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An Analysis of Inputs Cost for Carp Farming Sector in 2001 in Iran

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Abstract: Carp is widely sold and used in its fresh in Iran, however, recently a range of value additions may also be observed. It is essential to the sustainable development of a carp farm to know the production costs and their contribution. Warm-water fish farming is mainly based on common, silver, grass and bighead carp and the common carp and the three Chinese species are often reared in poly culture in Iran. Since, the 1970_S carp farming has spread around the Caspian coast and farmed production reached a peak in 2006 with production of more than 73,400 tons. A study of production, costs and profitability of carp farming sector was carried out to help clarify carp production costs and their difference with location in 2001. A total of 101 farms from the three main carp farming provinces, Guilan, Mazandaran and Khuzestan were randomly selected, classified and studied. The results of the survey showed that the various producer provinces have different cost structures. Overall, feed and fertilizer with the highest level of variation accounted for 23% of total costs, followed by seed and labor and salary with 23 and 17%, respectively. On average, benefit-cost ratio and the rate of farm income were closely related to location. This result suggests that farmers practice more efficiently and have better conditions in Mazandaran, followed by Guilan province.

Key words: Carp, farm, costs, production, Iran

INTRODUCTION

Iran covers an area of about 1.6 million square kilometers (SCI, 2000) and has a population of about 67 million in 2004 (Salehi, 2006). Per capita fish consumption is almost 7 kg $year^{-1}$ (PDD, 2006), less than the global average and the average for developed and developing countries. However, the limited supply from marine capture fisheries is unlikely to meet growing demand (Salehi, 1999). FAO (1992), Abzigostar (1996), Nash (1997) and Salehi (1999, 2003 and 2004) proposed that for the fisheries sector, this would mainly come from aquaculture, which has the largest potential for further production increase. Shehadeh (1996) and Salehi (2003 and 2004) have proposed the direction of effort towards the development of freshwater aquaculture and the enhancement of fish stocks in inland water bodies. Since carp is the predominant species in aquaculture in Iran (almost 75% of farmed production in 2005), the paper will analysis current and changing of farmed carp production in the main producer provinces. The carp is one of the most widely cultivated warm-water fish and has been introduced into some 81 countries (Welcomme, 1988; Holcik, 1991; Csavas, 1993, 1994; Michaels, 1994), particularly in developing countries. Common, Chinese and Indian major carps are cultured wherever traditional markets exist. Varadi (1995) noted world-wide progress in the culture of carp spices. Rusyde and Lampe (1990) indicated that the basic inputs of feed and seed constitute the principal cost of operating a carp farm. According to Pillay (1990) the economic viability of carp culture has never been in doubt, in areas where there is a market for carp and appropriate technologies are used. In Iran, carp farming was started about 40 years ago (Azari Takami, 1984), initially as an attempt at hatching of Chinese carp. Carp farming activities expanded quickly into Caspian Sea littoral and other provinces. It has undoubtedly seen great success over the last fifteen years, production from both carp farming and inland fisheries rising from less than 12,000 tons in 1986 to more than 95,000 tons in 2005 (PDD, 1997, 2006). However, in Iran, the share of aquaculture and inland fisheries to total fishery production has increased from 6% in 1973 to 9% in 1986, to more than 15% by 1995 (AD, 1996, 1997; PDD, 1997) and more than 22% by 2002 (AD, 2003), increased to almost 27% by 2004 (PDD, 2005). In 2005, national production from both aquaculture and inland fisheries was 134,164 tons of which 22,179 tons derives from national and artificial water bodies and 73,396 tons from carp farming, including 25% common, 7% grass, 5% bighead and 63% silver carp, 34,760 tons from rainbow trout farming and 3,829 tons from cultured shrimp (PDD, 2006). According to the Fisheries statistics (PDD, 1997; AD, 1998 and 2001) total aquaculture production has grown from 1,414 tons in 1973 to 33,680 tons in 1988, to 52,980 tons in 1995 and to 90,000 tons in 2002 and more than 134,000 tons in 2005 (AD, 2003; PDD, 2006). The marketing channels for carp differ between the provinces,

