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EFFECT OF FEEDING PATTERN AND COMPOSITION ON CARP PRODUCTION IN SMALL FAMILY FARMS

ADIB SAAD [a*], ALI MOHAMMAD [b], ABDOLLATIF ALI [c] AND HAIYAN SULAIMAN [c]

[a] Al Andalus University, Kadmus, Tartus, Syria.
[b] Faculty of Agriculture, Tishreen University, Lattakia, Syria.
[c] General Commission for Fisheries Resources, Jable, Syria.

AUTHORS' CONTRIBUTIONS

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ABSTRACT

This research was conducted in Jableh area of Lattakia Governorate (Syrian coastal zone) in order to study the effect of feeding pattern used on some growth and productivity indicators of common carp fish. Thirty family farms were studied, divided according to the nature of the food provided to them into: farms that depend on manufactured commercial feed (MCF), farms that depend entirely on household waste, and farms that depend on MCF and household waste together. Daily, relative, specific growth rate, feed conversion rate, feed conversion efficiency and survival rate were studied. Completely randomized design was used, and Correlations among studied parameters was estimated using Pearson coefficient of correlation. Results showed that the daily growth rate of farms that use MCF (1.94) was superior to those that use household waste (1.27) and a mixture of household waste and MCF (1.34). The MCF achieved the highest weight gain (349 g) from the performance of the rest of the food types, which did not show statistically significant differences between them. The type of feed did not affect the survival rate, which ranged between 95.7% and 99.4%. The feed conversion ratio was 3.54 in the case of MCF, and the feed conversion efficiency was 516.3%. There was no significant correlation between productivity (kg/pond) and average fish weight, daily, relative and qualitative growth rate, as well as with weight gain, while a significant correlation was found between productivity and survival rate (r). = 0.68 *) in manufactured feed farms. A strong significant correlation was found between productivity, pond area and number of fingerlings (r = 0.79 *) in processed fodder farms. It is recommended to use a number of fingerlings commensurate with the area of the ponds and the amount of feed provided to obtain good quality fish. Fingerlings weighing less than 200 grams must be grown.

Keywords: Family fish farms; common carp; survival rate; household waste; ponds.

1. INTRODUCTION

Family farming is a method of organizing agricultural production, forestry, fisheries, pastoral and aquaculture that is managed and operated by the family and relies mostly on the labor of the family, including both women and men [1]. Here in this research, our topic will be family farms for raising fish in ponds collecting water to irrigate vegetables and fruit trees or fodder plants for animals within the family farm. The world is currently experiencing global growth in aquaculture (with differences

**Corresponding author: Email: adibsaad52@gmail.com;*

between regions and economies), expansion of cultivated acreage, large aquaculture farms, and increased density and use of feed resources that are often produced outside of cultivation areas. Worldwide, aquaculture has an increasing social and economic impact through the production of feed and contribution to livelihoods and income generation [2] Common carp is one of the most farmed fish in the world. These omnivorous fish are resistant to, and tolerant of, a wide range of abiotic and biotic factors. Feed accounts for the bulk of expenditure in intensive and semi-intensive farming, and therefore fish feed must be of good quality to ensure high utilization, high growth rate, and good health, while at the same time protecting the aquatic environment. Fish feed is formulated to meet the nutrient and energy requirements of fish. Feed covers 40 to 60% of total production expenditure [3,4], and prices are a very important factor in fish feed formulation. Therefore, breeders seek to find cheap feeds that lead to acceptable growth and production of fish, with the aim of meeting the increasing need for fish meat as a result of the high and growing population and consumers.

In a project involving 256 farmers in Bangladesh, income from projects that combined fish farming with rice cultivation was 20 percent higher than income from rice-only fields because the farmers used less fertilizer and less pesticides. Total public benefits in consolidation projects increased by 64 percent in the dry season and 98 percent in the rainy season [5].

After knowing the advantages of double use of ponds in Africa, ponds became common use. An example of this is projects assisted by the FAO Fund for Food Security, where five African countries recently (Burkina Faso, Côte d'Ivoire, Ghana, Mali and Zambia) established a network demonstrating the benefits of integrating agriculture with aquaculture [6].

The aim of this research is to search for the best method for breeding and producing common carp fish in family farms, in addition to making use of the waste water of the breeding ponds in irrigating vegetables and fruit trees, i.e. conducting a comprehensive investigation between plant and animal production in the family home garden.

2. MATERIALS AND METHODS

The research was carried out in Jableh area of Lattakia Governorate (Syrian coastal zone) [Fig. 1], where field visits were made to family farms.Thirty family farms were studied, divided according to the nature of nutrition into: farms that depend on manufactured feed, farms that depend entirely on household wastes, and farms that depend on manufactured feed and household wastes together.

