World Applied Sciences Journal 3 (6): 926-929, 2008
ISSN 1818-4952

The Mechanization of Fish Farms in Rivers State, Nigeria

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Abstract: A total of 306 machines and equipment were examined from five local government areas viz Port Harcourt, Okrika, Obio-Akpor, Ogu-Bolo and Eleme as a case study in Rivers State, Nigeria. This study revealed the following values for each type of available machines and equipment: pelleting machines, 85 (27.7%);water pump, 71 (23.2%); generator, 38 (12.4%); air pump, 27 (8.8%);milling machine, 31(10.1%); mixer, 6 (2.0%); dryer, 3 (4.2%); oven, 8 (5.9%);pH meter, 2(0.7%) and dissolved oxygen meter, 2 (0.7%). Diesel engine, 76 (72.4%) was favoured as the prominent prime mover for the machines. Installation of air pump to enhance the dissolved oxygen level had contributed immensely to increase the stocking rate beyond normal rate of 30 fishes/m^2 to 150-200 fishes/m^2.Women, 34 (68%) dominated the post harvest processing of fish while men were predominately in fish, 65.75% and fish feed production, 63.2%. This study revealed poor operational and maintenance practices of the machines by the operators and this consequently affected the functional life span of the machines. The sex of machine operators was depended on the type of prime mover.

Key words: Mechanization · fish farms · machine operators · Nigeria

INTRODUCTION

Nigeria is among the largest fish consumers in the world with over 1.5 million tons of fish consumed annually. Yet, today, Nigeria has a big hole in her pocket as the country imports over 900,000 metric tons of fish while its domestic fish catch is estimated at 450,000 metric tons/year [1, 2]. This large dependence on imported fish has adversely affected her economy and mostly foreign reserves.

Fish production from aquaculture accounted for about 96,000 metric tons in year 2000, while only 20,000 metric tons in 1994 [3]. It is obvious from these figures that aquaculture has the potential to help expand the resource base and reduce the pressure on conventional sources of fish, generating employment, foreign exchange and elevating socio-economic of the farmers. The involvement of small scale aquaculture projects in the towns and villages will create employment and thereby alleviate poverty among our youths [4].

Processing and preservation are of utmost importance since fish is highly susceptible to deterioration immediately it is harvested. Therefore, processing of fish after capture is imperative to prevent serious economic losses. Smoking or drying is the most common method of fish preservation in Nigeria. Traditionally, fish is smoked in mud kiln or halved cut drum with wire netting on top and use of wood as source of heat after it has gone through brining process [5-7].

Hardwoods are preferred to softwoods for fish smoking because the former yield more acid and may therefore produce products that are more bacteriologically stable [8-10].

The need to mechanised fish and feed productions and post harvest processing has drawn the attention of National Agricultural Research to devote utmost interest and resources to engineering research in operations to minimise the drudgery, reduce labour intensities and unsanitary and inherent unhygienic handling that are involved in the traditional manual operations [11]. Mechanisation of fish production and processing steps up productivity and improved commercial quality and storability of fish production [12]. It has also increased the awareness of fish potentials to develop non-traditional fish products for raw materials in the food and pharmaceutical industry. The three different major

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operations undertaken in a fish farm includes hatchery and grow out, fish feed production and post harvest processing. All these operations can be adequately mechanised and these will consequently increase productivity.

MATERIALS AND METHODS

Study of mechanization of fish farming operations in Rivers State of Nigeria using five local government areas namely Port Harcourt (Zone 1), Obio-Akpor (Zone 2), Okrika (Zone 3), Ogu-Bolo (Zone 4) and Eleme (Zone 5) as case study was conducted in September 2007. The survey was carried out by means of a structured questionnaire and administered through a participatory learning technique. Data were collected by face-to-face interview. Each of the local government area was divided into ten zones. Two farms were visited in each of the zones. Thus, a total 100 fish farms were visited. Some of the issues addressed included: the different types of machines available in all these farms, the most prominent among the machines, sex of the machines operators, etc. The qualitative results obtained were collated and analysed using computer software [13].

RESULTS AND DISCUSSION

A total of 306 machines and equipment were obtained from these five local government areas of Rivers State. Most of the fish farms visited were just less than five years old. The recent upsurge of interest in aquaculture can be traced to the modern technology employed by the fish farmers and increased awareness of the potential of certain unexploited categories of fish products [14]. The owners of the farms are individuals, either retired or in active service who viewed the business as a source of sustainable livelihood even in old age. The only two government fish farms in the state are not properly functioning. The farms visited were classified into small, medium and large scales based on the type and number of machines available and the level of activities in the farm. The small scale farms were predominant (78%) while medium and large scales shared 17% and 5% respectively.With respect to capitalization of the enterprises, personal savings constitute more the 95% of funding for most of the enterprises while the other sources were from friends and relatives.

A look at Table 1, summary of the machines and equipment revealed prominent among the machinery were pelleting machines, 85 (27.7%); water pump, 71 (23.2%), generator, 31 (12.4%) and crusher, 31 (10.1%), pH meter, 2 (0.7%), dissolved oxygen (DO) meter, 15 (4.9%), dryer, 13 (4.2%), oven, 18 (5.9%) and air pump, 27 (8.5%).Other machines observed in descending order: oven 18, (10.1%); DO meter, 15 (4.9%); dryer, 13 (4.2%); mixer, 3 (0.1%); pH meter 2 (0.7%).