According to Salehi (2004 and 2006) in Guilan and Mazandaran harvesting starts in September, but in Khuzestan it may be two or three months later. The standard marketable size for carp is about 1 kg in weight and some farmers may delay their harvesting up to November, or even December to achieve larger sizes and potentially better prices. However, this delay is constrained by additional cost and most farmers, except a few with large farms and high capital investments, are unable to do so. Buyers are usually responsible for transporting the fish into the market. The majority of farmers harvest only once annually per pond, or even once per farm, but very large ponds or large farms may require more than one harvest (Salehi, 1999, 2004). A variety of market outlets ranges from local fish markets, wholesalers within each province, the co-operatives or wholesalers at Tehran. Wholesalers within the provinces, mostly in Guilan and Mazandaran, have often provided credit to the farmers (Salehi, 1999). In 2005, Guilan, Mazandaran and Khuzestan provinces were produced 18,209, 24,648 and 17,446 tons cultured carp, respectively, all three provinces were produced 82% of carp farming production in Iran. In Guilan province, more than 50% of carp production is sold to wholesalers at Rasht city. The wholesalers at Rasht transport and sell more than 50% of their stocks to the wholesalers in Tehran (Salehi, 2004). In Mazandaran province, some 35% of cultured carp is sold to wholesalers in the large cities of the province and more than 50% of cultured carp is sold in auction at the farm gate. More than 50% of the fish sold by auction in wholesalers or at the farm gate are transported and sold in Tehran, or export to Iraq, particularly by the main warm-water co-operative. In Khuzestan province more than 70% of carp production is sold to wholesalers at Tehran or export to Iraq. As Fig. 1 shows, carp market building up in September, increasing in December and peaking in March, with almost 90% supplied over October-march).

For further development, it is necessary to identify and distinguish cost-benefit differences between carp farming industry. According to FAO (1992) and Salehi (1999 and 2004) the characteristics of the carp farming industry in the three main fish farming provinces, Guilan, Mazandaran and Khuzestan are quite different. Salehi (1999) noted the highest farm income (32%) in Guilan, followed by Mazandaran and Khuzestan. Induced by the decline of fish availability from the Caspian Sea and supported by the Government, carp culture initially developed in Guilan, followed by Mazandaran, Khuzestan and other provinces during the last two decades. In Iran, the potential of carp culture to expand may be apparent, it may be constrained by market demand and producer profitability. How then can its expansion be guided an effective manner to avoid wasting resources?

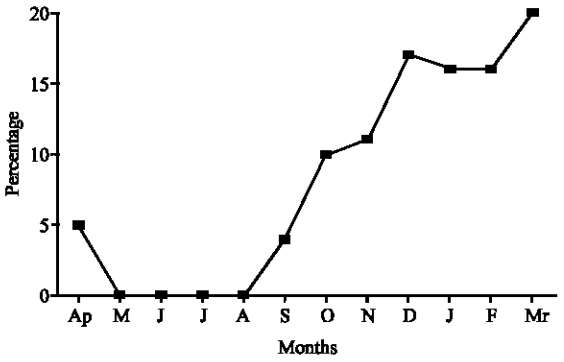

Fig. 1: Seasonality purchasing of cultured carp in Iran

Though, the objectives of this study are:

- To determine the costs and returns to farmers,
- To find the cost contribution of the inputs,
- To determine the profitability of carp farming in main provinces in 2001 in Iran,

MATERIALS AND METHODS

A study of yield production, costs and profitability was carried out to help clarify carp production costs and their differences with the provinces. According to Shang, (1981 and 1990) Cunningham *et al.* (1985) Jolly and Clonts (1993) and Salehi (1999 and 2004) key production cost indicators are not only useful for fish farmers but also for economics and policy making. The study was developed to indicate the following elements:

- The characteristics of carp farms in three main provinces of Guilan, Mazandaran and Khuzestan.
- Costs: including fixed and indirect operating costs, such as salary, insurance, maintenance, interest and depreciation, which are usually independent of the level of production and variable costs, such as seed, feed, fertilizer, chemical and drugs, labor, water and energy, harvesting and post-harvest and miscellaneous costs, which vary with output.
- Income: Total production, total cost of production, gross revenue, net return, benefit-cost ratio (net return/total cost), cost of input per unit of output (kg), value of unit of output, amount of output (kg) per unit of land (ha), and costs of input per unit of land (ha).
- Assessment of key factors affecting production costs.