The studied indicators: the average weights of fish was taken by sampling method, in order to estimate growth rates, and the following indicators were estimated according to the following formulas [7].

Weight gain (WG) = final weight - initial weight

Daily growth ratio (D.G.R)

$$= \frac{\text{Final weight} - \text{initial weight}}{\text{period between the two weights (day)}}$$

Relative growth rate (RGR)

$$= \frac{\text{Final weight} - \text{initial weight}}{\text{initial weight}} \text{X}100$$

Specific growth ratio (SGR)

$$= \frac{\ln(\text{final weight}) - \ln(\text{initial weight})}{\text{period between the two weights (day)}}$$

Feed conversion ratio (FCR) $= \frac{\text{dried fodder weight}}{\text{weight gain}}$

Feed conversion efficiency (FCE) $= \frac{\text{weight gain}}{\text{dried fodder weight}}$

Survival rate = (number of survived fish / number of total fish) x 100.

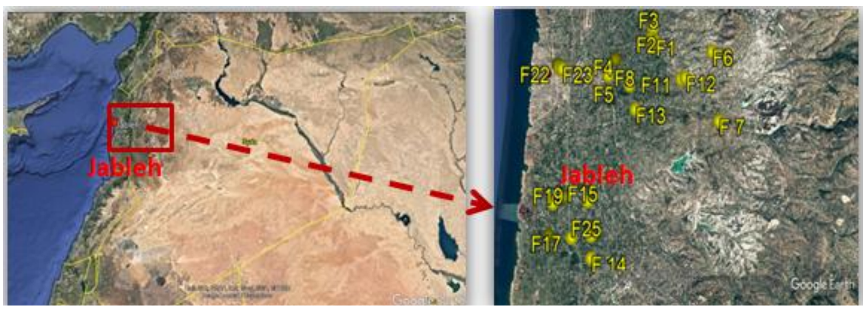

Fig. 1. Map with the location of the study area and sites of family fish farms (F) spread in the Jableh region on the Syrian coastal zone, which were visited in this work

2.1 Experimental Design and Statistical Analysis

The experiment was designed according to the completely randomized design**.** Data subjected to analysis of variance (ANOVA), Means were separated using LSD test. The correlation relationships between the studied parameters were studied using Pearson's linear correlation coefficient (r). MS Excel and CoStat. V6300, CA, USA were used in Statistical Analysis.

3. RESULTS AND DISCUSSION

3.1 Growth Parameters

Table 1 shows that the daily growth rate of farms that use manufactured feed (1.94) is superior to those that use household wastes (1.27) and a mixture of household wastes and manufactured feed (1.34).

The behavior of the relative growth rate was similar to the daily growth rate; this index outperformed the farms that use manufactured feed (3.49) than those that use household wastes (2.29) and a mixture of manufactured feed and household wastes (2.42). Regarding the specific growth rate, the fish farmed in farms that depend on manufactured feed and the mixture between manufactured feed and household waste gave the highest specific growth rate (1.22), and both of them outperformed farms that depend on household wastes only (0.01). The manufactured feed achieved the highest weight gain (349 g), outperforming the rest of the nutrition types that did not show significant differences between them, and it gave an increase of 228.5 g in household wastes, and 241.5 g in farms that depend on manufactured feed and household wastes.

In general, the results show that artificial feed is distinguished in various growth indicators for fish, and many studies have found a positive role for artificial feed in its various forms in promoting weight gain and daily, relative and qualitative growth rates for carp fish, such as the study. When calculating the feed conversion ratio, it was found that it reached 3.54 in the case of manufactured feed, and the efficiency of feed conversion reached 516.3%, and it was not calculated for the rest of the nutrition types due to the inability to calculate the dry weight of household wastes, as it varies according to the type of waste from day to another.

These two indicators were not calculated in the case of household wastes or its mixture with manufactured feed, since it was not possible to calculate the dry weight of household wastes.

The type of nutrition did not affect this rate, and it ranged from 95.7% in the case of household waste to 99.4% in the case of using a mixture of manufactured feed and household wastes. It is worth mentioned that the mortality rates were primarily due to the high temperature during the growing season [8] indicated that the appropriate temperature for carp growth ranges between 23 and 30^{o}C , and therefore the high temperature, especially in the summer, may negatively affect their growth and survival. Despite this, mortality rates were low.

