High Performance of Aquaponic System for Western Kenya

Introduction

Fisheries and aquaculture play important roles in providing food and income in many developing countries, either as a stand-alone activity or in association with crop agriculture and livestock rearing. Attempts to come up with innovative production methods to enhance production of fish from the wild and through technology-enhanced aquaculture is widely sought. Aquaponics, the integrated culture of fish and other aquatic organisms with plants is one such technology that has been proposed. However, this technology remains largely untried in Kenya and much of Africa. Though it has a great potential to produce for Kenya and other developing countries, Aquaponics is still a young science .

Materials and Methods

The study was conducted at the University of Eldoret hatchery . Eighteen plastic rectangular tanks of 100L each were used during this experiment. There were three aquaponic treatments each stocked with Monosexed Nile tilapia fingerlings. The fish were stocked at densities of 15fingerlings/tank, 30 fish/tank and 45 fish/tank for treatments 1, 2 and 3 respectively. These treatments were replicated four times. Each treatment was be subjected to a 16 lettuce density per m^2. Water quality was monitored and recorded using photometer 9500, Ysi DO and temperature Meter and Ysi photolab. Data from on fish and plant growth were collected and recorded. The water quality parameters were compared through the growth period using one way Analysis of Variance (ANOVA) while the growth of the monosex *O. niloticus* was compared using Phi prime (). All the statistical tests were carried out at a=0.05 using Minitab Ver. 17 and Statgraphics Ver. 16. Duncan's multiple-range test was applied to quantify the differences between treatments.

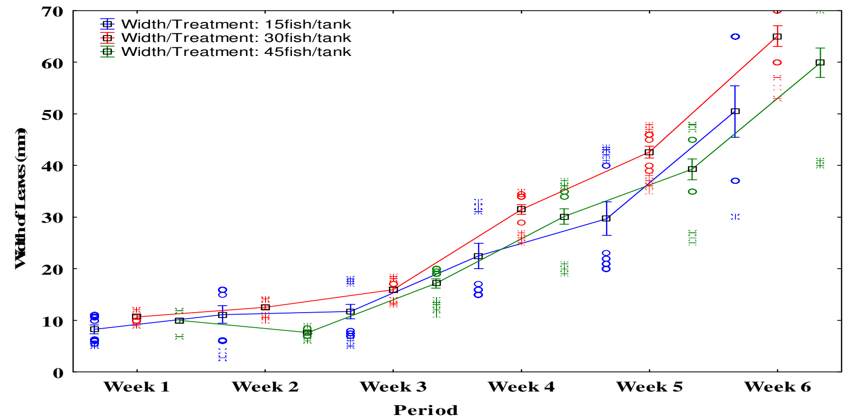

Fig 2: Width of lettuce leaves planted at different densities of fish

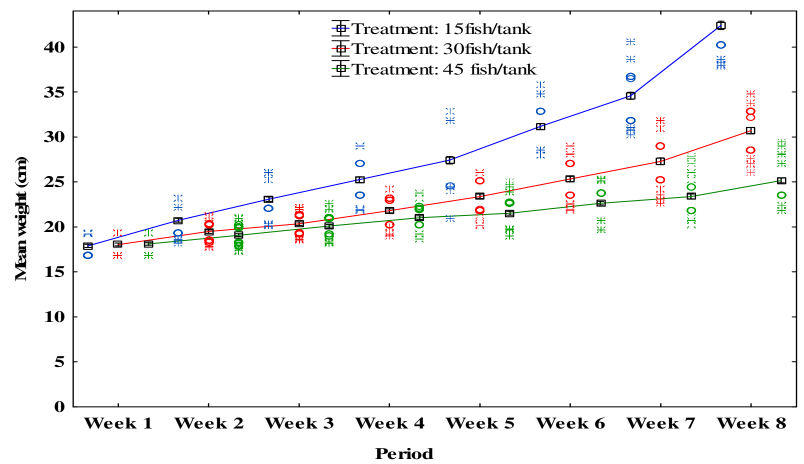

Figure 1: Mean weight of plants grown in the three aquaponic systems

Discussion

Fish grown at density 15 had the highest ($P<0.05$) growth compared to 30 and 45 in terms of both mean weight and length. This agrees with several works on stocking density which concluded that at lower densities the growth of fish is higher. Lower fish density aquaponic system had the lowest lettuce growth as compared to 30 and 45 densities. Growth of plants was evaluated in terms of width, height, weight and number of leaves. It was noted that lettuce grown in aquaponic systems that had fish densities of 30 and 45 fish per tank performed very well as compared to 15fish/tank treatment