Data collection, classification and analysis cover the year 2001. In designing the study, micro-economic analysis of farms production were carried out. The

methods used were farm surveys, were needed supplemental questionnaires were also used. Two sources of data were used. Primary data was obtained through personal interviews of fish farmers, which were conducted to obtain information on resources used and the quantity of output. The farms for questionnaire in each province were selected by stratified random sampling. Wherever core data was not sufficient, additional surveys, face to face interviews with farmers and experts and other available data was used to ensure a representative perspective on the sector. In 2001, 101 farms from the three main provinces were randomly selected, classified and studied. Of the 101 farms, 60 farms from Guilan, 26 farms from Mazandaran and 15 farms from Khuzestan province. Data on pond structure, stocking rate, species, labor, fertilization, feeding, water and energy, transportation, maintenance, facilities on farm, surface area, stocking time, harvesting time, individual production of species, sale price of species, various fish production activities, market channels and miscellaneous were recorded. Data were entered into a Microsoft Office Excel 2003 and methods for classification, summarizing, averaging and other functions were used for analysis.

RESULTS

There is a significant difference in average area of farms. As Table 1 shows, in 2001, the area of farms averaged almost 7,8 ha, varying from 4.5 ha in Guilan to 10 ha in Mazandaran and 18.5 ha in Khuzestan. The average yield was 4,380 kg ha^{-1} varying from less than 3,600 kg ha^{-1} in Guilan to almost 6,400 kg ha^{-1} in Mazandaran. Though, in Mazandaran, production (kg ha^{-1}) is higher than the average (+46%), but in Khuzestan and Guilan are less than the average (-6 and -18%, respectively). As Table 2 and Fig. 2 show, in 2001, total costs p ha were 21% greater in Mazandaran than in Khuzestan and 56% more than that in Guilan. Costs in Khuzestan were 29% more than that in Guilan. Among the operation costs, feed and fertilizer with the highest variation dominated all other costs averaging 23% of total cost, varying from 31% in Mazandaran to 19% in Guilan and 20% in Khuzestan. In 2001, average cost of seed is 20% of total costs, varying from 13% in Guilan to 15% in Mazandaran and 24% in Khuzestan. The other main cost is the cost of labor and salary, averaged 17% of total costs, varying from 12% in Mazandaran to 20% in Khuzestan and 22% in Guilan. The other major costs are the cost of harvesting and post harvest and water and energy averaging 8 and 9% of total costs, respectively.

As Table 3 shows, in 2001, the cost p kg of carp production in Khuzestan is higher than that in the two other provinces, at Rials 5,435 p kg^{-1} followed by Guilan with Rials 5,170 p kg^{-1} and only Rials 4,495 p kg^{-1} in Mazandaran. Of these costs, feed and fertilizer averaged Rials 1,023 p kg^{-1} in Khuzestan, Rials 982 p kg^{-1} in Guilan and Rials 1,394 p kg^{-1} in Mazandaran, while in contrast seed costs amounted to Rials 1,304 p kg^{-1} in Khuzestan followed by Rials 673 p kg^{-1} and Rials 672 p kg^{-1} in Mazandaran and Guilan, respectively. Other major inputs costs are labor and salary, water and energy and harvesting and post harvest p kg of carp production. In Mazandaran, feed and fertilizer and Maintenance is much higher than the average, while this was the case only for seed and harvesting and post harvest in Khuzestan and Labor and Salary and depreciation in Guilan in 2001

