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Effectiveness of Organic Fertilizer for Sustainable Environment : A Review

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ABSTRACT

Organic manure is an excellent alternative of inorganic fertilizers used in the fish pond. The main objective of the application of organic manures is to boost up the sustainability of the environment through which sustainable agriculture can be achieved by farmers. Organic manures can improve the quality of soil through the retention of a greater amount of organic content in the soil. Plant-derived materials can broadly act as an important source of organic matter, which is regarded as a critical component in the agricultural production system. The application of organic manure also has a great role in minimization the cost of semi-intensive farming by cutting down the cost of supplementary feeding. As we know that, fertilization and supplementary feeding are the most important managemental measures in the intensive and semi-intensive farming system, so we can easily bring down the cost of farming through the application of organic manures. But the most important issue regarding the application of any kind of fertilizer, especially organic fertilizers is the time of their application, otherwise, proper mixing would not be done, so eutrophication will be there.

Keywords : Organic fertilizer, Environment, Sustainable development.

INTRODUCTION

Organic fertilizers comprise a variety of plant-derived materials that range from fresh or dried plant material to animal manures and litters to agricultural by-products (Wohlfarth and Schroeder 1979, Kumar *et al.* 2005). The nutrient content of organic fertilizers varies greatly among source materials and readily biodegradable materials present in this make better nutrient sources. Nitrogen and phosphorus content is often substantially lower in organic fertilizers compared to chemical fertilizers. The organic carbon content of organic fertilizer can be of equal or greater importance than its nitrogen and phosphorus contents. Application of organic fertilizer promotes increases in heterotrophic bacterial biomass, which stimulates other secondary productivity and mineralizes nutrients to stimulate primary productivity (Schroeder 1978, Anderson 1987, Colman and Edwards 1987, Qin *et al.* 1995, Barkoh *et al.* 2005). Furthermore, through respiration, the increased bacterial population generates carbon dioxide, which increases dissolved inorganic carbon available to phytoplankton, dissolves limestone to increase pond total alkalinity and can moderate increases in pH during periods of intense photosynthesis. Also, through respiration, the bacterial population consumes oxygen and heavy applications of organic matter can result in low pre-

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dawn pond dissolved oxygen concentration (Qin *et al.* 1995). However, organic matter decomposition and nutrient mineralization occur over days in contrast to immediate nutrient availability from chemical fertilizer. The organic manures have been used as a means of maintaining and increasing soil fertility all along with the history of farming. Organic manures are bulky in nature but supply the nutrients only in small quantities (Alok *et al.* 1995). The organic manures are available in the form of green and dry plant residues, fresh animal wastes, decomposed material of plants and animal origin and biologically active preparations (Palaniappan *et al.* 1995). The use of manures and biologically active preparations of animal and plant origin was most commonly used by those farmers who practice organic farming (Somasundaram 2002). The major sources of organic plant nutrients in India are farmyard manure, rural and urban compost, poultry manure, sewage, sludge, green manure, crop residues, forest litter. Some estimates indicate that their potential source is about 16.9 million tones (Shukla and Mathus 2000). Efficient collection and application of those resources will go a long way in reducing the dependence on chemical fertilizers (Palaniappan 2002).

In order to maintain high fertility status of soil and to produce good harvests, it is necessary to optimize the fertilizer use through combination with various organic residues and materials. Plant residues are a notable source of organic matter with a favorable effect on the biodiversity, fertility and productivity of soils and they can be considered as a critical component in the agricultural production system (Follet *et al.* 1987). Organic residues and manures are the best alternatives and means for substitution in the integrated plant nutrient supply system.

Use of organic manure

The use of manure in aquaculture supports the production of protein using inputs of little nutrient value to man or livestock (Wohlfarth and Hulata 1987). Inorganic fertilizers are expensive and their use by smallholder farmers may be limited (Swift 1993). Animal manures have a long history of use as a source of soluble phosphorus, nitrogen and carbon for algal growth and natural food production (Knud-Hansen 1998). Animal manure is often used in semi-intensive systems to enhance the primary production of the ponds and fish growth (Boyd 1982, Colman and Edwards 1987, Diana *et al.*1988, Msiska 1988, Knud-Hansen *et al.* 1993, Edwards *et al.* 1997, Nguenga *et al.*1997, Nwachukwu 1997). Poultry and cattle manures have been tried with fish in ponds and produced excellent results (Gupta *et al.*1992, Knud-Hansen *et al.*1993, Kamanga and Kunda 1998). Pig manure has been tried in aquaculture in many areas (Boyd 1982, Hepherand Pruginin 1982). However, the use of organic manure in integrated systems remains poorly developed in many parts of Africa, as opposed to South East Asia where it is well developed (Edwards and Pullin1990, Pullin and Prein1995). The various types of manure have been found to control the natural productivity of the pond differently in terms of abundance and prevalence of phytoplankton and zooplankton as well as the benthic materials found in ponds. Boyd (1982) reported that poultry manure triggers more production of phytoplankton in ponds than any organic fertilizers including chemical fertilizer. However, traditionally not many fish farmers utilize this cheap resource. Fish farming is used as a means of supplementing the family income and/or for home consumption (Brummett and Noble 1995). Although the World Bank (1988) reported that there is a good number of livestock available that can produce manure for aquaculture in underdeveloped countries, the technology is under-utilized and their effect on the production of fish in aquaculture remains unexplored. Inadequate pond inputs, both quality and quantity, has been identified as one of the key factors limiting production in small-scale aquaculture. The use of organic manure can be a good option for small-scale farmers.