Plate 1: Experimental unit of the aquaponic system

Conclusion

Plant growth was highest in 45 and 30. Apparently 30 seemed to perform equally better as 45. Meaning that at 30 density better growth of both fish and plants is witnessed. Hence it can be concluded that the best stocking density for a 16 lettuce per metre is so fish/tank.

Table 1: Water quality parameters in the aquaponic system

		15 fish/tank	30 fish/tank	45 fish/tank
Parameter	Source	Mean ±SE Mean	Mean ±SE Mean	Mean ±SE Mean
Ammonia	FishTank-Out	$0.01±0.01^a$	$0.02±0.01^{ab}$	$0.03±0.01^b$
	Hydro-In	$0.02±0.01^b$	$0.00±0.00^a$	$0.01±0.00^b$
	Hydro-Out	$0.02±0.01^b$	$0.00±0.00^a$	$0.01±0.00^b$
	FishTank-In	$0.02±0.01^b$	$0.00±0.00^a$	$0.03±0.01^b$
Ammonium mg/NH_4	FishTank-Out	$0.01±0.00^a$	$0.02±0.01^{ab}$	$0.03±0.02^b$
	Hydro-In	$0.01±0.00^b$	$0.00±0.00^a$	$0.02±0.01^b$
	Hydro-Out	$0.01±0.00^a$	$0.00±0.00^a$	$0.02±0.01^b$
	FishTank-In	$0.01±0.00^b$	$0.00±0.00^a$	$0.03±0.02^b$
Nitrate (mg/l -N)	FishTank-Out	$1.26±0.48^b$	$0.80±0.35^{ab}$	$0.77±0.04^a$
	Hydro-In	$0.89±0.34^b$	$0.00±0.00^a$	$1.12±0.45^b$
	Hydro-Out	$0.89±0.34^b$	$0.00±0.00^a$	$1.56±0.49^b$
	FishTank-In	$1.26±0.48^b$	$0.24±0.15^a$	$0.96±0.23^b$
Nitrate (mg/l -NO_3)	FishTank-Out	$5.55±2.10^b$	$1.11±0.40^a$	$3.38±0.22^b$
	Hydro-In	$3.90±1.47^b$	$0.00±0.00^a$	$2.06±0.73^b$
	Hydro-Out	$3.90±1.47^b$	$0.13±0.09^a$	$2.40±0.76^b$
	FishTank-In	$5.55±2.10^b$	$1.08±0.66^a$	$3.32±0.25^b$
Nitrite (mg/l -N)	FishTank-Out	$0.01±0.00^a$	$0.69±0.52^c$	$0.03±0.01^b$
	Hydro-In	$0.00±0.00^a$	$0.14±0.03^c$	$0.05±0.02^b$
	Hydro-Out	$0.00±0.00^a$	$0.61±0.46^c$	$0.02±0.01^b$
	FishTank-In	$0.01±0.00^a$	$0.16±0.03^c$	$0.05±0.02^b$
Nitrite (mg/l -NO_2)	FishTank-Out	$0.00±0.00^a$	$0.54±0.06^c$	$0.10±0.02^b$
	Hydro-In	$0.00±0.00^a$	$0.47±0.09^c$	$0.16±0.06^b$
	Hydro-Out	$0.00±0.00^a$	$0.49±0.05^c$	$0.09±0.02^b$
	FishTank-In	$0.03±0.01^a$	$0.52±0.10^c$	$0.17±0.07^b$

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