *** | 55.03 | p<0.001 | 0.16 ** | 4.51 | p<0.01 | 2.00 *** | 56.45 | p<0.001 |
| AUG-SEPT | 2.35 *** | 75.40 | p<0.001 | 0.36 *** | 11.55 | p<0.001 | 2.26 *** | 72.51 | p<0.001 |

**Tabel 7b**. Statistical significance of the main values of the four groups (experimental series 2009-2010) regarding the average daily gain (SMZ) of the rainbow trout (*Oncorhynchus mykiss*) (Tukey-Kramer multiple range test)

| ISSUE | VARIABLES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | E1 vs M2 | | | E1 vs E2 | | | M2 vs E2 | | |
| | d | q | sem | d | q | sem | d | q | sem |
| FEB-MAR | 0.87 ooo | 50.78 | p<0.001 | -0.01 ns | 0.58 | p>0.05 | 0.86 *** | 50.19 | p<0.001 |
| MAR-APR | 1.39 ooo | 105.23 | p<0.001 | 0.03 ns | 2.27 | p>0.05 | 1.42 *** | 107.50 | p<0.001 |
| APR-MAY | 1.35 ooo | 55.03 | p<0.001 | 0.09* | 3.67 | p<0.05 | 1.44 *** | 58.70 | p<0.001 |
| MAY-JUN | 0.58 ooo | 30.84 | p<0.001 | 0.01 ns | 0.53 | p>0.05 | 0.59 *** | 31.38 | p<0.001 |
| JUN-JUL | 0.94 ooo | 27.55 | p<0.001 | 0.14* | 4.10 | p<0.05 | 1.08 *** | 31.66 | p<0.001 |
| JUL-AUG | 1.79 ooo | 50.52 | p<0.001 | 0.05 ns | 1.41 | p>0.05 | 1.84 *** | 51.93 | p<0.001 |
| AUG-SEPT | 1.99 ooo | 63.85 | p<0.001 | -0.09 ns | 2.88 | p>0.05 | 1.90 *** | 60.94 | p<0.001 |

**M1**-control group 2009 (Fiad farm); **E1**-experimental group 2009; (recirculanting system); **M2**-control group 2010 (Fiad farm);
**E2**-lot experimental group 2009 (recirculanting system)

## 4. Conclusions

Outcomes regarding the evolution of body mass index and growth in rainbow trout (Oncorhynchus mykiss), shows that due to the optimal environment in intensive recirculation system, trout have reached the appropriate size and body mass of market delivery within time much shorter than those of the classical growth system, which demonstrates that the increase of trout in recirculation system is very cost intensive. Recirculation systems provide optimal and constant environmental conditions necessary to obtain rhythmic productions, regardless of season, which leads to the necessary fish market.

In the traditional husbandry system, medial, and nutritional parameters can be controlled completely, they are continually being directly influenced by climate and weather conditions specific to the location of the farm and under the influence of season, which greatly influences the rate of growth and accumulation of body mass and can not make predictions in terms of ensuring steady and rhythmic production.

## Acknowledgements

We wish to thank the Forest Department Nasaud management and especially Ing Mr. Ioan Sarmas, the manager of Salmonid Complex Fiad-Telcişor, for their support in conducting these studies.

## References

1. Rasmussen, R.S., Jokumsen, A., Digestibility in selected rainbow trout families and relation to growth and feed utilisation. Aquaculture International Journal, 2009, 17, 187-197.
2. Vlaic, A., Genetica peştilor, Ed. Risoprint, Cluj-Napoca, 2006, pp. 7.
3. Mireşan, V., Ersek, A., Răducu, C., Fiziologia animalelor domestice. Ed. Risoprint, Cluj-Napoca, 2003, pp. 108.
4. Moogouei, R., Karabassi, A..R., Monavari, S.M., Rabani, M., Taheri, M..A., Effect of the selected physico-chemical parameters on growth of rainbow trout *(Oncorhynchus mykiss)* in raceway system in Iran. Iranian Journal of Fisheries Sciences, 2010, 9(2), 245-254.
5. Popescu, A., Sânziana, Cercetări privind structura costurilor şi a veniturilor în ferme ciprinicole, salmonicole şi sturionicole. Phd Thesis, USAMVB Timişoara, 2009.
6. Păsărin, B., Stan, T., Misăilă, C., Elemente de salmonicultură. Ed. Karro, Iaşi, 2004, pp. 68.
7. Bud, I., Vlădău, V., Ştefan, R., Peştii răpitori-Creştere, înmulţire, valorificare, Ed. CERES Bucureşti, 2007, pp. 138.
8. Păsărin, B., Salmonicultură practică, Ed. Alfa, Iaşi, 2007.
9. Oroian, T.E., Principii în ameliorarea peştilor, Ed. Risoprint, Cluj-Napoca, 2007, pp. 115-118.
10. Grozea, A., Ciprinicultură, Ed. Mirton, Timişoara, 2007, pp. 146-154.