Table 1. The effect of the nutrition type in the studied farms on the daily, relative and qualitative growth rate and weight gain. Similar letters within the same column indicate that there are no significant differences at 0.05 level

Nutrition type	WG	SGR	RGR	DGR
Manufactured feed	349 [a]	1.22 [a]	3.49 [a]	1.94 [a]
Household wastes	228.5 [b]	0.01 [b]	2.29 [b]	1.27 [b]
Manufactured feed + household wastes	241.5 [b]	1.22 [a]	2.42 [b]	1.34 [b]
LSD	123.8	0.19	1.24	0.69

Table 2. Feed conversion ratio, feed conversion efficiency and survival rate of carp fish grown under three types of nutrition

Nutrition type	Survival rate	Feed conversion efficiency*	Feed conversion ratio*
Manufactured feed	95.8 [a]	516.3	3.54
Household wastes	95.7 [a]	--	--
Manufactured feed + Household wastes	99.4 [a]	--	--
LSD	14.1	--	--

3.2 Productivity Analysis

The number of cultivated fingerlings was not equal between the different ponds, and the same was true of their area, so it was not possible to study the differences between the types of ponds or the nutrition used in terms of their productivity, but Pearson correlation coefficient (r) was used to study the correlation between the studied indicators.

3.2.1 Manufactured feed farms

Table 3 shows that there was no significant correlation between productivity (kg/pond) and the mean weight of the fish, and the daily, relative and qualitative growth rate, as well as with the weight gain, and the correlation was weak (r = 0.22), while a significant correlation was found between the productivity and survival rate (r = 0.68 *), and this is normal, as with higher survival rates, productivity will rise as a result of the increase in the number of fish obtained.

When calculating the coefficient of determination that determines the extent of the contribution of the independent variable (the studied indicators) to the variances of the dependent variable (productivity) (Table 3), it turns out that the amount of contribution of the mean weight of the fish to the productivity variances does not exceed 4.84%, and the same applies to the weight gain, while 46.24% of the variances in productivity are due to variances in the survival rate.

Table 3 shows a strong significant correlation between productivity, pond area and number of fingerlings (r = 0.79 *), and it was found from the study of the coefficient of determination that 62.41% of the productivity variances are due to the variances of the pond area and the number of fingerlings separately.

As for the relationship between productivity and the amount of forage provided, it was found that this relationship was highly significant (r = 0.82**), and the amount of forage provided was responsible for 67.24% of the productivity variation in farms that depend on manufactured feed (R^2 = 0.6724).

3.2.2 Household wastes farms

Table 5 shows that the behavior of the correlation relationship between productivity and each of the average weight of the fish and the different growth rates and weight gain had similar tendency as farms that depend on manufactured feed.The value of the correlation coefficient was close and not significant (r = 0.46), while an increased value of the correlation coefficient for survival rate (r = 0.61) was found, but the correlation was not significant, and the contribution of survival rate to productivity variances was low (R^2 = 0.3721).

Table 3. Pearson's correlation coefficient (r) for the correlation between productivity and different growth indicators in farms that depend on manufactured feed

	Survival rate	WG	SGR	RGR	DGR	Fish mean weight
Productivity	0.68*	**0.22**	**0.23**	**0.22**	**0.22**	**0.22**
Coefficient of determination (R2)	**0.46**	**0.04**	**0.05**	0.05	0.05	0.05

Table 4. Pearson's correlation coefficient (r) for the correlation between productivity, pond area (m2) and the number of fingerlings in farms that depend on manufactured feed

	Quantity of forage	Number of fingerlings	Pond area
Productivity	0.82**	0.79*	0.79*
Coefficient of determination (R2)	**0.6724**	**0.6241**	**0.6241**

Table 5. Pearson's correlation coefficient (r) for the correlation between productivity and different growth indices in farms that depend on household waste as fish feed

	Survival rate	WG	SGR	RGR	DGR	Fish mean weight
Productivity	**0.61**	**0.46**	**0.46**	**0.46**	**0.46**	**0.46**
Coefficient of determination (R2)	**0.37**	**0.21**	**0.21**	**0.21**	**0.21**	**0.21**

Table 6. Pearson's correlation coefficient (r) for the correlation between productivity, pond area (m2) and the number of fingerlings in farms that depend on household wastes as fish feed

	Number of fingerlings	Pond area
Productivity	0.48	0.48
Coefficient of determination (R^2)	0.23	0.23

Table 7. The value of Pearson's correlation coefficient (r) for the correlation between productivity and different growth indicators in farms that depend on household waste and manufactured feed

	Fish mean weight	DGR	RGR	SGR	WG	Survival rate
Productivity	0.99*	0.65-	0.65-	0.68-	0.66-	-0.82
Coefficient of determination (R^2)	0.9801	0.42	0.42	0.46	0.43	0.67

Regarding the relationship between productivity and the area of the pond, it was not significant (r = 0.48), and the same results was obtained for the number of fingerlings. This indicates that whether the pond area increased or decreased or the number of fingerlings increased or decreased, they are not factors that have a significant effect on productivity in farms that depend on household wastes. It seems that there are other factors that are more influential than these two factors; the variations in the quality of the wastes provided have a greater impact on productivity, and this needs further studies, since the quantity of household wastes is not specified and its quality varies from day to another; In addition, with the larger ponds and the increase in the number of fingerlings, the feed share of individual fish decreases, which may negatively affect the overall productivity (Table 6).

