Policy Brief

Improving seaweed production in the era of climate change challenges: Can Biotechnology be the magic wand?

Salum Hamad[1], Linda Maliaki[2]

Introduction:

The blue economy (BE) is advocated as a new economic frontier for coastal states, and more importantly for Small Island Developing States (SIDS) in Africa, with which Zanzibar shares common characteristics. The implementation of blue economy policy in Zanzibar has prioritized fisheries and aquaculture, maritime trade and infrastructure, energy, tourism marine and maritime governance.

The improvement of seaweed aquaculture is one of the primary aspects being considered in the blue economy policy. The sector supports livelihoods and provides

Figure 1: Eucheuma denticulatum, cultivation in Bweleo, Zanzibar

[1]Ministry of Agriculture Irrigation, Natural Resources and Livestock of Zanzibar
[2]Sokoine University of Agriculture in United Republic of Tanzania

employment between 15,000–20,000 inhabitants of the coastal areas of Zanzibar, 90% of whom are women. Over the past five years, seaweed exports have averaged 11.7% of merchandise exports representing a significant source of foreign exchange earnings.

Zanzibar contributes 0.5% of the global aquaculture, mainly spiny Eucheuma (Eucheuma denticulatum) (Fig. 1), a species of red algae which is also known as E. spinosum when cultivated. It is one of the primary sources of iota carrageenan. Carrageenan is an essential ingredient in diary industry. It is used in milkshakes, cheese, yoghurt, and in powdered milk including baby formula. Also is used in toothpaste, cosmetics, shampoos, paints and pet food etc.

Figure 2: Plates showing how seaweed is used on food in Zanzibar

Challenges facing seaweed aquaculture :

Despite initial successes, there has been a decline production from 16.7 to 8.8 metric tons between 2009 and 2019 (Fig. 3).

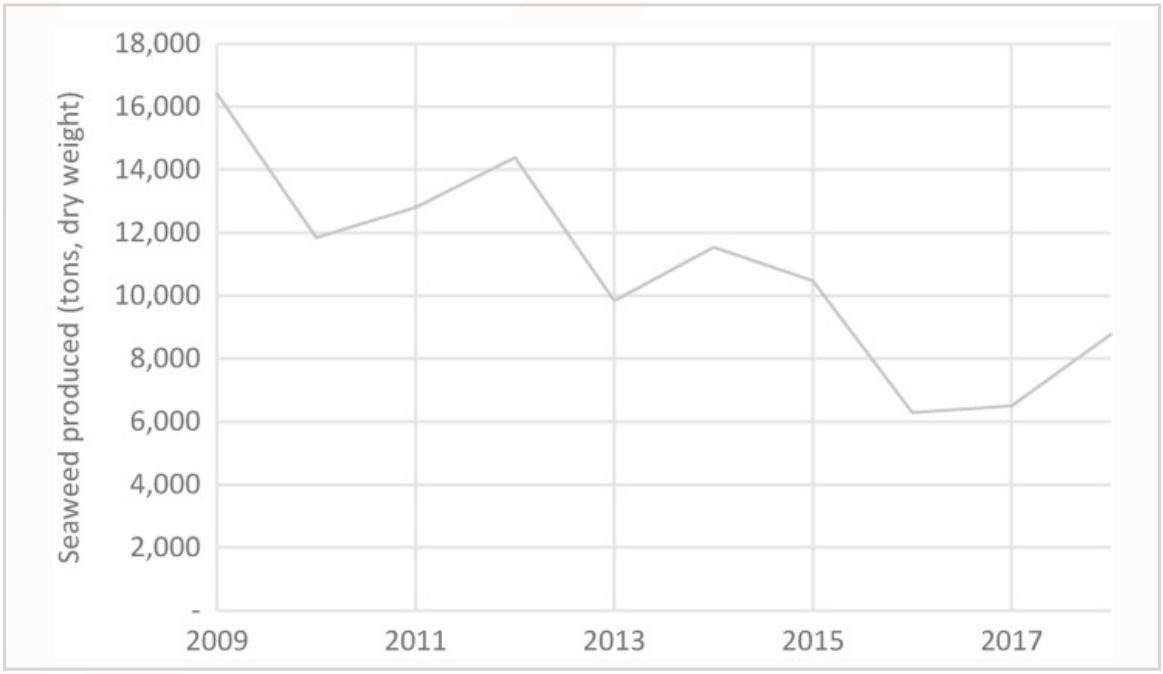


Figure 3: Seaweed production in Zanzibar between 2009 and 2018 (Department of fisheries of Zanzibar)

