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Constraints to Successful Carp Fish Farming Production in Jordan

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Abstract: This study was conducted for 6 months from July to December, 2012 under Livestock Research Diroctate, National Center for Agricultural Research and Extension (NCARE), these governorates are Al Karak, Irbid, Ajloun and Balqa, situated in the Northern, moderate and Southern parts of Jordan to investigate constraints to successful Carp fish farming. The study area was stratified into clans with a frame survey and a random sampling method employed to select 106 fish farms with each designated farming units-from where the data were collected. Information was collected with the use of questionnaires and personal interview, transformed into data and computed with simple percentages for this research. It was discovered that despite the abundant aquaculture potentials of the study area in terms of land, local feedstuffs, good climate, lack of feasibility study on sites selection, poor fish culture management methods, poor pond construction amongst others were some of the major constraints of fish farming in the study area. However, proper feasibility study on fish farm project, site selection, knowledge of fish farm management practices, fingerling transportation from the hatchery and a running capital are some of the measures that would remove the constraints. As the results gives a summary of the constraints to successful fish farming in Jordan. Based on the outcome of the in-depth interview with key informants. Response analyses of the sub-constraints led to the identification of 6 major mutually exclusive groups of constraints: Production, environmental, socio-cultural, institutional, technological and marketing.

Key words: Fish farming, constraints, carp fish, running capital, Jordan

INTRODUCTION

Jordan is small country (8.92 million ha) in the Middle-East between latitudes 29°30' and 32°31' with a total population of just 6.4 million (FAO, 2004; DOS, 2010). Climatically, much of Jordan can be classified as semi-desert with only the Western highlands enjoying a Mediterranean climate. Over 95% of the land area has an annual rainfall of <200 mm while only 2% has >350 mm. Temperatures in the Jordan Valley, Wadi Araba and Aqaba region can rise to 45°C in Summer and the mean annual temperature is 24°C. In Winter, the temperature in these areas falls to a few degrees above zero and frost is a rare event. Most precipitation falls in the form of rain. Snowfall occurs generally once or twice a year over the highlands. The rainy season extends from October to April with the peak of precipitation taking place during January and February (MoA, 2010).

Fish culture has become a newly developing enterprise has been practiced in Jordan since the mid of 1960's. Among the other sectors of animal production. Few numbers of farms are being established in different parts of Jordan, which create employment opportunities to the peoples. The challenges for fish production in Jordan will depend very much on the future demand of fish in general and the sustainability of aquaculture in particular. In 1966, FAO assistance establishment a pilot project in Wadi Al-Yabis (Al-Rayan) station in 1966 and another in Azraq in 1978. Wadi Al-Rayan is the first core for fish culture consisted soil and cement tanks for breeding Mirror Carp (*Cyprinus carpio* L.) for supplying farmers fingerlings at low prices to spread fish culture between them (MoA, 2010).

Fish plays a vital role in feeding the world's population and contributing significantly to the dietary protein intake of billions of the populace (Amao *et al*., 2006). Fish farming provides important services including supporting nutritional well-being, providing feedstock for the industrial sector, making contributions to rural development, increasing export opportunities, more effective administration of natural resources and conservation of biological diversity (Dagtekin *et al*., 2007).

Fish culture is an efficient means of animal protein production. It provides essential nutrition for over 1 billion people, including at least 50% of animal protein for 400 million people from the poorest countries (WBG, 2011). The quality of fish protein is high because it contains amino acids in the amount and proportions required for good nutrition and provides a good source of

vitamins, minerals and iodine (Edward and Damaine, 1997). The fat in fish is poly-unsaturated which can keep the level of cholesterol low to reduce the risk of coronary heart disease and alleviate some other diseases such as migraines, arthritis and tumor formation due to the unique omega-3-fatty acid they contain (Edward and Damaine, 1997). Fish meats are tender, light and easily digestible because they contain very little connective tissues. Therefore, liver can digest them easily without any difficulty. Fish bone is also beneficial as they supply calcium and phosphorus essential for bone and teeth formation (Edward and Damaine, 1997).

