# PRODUCTION AND USE OF PLANT-DERIVED RECOMBINANT CARP SOMATOTROPIN AS FOOD SUPPLEMENT FOR INCREASING GROWTH RATE IN CULTURED FISH

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## Introduction

While world demand for fresh water and marine fish products is growing rapidly, there is a decline in the catches of commercially important fish species. In order to increase fish production, many countries have turned to aquatic biotechnology. To increase growth rate of fish, a number of investigators have examined two entirely different approaches including production of transgenic fish species that express elevated levels of growth hormone (GH) and treatment

of cultured fish with recombinant GH. However, production of transgenic fish is considered by many regulatory agencies to pose environmental risks with respect to the possible escape of the genetically modified organisms into wild population. These risks may be ameliorated through controlled administration of fish growth hormone by feeding. In this context, fish growth hormone has no activity in mammals and can not be absorbed through human gut. Fish gut, however, has macro molecule absorption properties and can take up intact GH to allow enhanced growth rate. The overall objective of the present study was to develop a novel form of fish food based on canola seed protein containing an active form of fish somatotropin. The specific application of this technology would be to increase growth rate and food conversion efficiency in cultured fish using plant-produced fish somatotropin as food supplement. In this context, growth rate is a particularly important parameter in the economic equation, since it would significantly reduce the time to produce market-size fish and provide a major boost to the profitability of the industry.

**Materials and Methods**

A novel, plant-based system was used for the production and purification of recombinant carp GH (cGH) in oilseed species (Moloney and Holbrook, 1997). The system used the natural targeting of the native seed protein oleosin, for oil bodies, the subcellular storage organelles for triacylglycerides. This strategy provides for the rapid purification of the fusion protein through a simple process of flotation-separation (Moloney et al., 1996). We describe here the production of a functional carp GH (cGH) (Mahmoud et al., 1996) as an oleosin fusion protein in Brassica napus. A construct carrying an Arabidopsis oleosin sequence fused to that encoding cGH hormone was introduced into plants via Agrobacterium-mediated transformation. The oleosin-somatotropin fusion protein targeted specifically to oil bodies and accumulated in transgenic seeds to a level of approximately 0.4% of total seed protein.

**Results**

Common carp growth hormone was produced in Brassica napus as a translational fusion with the native seed oil body protein, oleosin. Natural targeting of the oleosin fusion protein to oil bodies provided for its rapid purification through a simple process of flotation-separation. The purified somatotropin-oil body complex was demonstrated to be functional through an

activity assay measuring induction of insulin-like growth factor-I (IGF-I; Kermouni et al., 1998. Experiments were carried out to test plant-derived cGH on rainbow trout fed a diet containing the recombinant product for eight weeks. Rainbow trout receiving a diet supplemented with oil body-coupled somatotropin equivalent to 0.29 µ g of carp growth hormone / g body weight / day exhibited significant increase in growth over controls during an eight-week feeding trial. Examination following completion of the study revealed no morphological abnormalities in animals receiving the experimental diet.

**Conclusion**

Plant-derived recombinant cGH can be used effectively to increase growth rate in cultured fish. The oleosin-based production system used in these studies is relatively inexpensive and can readily be scaled up to meet requirements for the commercial aquaculture industry.

**References**

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