THE PROSPECTS OF DUCKWEED CULTURING IN ALLEVIATING POVERTY IN NIGERIA.

BY

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ABSTRACT

Duckweed is the smallest of all flowering plants and the plant double its mass in less than 2 days under ideal environmental conditions. Dry matter of duckweed contains between 35 – 45 % crude protein. Moreover, the introduction of the plant to feed mill industries as a source of protein and binder supplement for pelleted fish feeds. Duckweed has great potential if cultivation is encouraged in Nigeria. as this will also provide a good employment opportunity for larger percentage of youth in the riparian communities. The thrust of this paper was to explore the possibility of introducing duckweed farming to the rural populace for alternative sources of income most especially, the fisher folks and other interested farmers.

INTRODUCTION

Globally, the economies of the world are undergoing adjustment due to recession being experienced in different countries including the developing nations. It is therefore not surprising that every visionary leader is seeking for a palliative measure to reduce the hardship on the part of the citizenry of his country. Nigeria is not an exception as inflation is biting hard on the whole populace of which the lower class people are the most affected. In this class is the largest percentage of the Nigerian people, who are the local farmers, fisher folks and other riparian communities dwellers, who are engaged in the agricultural sector of the battered economy. Recent reports from newspapers and other sources stated that majority of these group finds it difficult to meet their daily food supply for their families. Among other factors responsible for the above scenario is low level of income accrued to farmer's household.

Due to varying degrees of ecological degradation of many Nigerian inland fresh and brackish water bodies occasioned by anthropogenic factors like the activities of petroleum companies and effluents from many industrial estates, the use of obnoxious fishing methods like chemicals and other bad fishing gears; a lot of fishermen are jobless and their immediate families are starving. Aquaculture would have been a way out of this mess for the fishermen group but the high cost of setting up a good fish farm made this unattainable. From the above stated facts, it is not out of place to start exploring alternative sources of income for these groups of labour force in other to curb starvation and improve the standard o'] of the people either directly or indirectly in our society. The paper reviewed the works dc o far on the utilization of duckweed in Nigeria, evaluate the relevance of the plant to economy of the riparian communities and encourage the cultivation of the plant to serve as an alternative source of income.

WHAT IS THIS PLANT? DUCKWEED (*LEMNA SPECIES.*)

Lemna species are small floating aquatic plants found worldwide and often seen growing in thick blanket –like mats on still, nutrient rich, fresh and brackish waters. They are monocotyledons belonging to the botanical family Lemnaceae and are classified as higher plants; or macrophytes, although they are often mistaken for algae. The family consists of four genera, *Lemna, Spirodela, Wolffia* and *Wolffiella* among which about 40 species have been identified so far.

MORPHOLOGY

Duckweed is the smallest of all flowering plants. Lemna mature frond (leaf) diameter is between 6-8 mm across and when compared with other plants, duckweed fronds have little fibre (as little as 5% in cultivated plants). Because they do not need structural tissues to support leaves or stems. Due to this factor, virtually all tissues are metabolically active and useful as a feed or food product for fish and other aquatic animals. These important features contrast favourably with many terrestrial crops such as soybeans, rice or maize of which most of total its biomass is left behind after the useful parts have been harvested.

DISTRIBUTION

The plant is widely adapted to a variety of geographic and climatic zones. Out of all the four genera, the most common duckweed in Nigeria is *Lemna pauscostata* (Linn.) as reported by Mbagwu and Adeniji (1988).

GROWTH CONDITIONS

The plant is free floating on the surface of fresh or brackish water sheltered from wind and wave action by surrounding vegetation. The most favourable circumstance is water with decaying organic materials to provide duckweed with a steady supply of growth nutrients and trace elements. A dense cover of duckweed shuts out light and inhibits competing submerged aquatic plants including algae. In order to cultivate duckweed, a farmer needs to organise and maintain conditions that mimic the natural environmental niche of duckweed which include:

A sheltered, pond-like culture plot

A constant supply of water and nutrient from organic or inorganic fertilizers

Wastewater effluent rich in organic materials (as it provides a steady supply of essential nutrients and water).

RATES OF REPRODUCTION

Duckweed reproduction is primarily vegetative. Daughter fronds bud from reproductive pockets on the side of a mature frond (leaf). A single frond can produce as many as 10 generations of daughter plants over a period of 10 days to several weeks before dying.

Duckweed plants double their mass in less than 2 days under ideal conditions of nutrients availability, sunlight, and temperature (faster than any other higher plants like water hyacinth). Under experimental conditions; production rate can approach an extrapolated yield of 4 metric tonnes per hectare per day of fresh biomass or 80-mt/ha/ year of dry matter (solid material). This pattern resembles the exponential growth of unicellular algae. This denotes unusually high biological potential.

LIMITING FACTORS

Factors that limit growth rates in unmanaged colonies include: Nutrient scarcity or imbalance, toxins, extremes pH and temperature. Moreover, crowding by overgrowth of the colony and competition from other plants for light and nutrients. At Mirzapur experimental station

in Bangladesh, actual yield of fresh materials stands from 0.5 to 1.5 mt/ha/day.

NUTRITIVE VALUE

The duckweed fronds contain between 92 to 94% water. Reports from different authors confirmed that the dry matter of duckweed contains between 35 – 45 % crude protein (Mbagwu and Adeniji 1988). Duckweed protein was found to have high concentration of essential amino acids: lysine and methionine than most of plant protein and closely resembles animal protein in that respect. The plant also has high concentration of trace elements and pigment like carotene and xanthophylls, which makes duckweed a valuable supplement for poultry and other animal feeds (Haustein *et al.* 1988).