According the ministery of agriculture in 2010, the total local fish culture projects (Tilapia and Carp) is 24 with total local production (669.4) ton (312.4 ton Tilapia from 14 projects and 357 ton Carp from 10 projects). During 2010, the total fish imported 27141 ton and the production in Jordan was 1238.4 ton, from fish farms is about 728.4 ton while sea fishing reached 160 ton year^{-1}. Inland fishing from Jordan and Yarmouk Rivers was about 350 ton (MoA, 2010). The average consumed fish per capita in Jordan was rized from 3.60 kg year^{-1} (2004) to 4.8 kg year^{-1} (2010) and it is continuously on increase (MoA, 2010).

Carp culture intensity and production rate is increasing day by day but not as desirable rate due to some constraints. Furthermore, an understanding of the constraints limiting the growth and development of Carp farming is vital for the successful development of policies or programmes aimed at improving the performance of the fish sector in Jordan. This study, aim to study constraints to successful Carp fish farming production in Jordan.

MATERIALS AND METHODS

Study sites and duration: The study was carried out in four governorates in Jordan which have fish farming. These governorates are Al Karak, Irbid, Ajloun and Balqa, situated in the Northern, moderate and Southern parts of Jordan (Table 1), for a period of 6 months from July to December, 2012.

A purposive, systematic approach was used during the field research. As a case study, the sample selected included 106 holders (Table 1). These holders includes fish farms, farms practicing fish raising as part of its activities and holders that do not practice fish farming. The purpose of including these three categories of holders is to collect information about the existed fish farming farms and seeking the point of view of other holders about fish farming advantages and disadvantages in Jordan. The criteria for selection were based on the farmers experiences, their locations and their abilities to give the required information about the systems practiced in fish farming and other resources as in other parts of the country. Moreover, most of these farmers have a comprehensive knowledge of fish farming. In addition, the categories of these farmers were both small-scale and larger scale who own at least one or more enclosures for fish rearing.

Table 1: Locations of fish farmers and their farm sites in Jordan, No. of farmer interviewed

Farm sites	Frequency	Percentage
Alssafi	40	37.74
Ghour Al Hadeetha	11	10.38
Ghour Al Mazzrah	9	8.49
Al Baqooreh	2	1.89
Al Quwaismeh	1	0.94
Ein Al Barakeh	1	0.94
Deir Alla	9	8.49
South Shooneh	11	10.38
Kafrain	1	0.94
North Shooneh	12	11.32
Al Mashare'	3	2.83
Ghour Al Hadeetha and Al Mazzrah	6	5.66

Survey of fish farmers in Jordan, 2012

The questionnaires included 69 paragraphs used during this period were semi-structured, designed with predominantly closed as well as few open types while their components included demography, available resources, status of natural resources, challenges faced by fish farmers, opportunities of fish farming and the systematic approach to management practices. During the exercise, all 106 farmers were interviewed at their various farm sites. Simultaneously, observations were made and pictures were taken from the same sites where all the necessary data was collected using the same questionnaires which were accomplished with information from stakeholder institutions. These were specific (interrelated) questionnaires administered on stakeholders, accompanied with special request for secondary data collection. Most of this data was collected through desk studies at the National Center for Agricultural Research and Extension (NCARE). Information was also obtained from farmers who were feasible through telecommunication media. This information was also double checked during field visits.

Data analysis: The data were analysed using Microsoft Excel 2007 and Microsoft Access 2007.

RESULTS AND DISCUSSION

Table 2 which provides data on the background of the farmers shows that majority of the fish farmers were on full time while those on absentee ownership, blaming it on lack of running capital, farms poor returns, inadequate extensive services, erosion threats to ponds,

Table 2: Summary of responses of fish farmers on general information

General information	Description	Percentage
Nature of farm operation	(A) Part-time	20
	(B) Full-time	80
No. of fish farms in the study area		106
Functional fish farm		27
Non-functional fish farm		73
Reasons for functional fish farms		
Increasing income		44
Using the fish residues for vegetables		5
Hobby		15
Family source of food		11
Elimination of algae in pond		17
Presence of spring		4
The saline wells water help in fish farming		4
Reasons for non-functional fish farms		
Lack of running capital		8
Farms poor returns		5
Inadequate extensive services		7
Erosion threats to ponds		3
Insufficient water supply		3
High mortality		7
Lack experience		4
Selection site		6
Inefficiency of deign ponds		2
Lack of experience		5
Lack of ponds		10
Fair of failure		2
Fair of deteriorating the pond		6
Lack of time for fish farming		4
Lack of encouragement of formal directions		3
Marketing problems		4
Lack of fish		7
Lack of information about fish farming		4
Theft		1
Low production		3
Financial causes		6
Level of education		
	Primary education	24
	Secondary	23
	Polytechnic/college	30
	University	23
Nature of ownership of farm by		
	Inheritance	40
	Outright purchase	60
Size range of ponds between		
	250 m^3 (small ponds)	30
	500-1000 m^3 (moderate ponds)	45
	Above 1000 m^3	25
Feasibility studies on fish farm		
	Yes	30
	No	70
Technical/expertise advice on site selection		
	Yes	45
	No	55