Table 1: No. of sampled farms, average area and carp farm production in 2001 in Iran

Factors/Province	Guilan	Mazandaran	Khuzestan	Total
No. of sampled farms	60	46	15	101
Average area (ha)	4.5	10	18.5	7.8
Production (kg p ha^{-1})	3,575	6,400	4,100	4,380

Table 2: Costs factor p ha^{-1} of sampled farms and their share in the provinces in 2001

	Guilan		Mazandaran		Khuzestan		Mean[a]		SD
Factors/Province	Total costs (%)	R. 1000	Total costs (%)	R. 1000	Total costs (%)	R. 1000	Total costs (%)	R. 1000	R. 1000
Seed	13	2402	15	4307	24	5712	20	4835	1661
Feed	12	2217	20	5754	11	2619	14	3514	1937
Chemical fertilizer	3	554	6	1728	3	714	4	999	637
Animal fertilizer	4	740	5	1440	5	1191	5	1205	355
Chemical and drugs	1	186	1	288	0	118	1	179	86
Fuel	2	368	2	717	2	477	2	535	179
Water and electricity	10	1848	7	2016	6	1428	7	1663	303
Harvesting and post harvest	8	1480	7	2016	9	2142	8	2014	352
Labor and salary	22	4065	12	3450	20	4761	17	4269	656
Miscellaneous	5	926	8	2445	2	359	4	1068	1079
Maintenance	6	1108	9	2592	8	1905	8	2005	743
Depreciation	9	1662	5	1440	7	1664	6	1596	129
Interest	5	926	2	576	3	714	3	701	176
TC	100	18483	100	28768	100	23805	100	24583	5144

[a]: To Accounted the mean, the area of farms were also affected, SD: Standard Deviation, TC: Total Cost. US$ 1 = R 8,000 at 2001 rates

Table 3: Variable and fixed costs (Rials p kg^{-1}) of carp production in the main provinces

Cost factors/Province	Mazandaran	Khuzestan	Guilan	Mean	SD
Seed	673	1304	672	1,027	365
Feed	899	598	620	692	168
Chemical fertilizer	270	163	155	194	64
Animal fertilizer	225	272	207	249	34
Chemical and drugs	45	27	52	36	13
Fuel	112	109	103	109	5
Water and electricity	315	326	517	349	114
Harvesting and post harvest	315	489	414	426	87
Labor and salary	539	1,087	1,137	928	332
Miscellaneous	382	82	259	197	151
Maintenance	405	435	310	409	65
Interest	90	163	259	154	85
Depreciation	225	380	465	345	122
TC	4,495	5,435	5,170	5,114	485

Table 4: Production costs and returns p ha^{-1} of farms in the provinces. Unit: R 1000

Factors/Province	Guilan	Mazandaran	Khuzestan	Average	SD
Total costs	18,483	28,768	23,805	24,583	5,144
Gross revenue	21,060	33,318	26,736	27,957	6,135
Net return	2,578	4,550	2,930	3,373	1,052

Table 5: Costs and returns p kg^{-1} of carp production in the main provinces in 2001 in Iran

Factors/Province	Guilan	Mazandaran	Khuzestan	Average	SD
Total costs (R^1)	5,170	4,495	5,435	5,114	485
Gross revenue (R)	5,891	5,206	6,104	5,803	469
Net return[a] (R)	721	711	669	689	28
Benefit-cost ratio[b]	0.14	0.16	0.12	0.13	0.2
Rate of farm income[c] (%)	12	14	11	12	2

[1]: Rials, [a]: Equals gross revenue minus total costs, [b]: Equals net return on farm divided by total costs and [c]: Equals net return divided by gross revenue