Organic matter loading due to fertilization was significantly higher in ponds fertilized with cattle manure generally called cow dung but did not differ significantly with chicken and pig manure treatments. The levels of loading were comparable with those reported by Boyd (1990), Brummett (2000). It is reported that pond soils tend to acquire greater organic matter concentration than surface soils and may increase with organic fertilization (Boyd 1995). The organic matter acts as the substrate for the heterotrophic production of microorganisms and protozoans

in microbial food webs that can be utilized by fish to obtain the much-needed nutrition through natural crops of algae, bacteria and other microorganisms in organically fertilized ponds (Geiger 1983, Boyd 1995, Moriarty 1997). The results obtained in this experiment indicated that concrete ponds function similar to earthen ponds when simulated with a layer of soil (Keshavanath *et al.* 2002).

Environmental impact of organic manure

Organic manure is composite in nature, inexpensive and very significant in India, due to the fact that it can make use of various wastes derived from production processes of livestock and agricultural resources and that it is cost-effective (Edwards 1983, Pretto 1996). It has been used as a means of maintaining and increasing soil fertility all along with the history of farming. The organic manures are available in the form of green and dry plant residues, fresh animal wastes, decomposed material of plants and animal origin and biologically active preparations (Palaniappan *et al.* 1995). Plant residues are a notable source of organic matter with a favorable effect on the biodiversity, fertility and productivity of soils and they can be considered as a critical component in the agricultural production system (Follet *et al.* 1987). The International Competence Center for Organic Agriculture (ICCOA) estimated that in India by 2018, nearly 1.5% of cultivated crops would be tagged as 'Organically Produced' and about 2.5% of the global market will be held by India, for exporting organic products.

Organic manuring of fish ponds minimizes the use of supplementary food

Fertilization and supplemental feeding are the two important management measures adopted in the semi-intensive system of carp culture in Asia. A number of studies focus on the role of fertilizers in fish production (Garg and Bhatnagar 2000) and of supplemental feed-in systems receiving fertilizers (Aziz *et al.* 2002, Virk and Saxena 2003, Ahmed *et al.* 2005, Waidbacher *et al*. 2006). While supplemental feeding affects fish growth directly, fertilization contributes to growth via the planktonic natural food. In addition to acting as a food for fish, plankton performs other important functions in pond aquaculture: A net producer of dissolved oxygen, which is indispensable for fish growth (Teichert-Coddington and Green 1993) and the most important sink of ammonia-nitrogen, which is excreted by fish (Hargreaves 1998, Jiménez-Montealegre 2001). Jhingran *et al.* (1969) observed that natural food also supplies certain digestive enzymes that improve the utilization of artificial diets. The FAO/AADCP Regional Expert Consultation has emphasized the need for a greater understanding of the role of natural food organisms in semi-intensive farming based on systems that optimize pond fertilization, in order to bring down the cost of fish production (NACA/FAO 2000).

The best way to reduce the cost of fish production is to minimize the use of supplemental food; this can be best achieved by exploiting the synergetic interaction between natural food and supplemental feed. According to Moav and co-workers (1977), judicious organic manuring of fish ponds can eliminate the need for supplementary feeding.

CONCLUSION

Fertilizing should be done in time, should not be inappropriate times. For example, heavy rainfall to the seasons, fertilization and fertilizer water will mix with the surrounding soil by leaching. For this reason, fertilizer will be lost from the soil, as well as pollution of surrounding water and therefore it will result in eutrophication (FAO 2009).Water caused by chemical fertilizers is the most effective way to prevent eutrophication, especially in the form of phosphorus flow will stop. In addition, sedimentation, nutrients, dilution, pressure water application, filtrationor herbicides, such as the addition of some physical and chemical methods can be effective.

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