Survey, 2012

Table 3: Summary of responses on management practices

Management practices	Description	Percentage
Preparation of pond bottom before stocking		
	Yes	80
	No	20
Stocking of recommended density		
	Yes	45
	No	55
Sources of fish fingerlings/procurement		
	Local farmer	45
	Imported	55
Fish feedstuff used		
	Poultry feed	30
	Maize grain (ground)/fishmeal	13
	Kitchen waste	7
	Concentrated feed (32%)	50
Sources of water supply		
	King Abdullah channel	21
	Springs	7
	Tankers	60
	Water authority water	7
	Jordan valley authority	6
The quality of water used for fish farming		
	Fresh water	66
	Mixed water	32
	Saline water	2
Stocking Period for the *Carp* sp. 6-14 months		70
Form of marketing pond fish fresh		
Marketing channels for pond fish:		
	Local markets	30
	Relatives and friends and neighbors	55
	Restaurants	15
Fish handling/processing methods:		
	Washing with water only	85
	Employment of labour to secure/manage the farm	40
Daily routine management practices:		
	Feed fish, control, check disease out	70
	Change water/check water level	30
Satisfaction with farm output:		
	Satisfied	70
	Not satisfied	30
Reasons for not being satisfied:		
	Lack of running capital	7
	High cost of feeds	12
	Inability to pay staff	7
	Low return from investment	14
	Inadequate water supply/fingerlings	26
	High rate of mortality	10
	Poor management method	18
	Marketing	6

Survey, 2012

insufficient water supply, high mortality, lack experience, selection site, inefficiency of deign ponds, lack of experience and ponds, fair of failure, fair of deteriorating the pond, lack of time for fish farming, lack of encouragement of formal directions, marketing problems, lack of fingerlings, lack of information about fish farming, theft, low production and financial causes. The farmers were mostly level of education of majority are polytechnic per collage (30%). The farm lands for the venture were gotten by inheritance and outright purchase habouring a total of 106 ponds of which 73% were not functional. The ponds size ranged from 250 m^3 for small ponds and 500-1000 m^3 for moderate ponds and above 1000 m^3 for large ones. About 30% of the farmers had feasibility studies and 45% technical advice on site selection, respectively.

Table 3 shows the summary of responses of fish farmers to management practices. About 80% prepared

the pond bottom, the species generally cultured were *Tilapia* sp., *Carp* sp. An appropriate stocking density range that has proved suitable and is recommended for semi-commercial production in Jordan is 3-5 fry carp m^{-2}. About 45% of the farmers stocked the ponds between 3-5 fingerling per m^2. The highest stocking density was those of farms with 250 m^3 pond areas with 5 m^{-2} and the least of 3 fingerlings m^{-2} of multipurpose community fish farm with a pond area of 1000 m^3. The stocking/growth period ranged from 8-14 months or earlier depending on the species and the culture system employed. Farmers who were observed to use these recommended ranges had better yield and fish average body weight at final harvest. Farmers need to be given good advice about the choice of species that they intend to farm. Carps require more care and attention than Tilapia and a good-quality and readily available water supply is vital. Farmers are attracted from Tilapia to Carp farming by the potential for higher income, however in some cases their competence or farm quality is insufficient to raise Carps successfully. In such cases, these farmers are better off to remain as Tilapia farmers.

