

Research Application Summary

Effect of pond plastic sheeting on water temperature and improved growth of fish in Dowa, Malawi

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Abstract

Temperature is one of the limiting constraints to increasing fish production in areas where temperatures are below 25°C. In most areas in Malawi temperatures are between 14 - 24°C (www.atlapedia.com/online/countries/malawi.htm), with the exception of the lakeshore region. In search for a low cost technology to increase water temperatures to boost tilapia production, the effect of clear plastic sheeting on growth of *Tilapia rendalli* was tested on station. Results showed that covering 80 % of fish ponds using clear plastic resulted into a growth increase by more than 50 % (Specific Growth Rate (SGR) of 0.84). In absence of data on food availability and unionized ammonia, it was presumed that clear plastic sheeting acts as a greenhouse structure such as those that have been noted to reduce heating requirements in geothermal heat pump (GHP) systems by over 50%. Following these results, an on farm experiment was initiated at two fish farms in Dowa District, Malawi, in October 2008. Results from the initial and second phases of the experiment showed that the plastic sheeting had effect on temperature with highest temperature increase in ponds with 50% cover, but with no obvious increase in fish growth. The experiment will run for the third time in which more explanatory variables, including food and nutritional availability, will be investigated.

Key words: Fish production, Malawi, plastic sheeting, temperature

Résumé

La température est l'une des contraintes qui limitent l'augmentation de la production de poissons dans les zones où les températures sont inférieures à 25 ° C. Dans la plupart des zones au Malawi les températures varient entre 14 – 24° C (www.atlapedia.com / ligne / pays / malawi.htm), à l'exception de la région au bord du lac. A la recherche d'une technologie à faible coût pour augmenter la température de l'eau pour stimuler la production de tilapia, l'effet de bâches en plastique transparent sur la croissance de *Tilapia rendalli* a été testé sur la station.

Les résultats ont montré que la couverture de 80% des étangs à poissons à l'aide de plastique transparent donnait une augmentation de la croissance de plus de 50% (Taux de croissance spécifique (SGR) de 0,84). En l'absence de données sur les disponibilités alimentaires et de l'ammoniac non ionisé, il a été présumé que des bâches en plastique transparent agissent comme une structure à effet de serre telle que celles qui ont été notées pour réduire les besoins en chauffage de la pompe à chaleur géothermique (BPH) des systèmes de plus de 50%. Suite à ces résultats, une expérience sur la ferme a été lancée dans deux élevages de poissons dans le district Dowa, au Malawi, en octobre 2008. Les résultats de la phase initiale et de la deuxième de l'expérience ont montré que les feuilles de plastique ont eu un effet sur la température avec une plus forte augmentation de la température dans les étangs à 50% de couverture, mais sans augmentation évidente dans la croissance des poissons. L'expérience se déroulera pour la troisième avec plus d'explications variables, notamment la disponibilité alimentaire, qui sera étudiée.

Mots clés: La production de poisson, le Malawi, des bâches en plastique, la température

Background

Fish culture in earthen ponds has become a dominant practice in Malawi due to their natural fertility. However, fish culture in earthen ponds has a limited scope due to over-dependence on natural fertility. So far, most aquaculture research and development effort in Malawi has been directed towards increasing pond productivity mainly through fertilizer/manure/feed applications. This study aims at explaining the wholesome impact of clear plastic pond sheeting technique on fish production by determining parameters such as growth rate, fish production, fish survival, food availability, unionized ammonia and zooplankton abundance.

Literature Summary

Tilapias are widely farmed and dominate aquaculture production in Africa (Jamu and Ayinka, 2003). There are several attributes that make tilapias attractive as culture species. Such attributes include: high tolerance to poor water quality and crowding, good growth performance due to its wide range of feeding habit, high degree of disease resistance and mild flavored and white flesh (Fishbase, 2006). Tilapias are also widely cultured in order to replenish Malawi's dwindling fisheries.

In Malawi, fish farming has been practiced for many years with the aim of increasing and sustaining fish production thereby enhancing food security in the country (NASP, 2005). The development of fish farming in Malawi is aimed at improving fish production from small and medium scale farmers. *Tilapia rendalli*, *Oreochromis shiranus*, *Oreochromis karongae* and *Clarias gariepinus* are some of the major cultured species in Malawi in earthen ponds used by most smallholder farmers.

Oreochromis shiranus is one of the indigenous tilapia species widely used for aquaculture in Malawi and is locally known as *Makumba* (Msiska, 1988). This species is reported to have good taste and firm muscle tissue and is widely accepted in Malawi (Maluwa, 1990). Nevertheless the development of *O. shiranus* culture has been greatly hampered by poor growth and early sexual maturation in aquaculture ponds. There is a clear shift in the life history of the fish and is a common problem in tilapia culture (Noakes and Balon, 1982). One might manipulate the environment in order to improve the growth of *O. shiranus* in aquaculture ponds. This could involve all the culture environmental factors. Water temperature as one of the environmental factors that plays an important role in fish growth and survival (Boyd, 1990). *O. shiranus* survives at temperatures ranging from 23.0-42.0°C (Msiska, 1991).

Study Description

The study is in the second phase of the on-farm experiment and is being carried out in Dowa district. In the study plastic sheets of 200 micron strength are being used to mimic the green house effect which would in-turn cause an increase in temperature of the ponds waters. The study is being carried out at two fish farms each with 6 ponds. The experiment has three treatments (0% cover, 50% cover and 80% cover) which are each replicated twice at each of the farms.

Research Application

The study was first carried out on station at Bunda College in 2004 and showed a growth increase by more than 50 % (Specific Growth Rate (SGR) of 0.84) 50% in the 80% cover pond and a 1°C temperature increase). It was then taken on farm in 2008 where a growth increase was observed in the 50% cover treatment. The experiment is now being repeated on farm and the preliminary results show that there is a temperature increase in the cover treatments. There is also an abundance of different species of zooplanktons in the 80% cover. Some of the zooplankton species found include *T. neglectus*, *M. aquetoriolis*

aquetorialis, *Nauplii*, and *Diaphnosoma*. The study is going to undergo a third run.

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