Tilapia and a polyculture of Chinese carp species feed readily on fresh duckweed. The nutritional requirement of fish appears to be met completely in pond receiving only fresh duckweed despite relatively dilute concentration of nutrients in the fresh plant (Cassani and Caton 1983; Gaighers *et al* 1984, Moreau *et al* 1986).

Table 2: Proximate composition of Lemna spp and other freshwater and terrestrial plants.

Species	*Lemna spp*	Water hyacinth (*Eichhornia crassipes*)	Water velvet (*Azola pinnata*)	Pawpaw (*Carica papaya*)	*Leucaena leucocephala*	*Moringa oliefera*
Crude protein (%)	**35-45**	**14.4**	**21.5**	**23**	**25.6**	**26.6**
Crude fat	9.2	2.9	3.2	11.1	6.7	8.2
Crude fibre	16.2	24.8	12.0	11.4	12.1	8.8
Ash	27.6	19.4	16.1	15.9	8.4	12.4
NFE	43.6	30.1	47.1	38.5	47.2	44.4
Sources	Landolt and Kandeler (1987); Mbagwu, and Adeniji, (1988);	Hasan *et al* (1990); Ogunlade, (1996)	Reyes and Fermin (2003)	Reyes and Fermin (2003)	Hasan *et al* (1990); Reyes and Fermin (2003),	Reyes and Fermin (2003)

CULTURING DUCKWEED

Duckweed cultivation is a continuous process requiring intensive management for optimum production. Daily attention and frequent harvesting are needed throughout the year to ensure the productivity and health of the duckweed colonies. Fresh plants can be used daily in form of fish feed or dried for use in other animal feed or package for sale to feed producers.

Frequent duckweed cropping increases the productivity of land and labour resources especially where land is scarce like our urban centres throughout the country (Lagos, Ibadan, Port Harcourt, Kaduna, Kano etc). Also, where labour is seasonally underemployed like the northern parts of the country where farming season is very short due to longer period of dry season and there may be no irrigation facilities to go on dry season farming.

Location of duckweed farm

Land for duckweed farming should be able to retain water just like any appropriate fishpond locations. Also such site should be protected from flooding, as this could be devastative to duckweed sustenance. Fadama, floodplain/wetlands, or marshy soils and waterlogged environment that is not alkaline soils which may raise the pH of water beyond the plant can tolerate (pH 6.5-7.5 which is best for duckweed) will be very good for the establishment of duckweed farm. Any serious deviation from this will retard duckweed growth.

WATER AVAILABILITY

The ideal condition is for an all year round water supply. Groundwater, surface water irrigation or wastewaters are all potential sources of water for cultivation of duckweed. Ideally, 20 cm or more is required so as to reduce water stress and facilitate harvesting. Shading with vegetation such as bamboo or banana trees is useful to moderate temperature extremes.

NUTRIENT SOURCES

Duckweed cultivation involves hydroponics farming. This type of farming converts

substantial amounts of fertilizer into plant biomass. The nutrient removal rate is directly proportional to the growth rate. When plants are harvested, nutrients and trace minerals are removed from the system thus forming the basis for a highly effective wastewater treatment technology. Duckweed farming requires a dependable source of either commercial or organic fertilizers. Empirical testing of nutrients for duckweed was carried at out Mirzapur experimental program in Bangladesh. The result gave insight into the appropriate fertilizer application and plant requirement. Table 2 shows daily fertilizer application required for certain level of duckweed productivity.

Table 2: Types and fertilizer application rates for duckweed production (kg/ha)

	Daily production of fresh plants per hectare					
Fertilizer	500 kg	600 kg	700 kg	800 kg	900 kg	1000 kg
Urea	10.00	12.00	14.00	16.00	18.00	20.00
Triple super phosphate (TSP)	2.00	2.40	2.80	3.20	3.60	4.00
Muriate potash (MP)	2.00	2.40	2.80	3.20	3.60	4.00
Crude (Unrefined) sea salt	4.50	5.40	6.30	7.20	8.10	9.00

Source: Mirzapur experimental program in Bangladesh

CROP MANAGEMENT

Good crop management will maintain a complete and dense cover of duckweed, low dissolved oxygen and mid-range pH.

From the Bangladesh experience, when duckweed-farming enterprise was compared with other small scale farming business, the profitability of duckweed production compared favourably with alternative investment in agricultural sector. The profitability of duckweed production is sensitive to two factors and these are the cost of fertilizer and sale of fresh duckweed. In Nigeria today, research on finding the most economic sources of protein for fish feeds and other livestock feed formulation is still on going. Presently at National Institute for freshwater fisheries research, the use of duckweed as binding agents to formulate a floatable feed for fish is in progress. Duckweed is gradually becoming an essential ingredient in the fishery sub-sector. Other uses of Duckweed include: Fish culture (Tilapia and Carp), Fish feeds (Floater and adhesive nature in pellet feeds), Poultry and other livestock feeds, pharmaceutical drugs for human being, siltation and water treatment.

AREA OF FURTHER STUDIES

In other to maximise the benefits of duckweed within the Nigerian growing economy, there is need to carry out more in-depth studies on the cost benefit analysis study, livestock feeding trials in Nigeria and vitamin and minerals studies of duckweed composition.

CONCLUSION

Cultivating duckweed by the fisher folks for aquacultural practices and those who might cultivate the plant as a sole crop for the users or feed industries had great potential for the dwindling fortune of rural dwellers and most importantly, the riparian communities in Nigeria.

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