About 55% of the farmers got their fingerlings from the imported while 45% procured theirs from local farmer. All the farmers mentioned high price of commercial Carp supplementary feeds. To minimize the feeding cost local farmers were interested to use locally available low cost fish feed ingredients like wheat bran, olive pulp, tomato pomace, etc. Farmers were found for cheaper feeds despite slower growth rates and lower production being the result. Often they under-fed, or in one case did not feed fish at all, even though they claimed that they did. A majority of farmers were not conscious of the importance of choosing a quality feed, commonly utilizing cheaper feed alternatives. Quality feeds (pellet) result in higher production than cheaper alternatives like concentrated fish feed (32%). Feedstuffs used in feeding the fish include, poultry by product, poultry feed, maize grain (ground), fish meal, wheat bran, fish feed, rice/beans (cooked and ground) and kitchen waste. Water supply for the ponds came from King Abdullah Channel, springs, Tankers, Water Authority and Jordan Valley Authority. At harvest, about 55% of the farmers marketed their products in fresh to the relatives and friends and neighbors while the other was patronized by the operators for local markets 30 and 15% restaurants. Washing with water was the only method for fish handling. About 70% carried out the daily routine management practices of feeding fish and checking for disease while the remaining 30% other than feeding fish checked water quality and water level. About 70% of the farmers were satisfied with the farm output while the remaining 30% complained of lack of running capital, high cost of feeds, inability to pay staff, low return from investment, inadequate water supply/fingerlings, high rate of mortality, poor management method among other things and marketing.

The constraints to successful fish farming in the study area include:

- Lack of capital for investment
- High cost and non-availability of fish feeds
- Exploitation by greedy fishery consultants
- Diseases outbreak/mortality
- Poor management methods by employees
- Inadequate extension services

Others are; lack of feasibility study before establishment of farm, poor pond construction by non-experts resulting in seepage, pond cracks and drainage difficulty, inability to compound balanced fish feed with the basic ingredients from the abundant local feedstuffs to evoked proper fish health/growth, high productivity and for higher food conversion ratio to fish fresh; inability to procure farm inputs, such as fish fingerlings, fertilizers, feedstuffs and dragnets at affordable rates. Only few farmers had access to purchase improve fish variety raised through hybridization and Bio manipulation. Table 4 gives a summary of the constraints to successful fish farming in

Table 4: Summary of constraints to successful fish farming

Constraints to successful	Percentage
Marketing	25.00
Lack of local consumption demand	30.00
Low selling price of the produce	15.00
High marketing cost of the produce	20.00
Lack of proper marketing channels	35.00
Technological	12.50
Locally available methods of fish farming	15.00
Types of land infrastructure	9.00
Inadequate introduction of innovations	7.00
No technical advice on fish farm operation	13.00
Unavailability of equipment for use at different phases of production	12.00
Not using device to circulate dissolved oxygen at night in large ponds	20.00
Not using tranquilizers to calm aggressive spp when transported from hatchery	8.00

Table 4: Continue

Constraints to successful	Percentage
Not ensuring adequate aeration of the receptacle carrying fingerlings by supplying diffused air/oxygen bags	16.00
Socio-cultural	25.00
Changes in past government and administration	30.00
Community beliefs on choice of culture able species	20.00
Predation of fish by other animals	30.00
Poaching in the farm	20.00
Institutional	20.00
Poor level of loan utilization	13.00
Lack of motivating government policy	18.00
No feasibility studies on farm site selection	29.00
No loan facility/Govt. aid	10.00
No available the veterinary services for farms	30.00
Production	7.14
High cost of available land	9.00
Unavailability of fish feed on fingerlings	10.00
High cost of feeds	9.00
High cost of establishing fish farm	8.00
Inadequate fingerlings supply	3.00
Overstocking of ponds	3.00
Not feeding fish at 5% body weight	9.00
Non purchase of improved fish variety by hybridization/bio manipulation	8.00
Not practicing routine maintenance	7.00
Not checking of water quality parameters in the ponds	12.00
Stunted growth due to proliferation/overcrowding of some sp. (Carp)	8.00
Feedings fingerling before and during transportation which is detrimental to health	3.00
Not transporting fingerlings early in the morning to minimize fish mortality	5.00
High rates of mortality recorded in fish fingerlings	6.00
Environmental	11.11
High depletion of dissolved oxygen in pond	22.00
The average daily temperature in pond	4.00
Low water pH in pond	9.00
Pond water turbidity	12.00
Atmosphere polluted rains	15.00
Lack of perennial/constant sources of water supply	11.00
Seepage in the pond	13.00
Unavailability of adequate land	5.00
Unavailability of cultural species	9.00