Table 2 revealed poor operational and maintenance practices. The machines were not serviced as of when due and to crown it all, the lubricating oil in the engine was not changed for more than three months. With this singular act, the life span of the machines were reduced. No wonder, this study recorded a lot of abandoned machines. Most of the machines operators lack formal technical know-how and training in machines repairs and maintenance skill that are required to provide operation and maintenance skill to sustain small-medium scale enterprise. Mixing of the feed ingredients were done manually by using shovel. Installation of air pumps were done to enhance dissolved oxygen concentration and this enable farmers to increase their stocking rate beyond the normal rate of 30 fishes/m^2 to between 150-200 fishes/m^2 [11]. All the air pumps were powered by electric motors. Most of the ovens observed were being powered either by electricity, charcoal/firewood, none was being

Table 1: Summary of machinery and equipment observed during the study

Type of machinery	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Total	%
Pelletor (motorised)	33	27	9	5	11	85	27.7
Mixer	3	2	1			6	2.0
Crusher	10	8	4	6	3	31	10.1
Aerator	8	6	3	4	6	27	8.8
Dryer	5	3	2	2	1	13	4.2
Oven	4	6	4	3	1	18	5.9
Generator	12	10	6	6	4	38	12.4
Water pump	16	13	17	18	21	71	23.2
pH meter	4	2	5	3	1	15	4.9
DO meter	1	-	1	-	-	2	0.7

Table 2: Service and maintenance duration

Type of machine	Regular (%)	Irregular (%)
Pelleter	16	84
Mixer	5	95
Milling	38	62
Airpump	75	25
Dryer	-	100
Oven	-	100
Diesel engine	27	73
Petrol engine	35	65
Electric motor	30	70

Table 3: Prime mover of engines

Prime mover	No. observed	Observed (%)
Diesel	76	72.4
Petrol	8	7.6
Electric motor	21	20.0

Table 4: Sex of machine operators

	No. of fish farm visited	
Operation	Male	Female
Fish production	46 (65.7%)	24 (44.5%)
Fish feed production	55 (63.2%)	32 (36.8%)
Fish processing	16 (32.0%)	34 (68.0%)

powered by gas. The dryers were powered by electricity and most at time were not in use because of the erratic nature of electricity in those areas. Milling operations were mostly done in the market. All the farms using recirculatory systems depend on generators for their operations.

Diesel engine was the most common prime mover, 76 (72.4%) found in various feed processing machines. The electric motor recorded 21 (20.0%) while petrol engine, 8 (7.6%). The sex of the machine operators depends on the type of prime mover (Table 3).

Diesel engines were being manned most times by men while petrol engines were common among the women. Fish and fish feed production were predominantly done by men while post harvest handling is commonly done by women (68%) and male (32%) (Table 4).

The total number of abandoned machines and engine were 44 while pelleter and diesel engine were 12 and 9 respectively (Table 5). This table showed reasons given by the machines operators for abandoning their machines within a space of two years. On the spot assessment, revealed that apart from reasons mentioned above, the machine operators were not trained on machine management and services. Some of the machine operators complained bitterly on adulterated spare parts as well as lack of experience machine repairers.

This study is similar to Yiljep *et al*. [15] that reported poor information dissemination on availability of improved technology and innovation as one of the major bottleneck to the adoption of farm mechanization. The major sources of water were bore hole, 65% and well, 17%. None of the fish farms visited have access to tap water, that is, public tap water.

CONCLUSION

This study had quantitatively evaluated the mechanization of fish farms in Rivers state, Nigeria. It was recorded that in spite of recent upsurge of interest in aquaculture, increase awareness of potential of certain unexploited categories of fish products in food and pharmaceutical industries, mechanization status remains low. Poor information dissemination of the available improved system and machinery to boost the present fish production level were identified as a major factor hindering adoption of mechanization. In the course of this study, it was observed a lot of abandoned machines with life span of less than five years were observed. This ugly situation was attributed to poor operational and maintenance culture of the machines by the operators and this consequently shorten the life span of the machines. Information gathered revealed that fish farmers received no financial assistance from the government, non-governmental groups and commercial banks.

RECOMMENDATION

Fish farmers must be aware of improved system and machinery before their adoption. The lack of information can be effectively tackled through research and development organizations. They should continuously provide comprehensive information on the availability of their proven appropriate tools and machinery to extension workers and fish farmers. This could further strengthen if research and development organizations establish their own extension units.

Federal government to link potential local fabricators and manufacturers with centres having prototypes ready for commercial production. Appropriate government agencies must be put in place to sustain such linkage. Any machine to be developed for mechanization should vary among between the various agro-ecological zones of the country. Training in machinery repairs, maintenance

Table 5: Abandonment of machines

Type of machine	No. abandoned	Old age	High operation cost	No. availability of spare parts	Repair	Low
Fish production	12		3		35	62
Mixer	-	-	-	-	-	-
Milling	5	2	4	10	41	43
Aerator	8		3	17	80	
Dryer	2	-	-	-	75	25
Oven	-	-	-	-	-	-
Diesel	9	13	9	14	47	17
Petrol	2	5	17	8	63	7
Electric	6	7	15	12	54	12

practices after sales services and spare parts stocking must be incorporated into procurement agreement of machinery and equipment.

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