

For fish feed, smaller is better - but only if quality, reliable nutrition is provided

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Within previous editions of *Aquafeed*, it has been discussed how Insta-Pro International has developed a low-cost, easy-to-use, and durable Medium Shear Extruder for small-to-medium producers of fish feed pellets (see [Aquafeed, Autumn 2013, volume 5, issue 3, pages 41-45](#)). The Medium Shear Extruder was built with decades of extrusion experience to back it up. Notably, the machine uses high shear, dry extrusion techniques for recycling aquatic co-products thereby utilizing more of the original raw material available for aquaculture diets in place of expensive fish meal (see *Aquafeed*, Spring 2014, volume 6, issue 1, pages 32-34).

When producing aquaculture pellets for fish feed, pellet diameter size is critical. The correct pellet diameter maximizes feed intake and performance, especially in young fish. Tilapia is a

good example of the varying pellet size needs. Tilapia fry (0.1-2 g body weight) require either pellets less than, or equal to, 2 mm in diameter (1). This can include crumbled pellets, or mash feed, which are about 0.6-1.5 mm. Fingerling tilapia (10-20 g body weight) need pellets with a diameter of 2.5-3 mm (1). Growing and finishing tilapia are fed to weights of 0.5-1 kg and are progressively fed pellets with greater diameters (1).

Fish feed manufacturers face challenges when smaller pellet diameters are desired.

New die designs successfully reduced pellet diameter, which means that feed for younger, smaller fish can be produced

To make smaller pellets, the dry mix of ingredients is forced through small dies at the end of the extruder barrel. As such, particle size of the dry mix must be smaller than the die openings.

Typically, the dry mix must be at least one-third smaller than the die opening. Additionally, uniformity is an important factor in pellet generation. One randomly large, amorphous particle easily blocks the die opening and prevents pellets from being made. Therefore, in order to make small pellets, fine-grinding capabilities are requisite.

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experimented with a new die and cutter-head apparatus in an attempt to improve the production of smaller pellets on the MS3000 Medium Shear Extruder. A typical blend of ingredients and formulation for omnivorous fish feeds was used in these experiments. The dry mix was finely ground to an average particle size of 0.5 mm. This fine mix was then preconditioned and extruded to gelatinize the starch, denature the proteins, destroy microorganisms, and produce shaped pellets. New 1.5 and 2 mm die plates were used, and following cooling and drying, 10 pellet samples from each die plate were evaluated by measuring the diameters with calipers. This data was then compared with diameters of pellets made using older versions of the 1.5 and 2 mm die plates to determine if any progress was made with the new designs.

The results are shown in the graphs on the

next page. First, the new dies successfully reduced pellet diameters. Pellets produced with the new 1.5 mm die were just under 2 mm in diameter, while those made with the old design were nearly 2.5 mm. Similarly, pellets produced with the new 2 mm die were 2.7 mm in diameter, while those with the old design were 3 mm. Note that actual pellet diameters are almost always bigger than the die size due to expansion during the extrusion process.

Secondly, it's important to track pellet uniformity by measuring pellet diameter variation (shown below as coefficient of variation). With the new 1.5 mm die, variation actually increased slightly versus the old 1.5 mm die design. With the new 2 mm die, uniformity increased.

New die designs successfully reduced pellet diameter, which means that feed for younger, smaller fish can be produced. However, with the new 1.5 mm die, pellet

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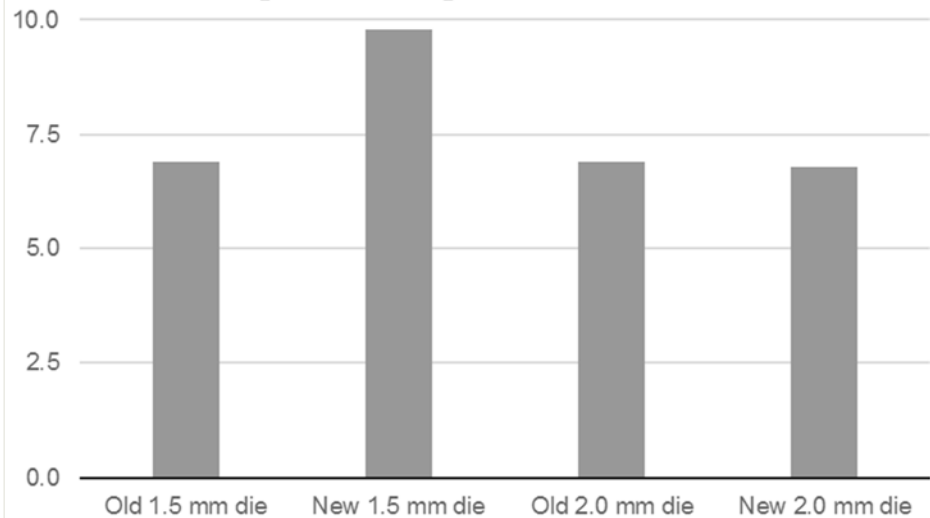
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diameter variation increased slightly, which indicates the need for further development.

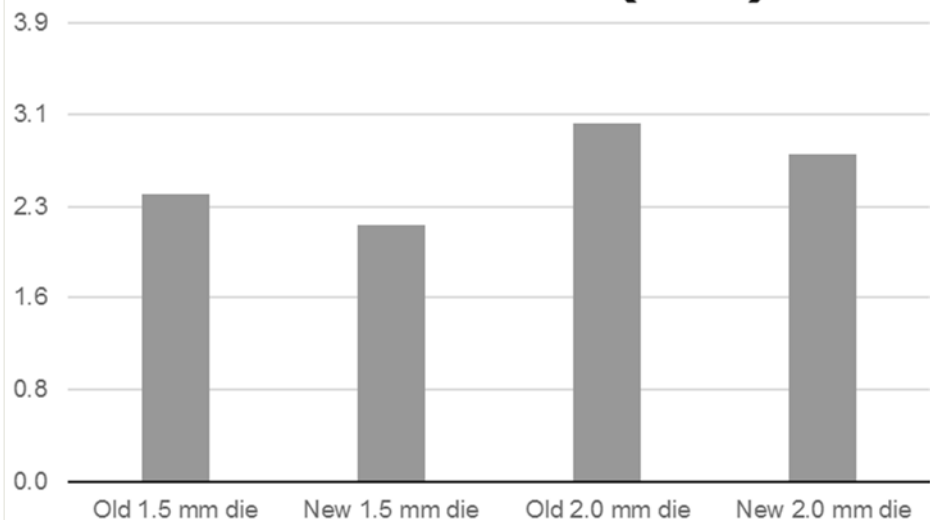
Pellets produced through the Medium Shear Extrusion process expand upon exiting the new dies (as shown above) and float thereby ensuring that the fish have access to quality nutrition. In addition, Medium Shear Extrusion from Insta-Pro adequately cooks the dry mix to produce highly-digestible nutrients in the pellets. This is shown by the high degree of starch gelatinization in fish pellets (2).

Insta-Pro International prides itself on a culture of continuous improvement and is pleased to be helping processors produce small, floating fish feed pellets to deliver high-quality nutrition for aquaculture.

Pellet diameter variation (CV, %)



Pellet diameter (mm)



References

An overview of feeding management of farmed tilapia throughout the culture cycle. *Aquafeed* Spring 2014, page 23.

[Low cost Medium Shear Extruder for pet food and aquafeed.](#) *Aquafeed* Autumn 2013, page 44, figure 5.



More information

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