Survey, 2010

Table 5: Summary of major constraint affecting Carp production in Jordan

Constraints	Average percentage	Order of constraint
Environmental	11.11	4th
Socio-cultural	25.00	1st
Institutional	20.00	2nd
Production	7.14	5th
Technological	12.50	3th
Marketing	25.00	1st
Total	100.75	

the study area. Based on the outcome of the in-depth interview with key informants. Response analyses of the sub-constraints led to the identification of 6 major mutually exclusive groups of constraints: Production, environmental, socio-cultural, institutional, technological and marketing, as shown on Table 4, 5 and Fig. 1. The results across all the major constraints having adverse influence on the operation of individual farms is marketing and socio-cultural were the most major constraint that affecting on Carp production in Jordan (25%) and the second constraint with average percentage 20% is institutional while the third constraint in order influence on production is technological (12.5%) and among the environmental constraints (11.11%), high depletion of dissolved oxygen was the most severe sub-constraints. The production constraints (7.14%) had

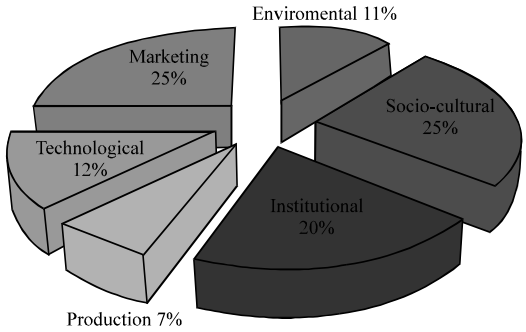

Fig. 1: Summary of major constraints of Carp production in Jordan

many sub-constraints of which not checking of water quality parameters in the ponds, unavailability of fish feed on fingerlings, high cost of available land, high cost of feeds and high cost of establishing fish, etc.

Essen (2005) has listed successful culture able species, good pond management would use water testing kits to determine the necessary water parameters. This and other routine practices would detect fouling of water through feedstuff, ammonia problem, dissolved oxygen,

temperature, etc. Pond fish strives well in good quality water with mean temperature of 19-23°C, pH of 6.5-9.0, stocking density of 3-5 m^{-2}, provision of balanced feeds, maintenance of feeding time and feeding at 3% body weight for fingerlings and 5% body weight for the adult.

CONCLUSION

Now-a-days, culture of fishes is only source reliable to get fishes rather than capture. Because open water source is indiscriminately affected by many natural and manmade interferences.

However, many technologies are generating by many scientists to increase fish production but there are so many problems to implement. This research highlights a little of that aspect but further many other extensive researches are required in compliance to poor economic countries like Jordan.

RECOMMENDATIONS

The enormous obstacles placed by nature, individual farmers and associated functionaries do not allow fish farming to be successful in Jordan, despite the availability of resources for fish farming. The greatest obstacles are water, lack of initial studies to properly locate the farm structure and capital to run the fish farming business. Based on the findings of the study, the following were recommended to encourage fish farming activities.

Awareness and training programmes on pond management, especially on the importance of feed, choice of species, stocking density, importance of fertilizer and water management.

An improved monitoring framework (extension service) is needed and a finance scheme developed for rural fish farmers.

There is a need to develop additional sales outlets for live fish and product development and training to diversify the ways in which fish can be sold.

Decentralize hatcheries to improve farmer access to fry and increase fingerlings production. Government should subsidize the cost of farm inputs, such as fish seeds (fingerlings), fertilizers, water testing kids and culture tanks.

Promote green-water method of Carp farming for those who can not or won't buy feed. Train farmers on feed preparation and encourage them to make their own feed. Collaboration between stakeholders (Government departments, farmers associations, regional and international organizations, donors and education and research institutions) should be encouraged and further strengthened. The fish farmers folks should form organize themselves into co-operative societies, in order to attract government assistance or loan facilities from banks.

Ministery of Agricultural and National Center for Agricultural Research and Extension (NCARE) should promptly organize seminars, workshops, conferences and extension services to broaden the knowledge of the fish farmers in the fish farming business in the study area. Farmers should utilize the local feedstuffs that abound in the study area and compound them into a balanced diet to reduce management cost as well as evoke proper fish health/growth.

Farmers should first of all carry out feasibility studies in their selected sites before the actual construction to ascertain water parameters, soil nature and types, water holding capacity, plankton communities and the possible culture able fish species, etc.

Fish farmers should practice test-cropping to avoid cannibalism by shooters and also maintain proper sanitary conditions to chase away other predators such as snakes, toads, birds, etc.

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