The combination of low-sale price and seaweed die-offs, linked to climate change and overgrowth of fouling organisms such as epiphytes, the non-parasitic plants that thrives on algae thallus for their support and growth, and their infestation has a prime economic impediment in commercial cultivation of seaweed. Many farmers have reduced their farm size or abandoned the activity altogether. Another factor that has contributed to the decline in production is the loss of quality due to repetitive vegetative propagation of the same seaweed plants. This results in loss of genetic diversity and slow growth, reduction in phycocolloid yield and quality and susceptibility to disease.

Figure 4: Seaweed infested by epiphytes plants

> The improvement of seaweed aquaculture is one of the primary aspects being considered in the blue economy policy. The sector supports livelihoods and provides employment between 15,000–20,000 inhabitants of the coastal areas of Zanzibar, 90% of whom are women.

How biotechnology can address seaweed climatic challenges:

Several biotechnology techniques such as tissue culture/micro propagation, protoplast isolation and fusion, hybridization, gene transfer, grafting, utilizing gene markers can be employed successful to overcome the production challenges.

For instance, tissue culture techniques can be used to produce large numbers of planting material within a short period. In addition, gene or molecular markers can be used to select disease resistance or heat-tolerance strains that can be used in the breeding programs for genetic improvement of susceptible cultivated species. Also, highly advanced biotechnology techniques such as protoplast fusion and gene transfer can be used to develop good seedlings seaweed for commercial production.

Recommendation :

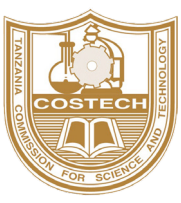
Biotechnology can become a magical wand in addressing the production challenges facing seaweed farming sector. Biotechnology could enable the development of new varieties of seaweed that of high good quality disease resistance and tolerance to abiotic stress associated with climatic change.

- There is need for relevant sectors such as Research and Planning commission to establish biotechnology and biosafety policies, to facilitate and coordinate biotechnological research.
- The Ministry responsible with Education, Science and Technology should incorporate biotechnology discipline in the study curriculum to build the aptitudes of present and future generation.
- The ministry responsible with aquaculture should invest in seaweed biotechnological research to generate technologies that will address seaweed production challenges.
- Ministry responsible for finance should mobilize and allocate funding resources to enable relevant sectors to implement their biotechnological related programs.

Citation:

Eklöf JS, Msuya FE, Lyimo TJ, Buriyo AS (2012) Seaweed farming in Chwaka Bay: a sustainable alternative in aquaculture. People, nature and research in Chwaka Bay. WIOMSA, Zanzibar, pp 213–233. Msuya FE, Shalli MS, Sullivan K, Crawford B, Tobey J, Mmochi AJ (2007) A comparative economic analysis of two seaweed farming methods in Tanzania. The Sustainable Coastal Communities and Ecosystems Program. Coastal Resources Center, University of Rhode Island and the Western Indian Ocean Marine Science Association. Msuya FE (2011) The impact of seaweed farming on the socioeconomic status of coastal communities in Zanzibar, Tanzania. World Aquacult 42(3):45–48. Bryceson I (2002) Coastal aquaculture developments in Tanzania. Sustainable and non-sustainable experiences. West Indian Ocean J Mar Sci 1:1–10


OFAB
TANZANIA


COSTECH
TANZANIA COMMISSION FOR SCIENCE AND TECHNOLOGY


AATF
PROSPERITY THROUGH TECHNOLOGY