Chapter 10

Marine Plants as a Sustainable Source of Agri–Fertilizers for Small Island Developing States (SIDS)

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ABSTRACT

Climate change is forcing farmers in Small Island Developing States to find novel methods to maintain crop productivity. Past practices using chemical fertilizers and poor waste management severely damaged many coastal areas, leading to an ecosystem shift towards algal dominance. In this chapter, the authors propose an approach to deal with this issue by devising methods which divert excess marine plant biomass into agricultural uses through conversion of the biomass to solid and liquid fertilizers. Seaweed-based fertilizers have already been tried with much success on crops in some developed countries, but these are expensive to import into Pacific Islands. The authors also suggest empowering local communities with the knowledge to convert marine plant biomass into ecologically friendly fertilizers. They will be able to save on the purchase of commercial fertilizers detrimental to the environment, while at the same time reducing the spread of seaweeds on their coral reefs. Farmers’ incomes will increase.

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INTRODUCTION

With the effects of climate change being increasingly felt by Small Island Developing States (SIDS) in the Pacific Region, farmers are challenged to find ways to maintain crop productivity and sustainability with their limited economic resources. Over the past decades, farmers were encouraged to use chemical fertilizers rich in phosphates and nitrates, before it was realized that these could cause long-term damage to the environment, freshwater table and marine ecosystems downstream resulting in ecosystem shifts towards algal dominance (Kinsey and Davies, 1979). In the Pacific Islands in recent years, there has been a concomitant issue with overabundant seaweeds, which are also threatening to cause ecological shifts towards algae-dominated coral reefs. Such shifts result in losses in reef productivity, touristic attractiveness and fisheries livelihoods for local communities (Mosley and Aalbersberg, 2005).

Seaweed-based fertilizers have been used since the 1920s and earlier in Europe, but their use was restricted to coastal areas and was not cost-effective compared to their chemical counterparts. However, with the advent of liquid fertilizers and foliar sprays in the 1960s, there was renewed interest in the use of seaweed-derived additives in agriculture. In particular, a wide range of beneficial effects were noticed while using algal extracts, such as enhanced germination, better root development and growth, better assimilation of nitrogen and phosphorus, better resistance to pests and diseases, and cleaner, longer lasting fruits (Merigout, 2006; Kumar et al. 2012). For instance, brown seaweed concentrate applied as a foliar spray was reported to cause early fruit ripening, an increase in fresh fruit weight of up to 17% and an increase of about 10% in the number of harvested tomato fruits in trials done in South Africa (Crouch and Van Staden, 1992). Algal-derived hormones such as cytokinins are considered to produce these beneficial effects in terrestrial plants (Mooney and Van Staden, 1986). However, the current prices of imported seaweed liquid fertilizers are prohibitive for local Pacific communities. Increased water holding capacity and plant growth are seen with the addition of as little as 10% seaweed compost to soils (Eyras et al. 1998). In some countries such as Pakistan, drifted seaweed biomass is turned into organic compost through aerobic composting methods, and when applied to plants was found to produce a germinability factor comparable to that of cow manure and commercial fertilizers (Haq et al. 2011). Added benefits reported from the use of seaweed extracts as foliar spray on agricultural crops include a reduction in the number of harmful insects such as red spider mites (Hankins and Hockey, 1990), protection against oxidative and thermal stress in leafy vegetables such as spinach (Fan et al. 2011) and enhanced chlorophyll levels in leaves leading to higher photosynthetic rates and growth (Blunden et al. 1997).
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