

Relieving Tropical Pressure through Ecosystem Thinking - Guayule an Example

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Editorial

Agriculture is defined as the cultivation of animals, plants, fungi and other life forms for food, fibre, biofuel, medicinal and other product used to sustain and enhance human life. A wide range of rubber products are manufactured from the latex harvested from rubber plantations. The area which the industry caters include defence, aviation, aeronautics, railways, agriculture, pharmaceuticals, mines, tall plants, ports, family planning programmes, hospitals, sports, i.e. practically to every conceivable fields.

The yardstick to measure the growth rate of the industry is rubber consumption. According to International Rubber Study Group (IRSG), the world natural rubber decreased 1.5 percent in 12.1 million tonnes. The World natural rubber demand is expected to increase to 17.5 million tonnes in 2016 under the IMF scenario. Today 92 percent of the Worlds natural rubber namely hevea rubber or tree rubber is produced in countries which include China, India, Malaysia, Indonesia, Thailand, Philippines, and Vietnam. In the event of war, diseases or natural calamities a constant supply of rubber to an ever expanding rubber industry cannot be assured. Continued pressure worldwide on hevea rubber has contributed to renewed interest in the alternate source or rubber called Guayule rubber (shrub)

Description of the Plant

Guayule, *Parthenium argentatum* commonly known as Guayule is a flowering shrub in the aster family Asteraceae that is native to the south western United States and northern Mexico. It was originally discovered by J.M Bigelow in 1852. Guayule is well adapted to semi-arid and Mediterranean area and found to grow well under temperature -9 to 40 °C and rainfall between 200- 250 and 500 mm are well suited for its sustainable production. These places are mainly found in Africa (Sahara, Namibia and Kalahari deserts), the Middle East (Arabian desert, Iran, Afghanistan, Rajasthan), North and South America (Mojave desert, Chile) and Australia.

The selection of suitable site for the Guayule production depends on well drained soils mild winter temperature. The plants have shown to maintain production at salinities even up to 4.6 deciseimens per meter. Transplanting has been and still is the most reliable method of guayule stand establishment. Although Guayule is semi-arid, drought resistant shrub, it must be irrigated for maximum sustained production. It may require 1000 to 1300 mm of applied water (irrigation plus rainfall) per year to attain maximum production. Scientists have classified Guayule as low user of major nutrients. Recent research has shown that the plant does not require high nutrient levels. Fertilizer requirements are based on soil fertility and general condition of the plants. Because the Guayule plant produces terpene resins, which are natural pesticides it is resistant to many pests and diseases. Herbicides are primarily necessary for stand establishment. Plants are harvested two years after planting by cutting mechanically the plants at 5 cm of the soil, then each year during 10-12 years. Rubber content in the plant depends on area of cultivation soil, season, and irrigation. It varies from 5 to 12 per cent. Resin content also found in the same range. The potential yield of rubber reported is 500 kg to 1.0 tonne per hectare per year as against of hevea rubber at 1200 Kg per hectare per year. Selection of high yielding guayule is complicated because of apomixis characteristic (asexual cloning via gametes). Scientists hope to release a fully sequenced genome of Guayule which will help researchers to identify gene that relate to specific traits. The foundation of molecular biology is used to develop plants that can adapt and survive harsh environment.

Benefits of Guayule as a Source of Rubber

The advantages of growing Guayule are many. It reduces the reliance on petroleum based synthetic rubber. Hevea rubber is subject to price fluctuations. Both these sources are governed by International trade agreements which pose certain amount of risk to domestic producers. Hence growing Guayule rubber provides a safe and secure domestic market in time of global uncertainty. The crop is grown locally, creating jobs in rural communities. It

is adapted to hostile environment, hardy in nature and is more efficient use of water than traditional crops. Even better, Guayule is a sustainable crop because the entire plant is used either for rubber, resin or cellulosic feedstock for biomass.

Guayule's value as a potential biofuel has been enhanced recently. The finding of Earth's policy institute revealed food used as bio-fuels pit the 800 million people with cars against 800 million people with hunger problems, meaning that bio-fuels derived from food crops, like maize raise world food prices. Guayule can be economically viable bio-fuel. Crop that does not increase world hunger problem and it can be grown where food crops fail. After rubber is extracted, 60 percent of the feed stock is suitable for bio-fuel. The biomass is a cellulosic feedstock that produces clean energy to heat, cool and light homes and offices. The reins from the plant are ideal for building materials. So there is no waste from Guayule. Every part of the plant is used for some purpose. There is a possibility of producing Biochars through pyrolysis of biomass which can be used as effective soil improver.

Soils are at the heart of terrestrial ecosystem. Growing Guayule enhances the ecosystem functions of barren lands. Lending the soil to vegetation- soil become a medium of plant growth, regulator of water supply, contribute to nutrient cycling, becomes a habitat for many organisms, modifies the atmosphere and supplies raw material for the industry (Rubber). The management of soil carbon is central to soil fertility. Typically after 15 to 30 years of sequestration soil becomes saturated and ceases to absorb carbon. This implies that there is a global limit to the amount of carbon that soil can hold. One of the methods to accomplish this objective includes use of soil cover. Growing Guayule can serve the purpose as they will protect the soil from the sun and allow soil to hold more water and propagate more soil microbes. Thus degraded land can be restored through a

process of impeding carbon release while returning land to agriculture.

Recently, the guayule plant has seen a small but growing resurgence in research and agriculture due to its hypo allergic properties. While hevea derived rubber contain protein that can cause severe allergic reactions in a few people guayule. With AIDS crisis of 1980's, the surge in rubber glove usage revealed as many as 10 percent health care products were allergic to latex and thereby creating a niche market for guayule. There are synthetic alternatives for medical devices but they are not as stretchable as natural rubber. Guayule performs like hevea but contains none of the proteins that cause latex allergy.

Future Prospects

Sources of rubber from hevea trees originate mainly from Tropical areas. They cannot be exploited further because deforestation of tropical rain forest and allocating the land to mono culture crop like rubber can destroy the fragile ecosystem prevailing in tropics which are rich in biodiversity. Tropical regions indirectly control the whole world climate, so any environmental stress in this region is likely to spread and damage ecosystems prevailing in other parts of the globe. In our race to grow more rubber, it is imperative to understand the delicate equilibrium existing in tropics and divert our attention to areas which are neglected (wasteland and deserts). There lies our wisdom as "stewards of the earth".

Governments in the tropical countries can consider allowing farmers living in semi-arid tracts to sell carbon credits once they document they have sufficiently increased soil carbon content. Isn't worth the time and effort to get interested in this super plant "Guayule".