



## IPN resistance for rainbow trout

The viral disease IPN has traditionally been a problem for rainbow trout in the fresh water phase. The disease may cause major losses, both in increased mortality rates, reduced growth and instances of weakened fish that have survived an IPN outbreak. This means a high degree of uncertainty as to how fish will perform compared to annual production budgets.

In 2009 AquaGen performed the first selection for IPN resistance in rainbow trout using traditional family based breeding. In parallel with this work, a number of challenge tests were used to identify and document genetic markers that can be used to select broodstock with IPN resistant genes. It was proved that IPN resistance in rainbow trout is to a large extent controlled by one single QTL, just like in salmon. The first eggs selected for this QTL were delivered to fish farmers in January 2015.

### Effect testing of IPN resistance

The effect of the genetic marker has been documented in two separate challenge tests on rainbow trout fry soon after start feeding. In order to eliminate environmental effects between test groups all fish were challenged in the same tank. At the end of the experiments both living and dead fish were genotyped and grouped as respectively qq (homozygote, IPN sensitive), qQ (heterozygote) and QQ (homozygote, IPN strong).

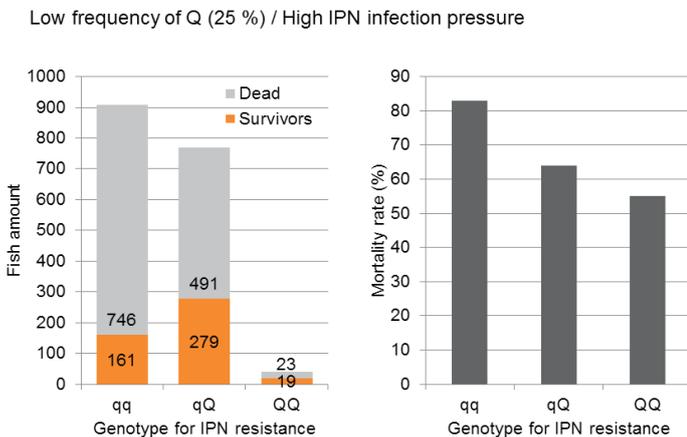


Figure 1. Experiment 1, effect testing of IPN resistance in recently start fed rainbow trout fry. In the group, that comprised 1719 fish, the frequency of the favorable IPN resistant variant Q was only 25%. The IPN infection pressure was high resulting in an accumulated mortality rate for the IPN sensitive fish (qq) of 83%.

#### Products with IPN resistance:

- AquaGen® Rainbow QTL-innOva® IPN

The results from both experiments show a significant difference in mortality rates between the different genotypes, where the degree of IPN resistance depends on the frequency of Q (Fig. 1 and 2).

In experiment 1 the frequency of the favorable IPN resistant variant Q was relatively low (25%). This has contributed to the building up of a high IPN infection pressure because of the high number of IPN sensitive fish (qq) in the group. In experiment 2 the genotypes were more evenly distributed (48% Q), and had a moderate IPN infection pressure. In both tests the mortality rate was considerably lower in the groups that carried the IPN resistant variant Q, and the difference was especially high when the infection pressure was moderate. These infection experiments document that the QTL for IPN resistance in rainbow trout has a good effect on IPN in laboratory experiments.

### Great expectations for protection by QTL-selection

In the eggs selected for IPN resistance (that only have the genotypes qQ and QQ), the frequency of Q will be 60–80%. This level of frequency will provide a positive population effect (a kind of “herd immunity”) that means there will be a higher threshold for the IPN virus to overcome to establish itself in the group of fish, and the extent of a potential IPN outbreak will be considerably reduced.

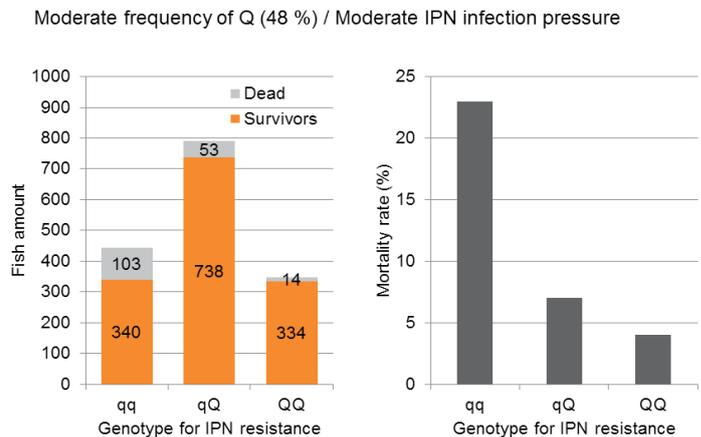


Figure 2. Experiment 2, effect testing of IPN resistance in recently start fed rainbow trout fry. In the group, that comprised 1582 fish, the frequency of the favorable IPN resistant variant Q was at a moderate 48%. The IPN infection pressure was also moderate with an accumulated mortality rate for the IPN sensitive fish (qq) of 23%.

#### Advantages of Rainbow QTL-innOva® IPN:

- IPN protection through the entire life of the fish
- Greater predictability in production of rainbow trout