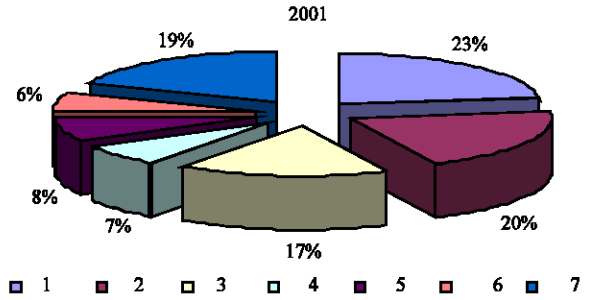

Fig. 2: Percentage of total costs p ha by major groups of inputs in 2001. (1) Feed and Fertilizer (2) Seed (3) Labor and Salary (4) Water and Energy (5) Harvesting and post harvest (6) Depreciation and (7) Other costs

(Table 3). Though, in 2001, variability of seed is higher than the other operation costs, followed by labor and salary. Table 4 summarizes the profitability of carp farming sector per ha in the provinces, as defined by following measures:

- Net return, defined as gross revenue minus total costs.
- Benefit-cost ratio, defined as net return for the farm divided by total costs.
- Rate of farm income, defined as net return divided by gross revenue, times 100.

As Table 5 shows, net return p ha, averaged R 3,373,000 in 2001, despite a higher cost p ha, the net return per unit of land is higher in Mazandaran, at R 4,555,000 ha^{-1} compared with R 2,578,000 p ha^{-1} in Guilan and R 2,930,000 p ha^{-1} in Khuzestan. As Table 5 shows, the benefit-cost ratio in Mazandaran is also higher than elsewhere; at 0.14 compared with 0.12 and 0.11 in Guilan and Khuzestan, respectively. The average rate of farm income for carp rearing is 12%; varying from 12% for Guilan, 14% for Mazandaran and only 11% for Khuzestan.

In 2001, on average, total costs per ha is higher than the average at 17% in Mazandaran, compared with -25 and -3% less than the average in Guilan and Khuzestan, respectively. Net return per ha averaging R 3,373,000, however in Mazandaran is 35% higher than the average, in Guilan and Khuzestan are less than the average at -24 and -13%, respectively. As Table 5 shows, net return p kg averaged Rials 689 in 2001, profitability p kg of carp culture in Guilan is higher, followed by Mazandaran, farmers in Guilan and Mazandaran having benefit-cost ratio of 8 and 23% more than the average, respectively, while in contrast, in Khuzestan having -8% less than the average.

DISCUSSION

In Iran, it appears that over the last fifteen years demand for carp products is initially increasing as a result