The correlation between feed quantity and productivity was not studied because it was not possible to estimate the quantities or quality of household waste added to the ponds.

3.2.3 Farms that depend on a mixture of household wastes and manufactured feed

Table 7 shows a strong significant correlation between the mean fish weight and productivity (r = 0.99), and the mean fish weight variances were responsible for 98.01% of the productivity variances (depending on the coefficient of determination), but a negative correlation emerged between all growth indices as well as survival rate and productivity, but here the correlation was not significant.

This study represents one example of remediation and reuse systems commonly called integrative plant hydroponics. In aquaculture, water serves a dual purpose: to host fish (i.e. grow fish within these waters) and to grow crops, generating two products simultaneously. This is not the only benefit; the fish waste fertilizes the water used to irrigate the plants, and the plants clean the water for the fish [9]. It's a win-win situation. Producing more food with less is part of the future of agriculture. In Algeria, Egypt and Oman, as in other countries in North Africa and West Asia, water is not the only challenge; there is also a shortage of good quality soil. Of the total area suitable for cultivation in the region, 45 percent of it faces high salinity, nutrient depletion, and erosion-related problems [6]. Integrated Hydroponics is the answer to producing vegetables, fruits, and other foods on difficult or unusable lands. It is a great way to provide the people of the region with locally produced food that gives them the protein and minerals they need, but without the heavy use of water [10].

4. CONCLUSIONS

Family fish farms can provide the farmer and his family with an additional amount of low-cost animal protein, in addition to the benefits of farm wastewater in irrigating plants and providing part of the organic fertilizer.The daily growth rate of fish for farms using manufactured feed (1.94) was higher than those using household waste (1.27) and a mixture of household waste and processed feed (1.34), and the processed feed achieved the highest weight gain. This study represents one example of remediation and reuse systems commonly called integrative plant hydroponics. In aquaculture, water serves a dual purpose to host fish (i.e. grow fish within these waters) and to grow crops, generating two products simultaneously. This is not the only benefit; The fish waste fertilizes the water used to irrigate the plants, and the plants clean the water for the fish It's a win-win situation. Finally, the strong significant positive correlation between productivity, pond area and the number of fingerlings on farms that only provide manufactured feed is highlighted.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. FAO, UN decade of family farming 2019-2028.2019.
   Available: http://www.fao.org/family-farming-2019/home/what-is-family-farming/en
2. FAO. The State of World Fisheries and Aquaculture; 2020.
   Available: https://www.fao. org/ publicat/ sofia /2020/en
3. Meyers SP. Aquafeed formulation and ingredients. In: Chang YK, Wang SS. (eds.) Advances in extrusion technology. Aquaculture / animal feeds and foods. Technomic Publishing Company, Inc. Lancaster, PA. USA. 1999;19-27
4. Aarseth KA, Sorensen M, Storebakken T. Effects of red yeast inclusions in diets for salmonids and extrusion temperature on pellet tensile strength: Weibull analysis. Animal Feed Science and Technology. 2006;126:75 – 91.
5. Capistrano-Doren L. Et N. Luna (EDS). Farmer-proven integrated agriculture-aquaculture: a technology information kit. IIRR et ICLARM. Manille, Philippines; 1992.
6. FAO. How aquaponics and integrated agri-aquaculture farms are Making Smart use of Water.
   Retrieved on 7 December 2022 at
   Available:https://www.fao.org/fao stories/article/en/c/11- 11580
7. Hamed H, Al- Shawee S. A study of effect of various types of probiotic the growth characters of fingerlings fish common carp (*Cyprinus carpio* L.). Al-Anbar Journal for Veterinary Science. 2013;6(1):145-156.
8. Warda S. Information about raising Carp; 2021.
   Available: http://aleef.com (2/12/2022)
9. Hamilton SF, Richards TJ, Roe BE. Food waste: Farms, distributors, retailers, and households (Book Chapter); Handbook of Agricultural Economics. 2022; 6:4653-4703.
10. Edwards P. Aquaculture and poverty: past, present and future prospects of impact. Document de travail préparé pour la cinquième Consultation des donateurs pour le développement des pêches tenue à la FAO, Rome. 1999;21-23.