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SUMMARY - Although aquafeed manufacture does not have a long history in Turkey, there are at present nine feed manufacturing companies producing aquafeeds (some of which also produce feeds for domestic land animals). The main finfish species farmed in Turkey are rainbow trout (*O. mykiss*), European seabass (*D. labrax*) and gilthead seabream (*S. aurata*), and common carp (*C. carpio*); the total aquaculture production of these species in 1996 being 18,510 metric tons (mt), 11,580 mt and 780 mt, respectively. The aquafeed manufacturing plants currently produce feeds ranging in size from micro-granulated/starter feeds for trout, sea bream and sea bass larvae/fry to 2.2-6 mm size pelleted feed for grow-out/adult fish. Pelleted fish feeds are currently produced by conventional mechanical pressing technology, although some plants have plans to change their pelleting technology to the use of extruded plants in 1998.

Key words: Aquaculture feeds, Turkey, feed manufacture, trout, seabass, seabream, carp.

RESUME - *"Situation actuelle de la fabrication d'aliment poisson en Turquie". Bien que la fabrication d'aliment aquacole ne soit pas très ancienne en Turquie, il y a à présent neuf compagnies qui fabriquent de l'aliment aquacole (certaines d'entre elles produisent également des aliments pour animaux terrestres domestiques). La principale espèce de poisson élevée en Turquie est la truite arc-en-ciel* (O. mykiss), *le bar* (D. labrax) *et la dorade* (S. aurata), *et la carpe commune* (C. carpio) *; la production aquacole totale de ces espèces en 1996 a été de 18 510 tonnes métriques (mt), 11 580 tm et 780 tm, respectivement. Les usines de fabrication d'aliment aquacole produisent actuellement de l'aliment dont la taille va de micro-granulés/aliment de départ pour larves/alevins de truite, daurade et bar, jusqu'à des granulés de 2,2-6 mm pour poissons en grossissement/adultes. Les aliments poissons en granulés sont produits actuellement par une technologie conventionnelle à presse mécanique, quoique certaines fabriques prévoient de changer leur technologie de granulation pour devenir des fabriques à extrusion en 1998.*

Mots-clés : *Aliments aquacoles, Turquie, fabrication d'aliment, truite, bar, dorade, carpe.*

The present situation of aquaculture in Turkey

The history of aquaculture in Turkey is relatively recent. Modern freshwater fish farming began in 1970 with the culture of rainbow trout (*O. mykiss*) by government facilities and research institutes, and has developed very rapidly since 1980 with the introduction of specific university courses on aquaculture. Marine culture has only been in operation for about 13 years, with the bulk of production coming from net cage farming systems. Aquaculture is currently becoming even more popular and is emerging into a very important sector in Turkey.

Turkey is surrounded on three sides by the Mediterranean Sea, the Aegean Sea and the Black Sea. Although most of it's natural fisheries production comes from the Black Sea, the most suitable areas for net cage culture are along the Aegean coast and along the west part of the Mediterranean coast. Regarding inland aquaculture potential, there are 33 rivers (178,000 km total length), over 200 natural lakes (more than 900,000 ha water surface), and over 180 dam lakes (355,000 ha water surface) and underground water sources (9×10^9 m^3).

In recent years, total fisheries production (catch plus aquaculture) reached between 500,000 and 600,000 mt/year, with total aquaculture production (according to the Turkish Statistical Institute) estimated to be about 32,201 mt in 1996. The production of the major aquaculture species and the number of licensed farms are shown in Table 1.

It is important to mention that some non-licensed farms also exist and that total production may in fact exceed 50,000 mt per year. In addition to those major species mentioned in Table 1, other fish

species are cultured on a more limited scale, and include the grey mullet (*Mugil cephalus*), two-banded bream (*Diplodus vulgaris*), striped *bream (Lithognathus ormyrus*), sharp snout bream (*Puntazzo puntazzo*), white bream (*Diplodus sargus*), dentex (*Dentex dentex*), and white grouper (*Epinephelus aeneus*).

Table 1. Total production of main aquaculture species and number of licensed farms in Turkey (Source: Ministry of Agriculture, 1997)

Species	Number of licensed farms	Total production (mt)
Trout	629	18,510
Carp	97	780
Salmon	2	193
Seabass and sea bream	141	11,530
Mussel	8	1,918
Total	881	33,201

Aquafeed Industry in Turkey

Farmers currently purchase their feed from one of nine different aquafeed manufacturers within the country. Table 2 lists the major aquafeed producers in Turkey and the feed lines produced.