of a relative decline of Caspian bony fish and increasing in urbanization, population and economic growth (Salehi, 1999). Nash (1997) noted bony fish production appears to be leveling off and according to (FAO, 1992; Shehadeh, 1996; Nash, 1997; Salehi, 1999, 2004, 2006) aquaculture is a key factor in the national strategy for increasing fish production and carp farming has grown steadily in Iran. World-wide progress in the culture of carp species were noted by Bailly *et al*. (1990), Pillay (1990), Horvath *et al*. (1992), New and Csavas (1993), Rath (1993), Billard and Gall (1995), Biro (1995), Jeney and Jeney (1995) and Varadi (1995). The result from data obtained from the three main provinces quite clearly demonstrate that carp farming is a profitable activity with an average of 12% rate of farm income in 2001. The economic viability of carp culture has been noted by Pillay (1990) and Salehi (1999 and 2004) in areas where there is a market for carp and appropriate technologies are used too. The results of the survey showed that the various producer provinces have different cost structures, depending on availability and quality of inputs, farm management, climate, area of farms and other factors. In 2001, feed and fertilizer, seed and labor and salary are the major input costs in Iran, however Rusydi and Lampe (1990) and Salehi (1999 and 2004) indicated that the basic inputs of feed and seed constitute the principal cost of operating a carp farm. In Guilan, where carp culture is older and farmers have smaller farms and may manage ponds on an ad hoc basis, they usually use agricultural wastes as feed and fertilizer, but in Mazandaran the price of feed and fertilizer was higher than elsewhere, consequence 50% production more than the average per ha by 2001. In Khuzestan, seed prices are much higher as most fry/fingerling come from Guilan hatcheries and thus include transport cost, as well as allowing for higher mortality combined with high stocking rate, thus increases the cost in 2001. However, it is expected, that increased hatchery production in Khuzestan will reduce the cost of seed. Increased cost of harvesting and post harvest in Khuzestan is likely to be due to the greater distance to markets. Feed and fertilizer productivity is usually considered as important indicator of the level of efficiency of carp farming production. Overall, inflation has also had a significant impact on production costs in 2001 in Iran. Additional costs and reduced revenue per kg (due to single harvesting and supplying large quantity of product in markets over short time period) reduced the profitability. As noted by Cunningham *et al*. (1985), Bjorndal (1987, 1988 and 1990), Pillay (1990 and 1994), Hatch and Kinnucan (1993), Jolly and Clonts (1993), Muir (1995), Muir *et al*. (1995), Nash (1995) and Salehi (1999 and 2004), development objectives of farmed production depends on its profitability and increases in yield, reduction in costs and increases in price of product were the major means of increasing profit. Though, reduction in major operation costs, such as feed and fertilizer, seed and labor and salary, as well as main fixed cost (construction), increase production per unit of land, associated with increased stocking rate, survival rate, good pond management, growth rate and increased price per quantity of fish by aiming at higher valued production may all increase carp farm profit. Despite higher production per unit of land, the present profitability of carp farming in Khuzestan followed by Guilan and Mazandaran may not be acceptable in the longer term. Future production vary widely and will be to a large extent dependent on the ability of producers to reduce production costs and on the potential for markets to be developed, as has been the case elsewhere, where development has arisen through on acceptable of market opportunities and technical feasibility (Roberts and Muir, 1994; Muir, 1995; Muir *et al*., 1995; Salehi, 2006). In the short term, in order to expand cultured carp production, it may be necessary to increase technology and/or improve the management skills, developing and applying methods that can cope with restrictions of reduced resources, increased quality control and reduced resource quantity. An increase in management input to improve feeding and fertilizer as well as seed and labor strategies and increase feed and seed productivity might be expected to increase production. The significant expansion and increasing intensification in aquaculture raises questions concerning the industry's future viability in the condition of increasingly limited resources (such as water, area and feed) and great concern for sustainable development (New, 1991; De Saram and Singh, 1992; Pillay, 1992; Pullin *et al*., 1993; Bagarinao and Flores, 1995; Chamberlain and Rosenthal, 1995; Muir, 1995; Reinertsen and Haaland, 1995; Salehi, 1999, 2004). With regard to the government policy toward carp farms, the government should assist farmers, especially those in Khuzestan province and larger farms in Guilan and Mazandaran, with high operating costs, particularly feed and fertilizer costs, seed and labor, insufficient knowledge and inadequate management. Appropriate short-term credit schemes, applied research, an effective extension services related to the problems of share of each species for production, size and amount of seed per unit area, methods of rearing, feed and fertilizer use, farm preparation, diseases control, water management and poly culture of carp and other species such as Indian major carps and other market accepted of local species are initially necessary. It might be necessary to promote low-cost technologies for carp production as well as to provide institutional and policy support to enable poor households to gain access to resources and

adopt carp culture. This would be significantly important for small-scale production in most of the rural areas and integrated with other agricultural activities. It is expected that production of carp in Caspian area will become more intensive and will increase in the next few years, particularly in areas, where there is a good demand for carp products, farm profitability is higher than elsewhere and there is a limitation for land to expand carp farms. Other areas are also likely to commence production, but production growth in Khuzestan will depends on productivity growth of feed and fertilizer and seed. The availability of natural resources in Khuzestan are most attractive for future expansion and a development strategy may be focused here, as well as poly culture with other market accepted of local species, the main constraint being the higher cost of production, poor harvesting and post-harvest facilities and low profitability of farms. If the cost of feed and fertilizer can be reduced through improved feed quality and farm management, Khuzestan and the largest farms in Guilan may become more attractive. With moderate natural resources and profitability, development is more suitable in Mazandaran. Overall, the choice of development strategy will depend on both location and profitability.

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