The Pinar Feed Industry is one of the most famous and oldest establishments in this sector in Turkey. The company initially started producing ruminant feeds in 1983 with a feed production capacity of 5 mt/hour, and one year later started producing poultry feeds, increasing their feed production capacity to 10 mt/hour. In 1986 the company initiated research-development efforts on the production of fish feeds, and in 1987 they produced their first pelleted fish feed in collaboration with a French company with a total production capacity of 20 mt/hour. At present the company has a total feed production capacity of 40 mt/hour (including aquafeed) for domestic farmed animals. However, there is no clear information on the exact capacity of aquafeed production (although this can be increased depending upon the demand by fish farmers). With the exception of Abalioglu Feed Industry, none of the above mentioned aquafeed manufacturing companies are using extruder technology for the production of aquafeeds. However, at the time of this report Abalioglu Feed Industry were not producing extruded aquafeeds because of some technical problems with their extruder. Consequently, at present all the pelleted aquafeed lines produced in Turkey are using conventional mechanical pressing technology. However, it is reported that the Pinar Feed Industry plans to convert to the use of extruder technology in 1998.

Table 2. Aquafeed manufacturing industries and major feed lines produced in Turkey

Name	Fish Species
Pinar Feed Industry and Marketing	Trout, seabream, seabass and carp
Abalioglu Feed Industry	Trout, seabream and seabass, carp-mullet
Hakan Feed Industry	Trout, seabass, seabream and carp-mullet
Yatagan Feed Industry	Trout, seabass, seabream and carp
Ozugur Feed Industry	Trout, seabass, seabream and carp
Korkuteli Feed Industry	Trout, seabass, seabream, carp, mullet
Bilecik Feed and Food Industry	Salmon, trout, seabass, seabream
Elazig Feed Industry	Trout, carp
Samsun Feed Industry	Trout, carp

The Bilecik Feed Industry is also one of the oldest establishments in the aquafeed sector and are currently the only producer of salmon feed in the country. At present, the aquafeed industries produce micro-granules (300, 500, 800 micron size ranges) for seabass and seabream larvae, feed granules (feed number 2, 3 and 4) for seabass and seabream fry, and also pelleted feeds (2.2 mm, 3 mm, 4.5 mm and 6 mm diameter size range) for fingerling to grow-out seabass and seabream. For rainbow trout, feed granules (size number 1, 2, 3 and 4) and pelleted feeds (2.2 mm, 3 mm, 4.5 mm and 6 mm diameter size range) are produced. For carp and mullet, 2.2 mm, 3 mm, 4.5 mm and 6 mm feed are produced. Apart from these products the Bilecik Feed Industry also produces salmon feed as 0.44-0.59 mm, 0.59-0.84 mm, 0.84-1.50 mm, and 1.50-2 mm granules, and 2.5 mm pelleted feeds for fry and fingerlings. They also produce 4.5 mm, 5.5 mm and 9.0 mm pelleted feed for larger salmon. The aquafeed products are usually marketed within 25 kg and 50 kg polyethylene bags. In addition, some companies produce special feed lines for trout, seabream and seabass broodstock. However, it is interesting to note that several large fish producers (especially trout farmers) are trying to produce their own feed. Moreover, fish farmers in Turkey are not generally happy with the price of available aquafeed, the price of which fluctuates considerably throughout the year.

The main feed ingredients used within aquafeeds in Turkey are fishmeal, meat and bone meal, blood meal, meat protein concentrate, dried yeast meal, wheat and corn. Recently, soybean meal and de-hulled soybean flour has been used as a partial dietary replacement for fishmeal within aquafeeds. Although the use of dietary feeding attractants has not been widespread in Turkey, this practice is expected to increase as the levels of dietary plant protein sources increases. The main lipid source used within aquafeeds for trout, seabass and seabream has been fish oil.

Conclusion

Aquaculture is a very promising sector in Turkey. Although the total capacity of aquafeed production is not clear, existing feed manufacturers generally have capacity for producing both aquafeeds and domestic farm animal feeds. However, for the future benefit and development of the aquaculture sector in Turkey it will be necessary for the resident aquafeed producers to change from the use of conventional pressing pelleting technology to the use of more modern extruder processing technology; the latter resulting in the production of aquafeeds with a higher quality and nutritional value for the major cultured aquaculture species.

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