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PLANTATIONS SHOULD PREPARE TO MEET CLIMATIC CHANGE CHALLENGES

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Global warming and climate change are aspects of our environment that cannot be easily or quickly discounted.

We have seemingly negatively effected our environment by a cycle of harmful processes that now seem to be feeding upon themselves to exponentially increase the damage to our ecosystem.

PLANTATIONS

In the plantation sector, there could be both direct and indirect impacts. Direct impacts will result from increased carbon dioxide levels, which affect photosynthesis, and rising temperature which, in turn, cause heat stress and increased evapo-transpiration in crops.

Indirect impacts will result from changes in moisture levels, an increased incidence of pests and growing spoilage of agro-products as a result of enhanced microbial activity. These effects could result in reduced yields and shifts in productivity.

According to current climate change predictions for Sri Lanka, the effects of climate change by 2050 will be marginal, reaching only +0.50C for temperature increase and +5 percent for evaporation/rainfall (wet season only) in the high scenario.

However, in the scenario for 2012 the changes become quite significant.

The trends also suggest that within the averages, the intensity of dry weather and rainfall may increase. Therefore, climate change could have increasingly significant effects even in the scenario for the year 2070.

TEA PLANTATIONS

Studies on weather patterns and crop yields for the past years have shown that drought affects tea by reducing the yields.

Even in areas equally capable of growing the tea plant, the qualities of the finished tea can be profoundly influenced by climate conditions. This is caused both by changes in chemical composition of the tea plant in response to different growing condition, and by chemical changes that occur during processing.

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For example, in cooler and drier air, common at high elevations, when processing tea as one would make black tea, it is possible to achieve a "hard wither", where the tea leaves dry out before they are fully allowed to oxidize. In hot, humid air, this same process is not possible. This explains why some first flush teas sometimes have a very green character, like green tea, but why neither low elevation black teas, nor black teas produced during the rainy season, have this same character.

For example, first flush teas, grown in some other region, but at a lower altitude, tend to still be darker. Similarly, second flush teas are also darker.

On the other, irregular patterns of rainfall and high seasonal concentrations in the wet zone, with attendant increases in run-off ratios, could result in soil erosion, land degradation and the loss of productivity of plantation crops.

NATURAL RUBBER

The latex yield of rubber trees is mainly determined by physiological factors and harvesting intensity. Both these factors are influenced by clonal characteristics, agronomic practices and environment. Given the physiological factors and agronomic practices, the major yield-limiting factor is harvesting intensity, which in turn is mainly determined by weather and price factors.

Extreme weather in terms of long and intense dry spells and heavy rains can substantially reduce harvesting intensity through reduced tapping days. The response of growers to the prevailing rubber prices is also reflected in harvesting intensity.

The interplay of weather and price factors in determining NR production makes it difficult to measure the influence of weather factors on price.

NR PRODUCTION

There was a structural shift in NR prices from the late 1970s. The prices of NR reached a peak at the end of 1970s. In response to the booming prices, in the beginning of 1980s, a large scale new-planting and replanting of rubber happened in all major producing countries.

To push the existing yielding area into a gestation phase, in 2003-09 there were a large-scale replanting in non-traditional regions, considering that the new-planting undertaken in the beginning of 1980s entered the declining phase in 2010 because of ageing.

These new-planted and replanted areas in 2003 and 2004 marginally added the global supply from 2010 to 2011. From 2012 to 2016 a substantial addition of supply is expected according to the new-planting/replanting which was undertaken from 2005 to 2009.

On the other hand, the new-planting and replanting undertaken during 2003-09 were mostly in non-traditional regions. These areas are agro-climatically marginal to grow rubber and their productivity is not expected to be significantly high.

Hence, the existing marginal growers should be skilled in tree improvement, vegetative propagation, latex harvesting and processing technologies and so on.

Climate change would have a negative bearing on future yield. Rain and drought affect tapping days and disrupts harvesting. The higher temperature especially in the morning will affect latex flow and as a result, the yield of rubber will be low.

Furthermore, climate change may cause new diseases which are detrimental to rubber trees. The existing clones that have tolerance to climate change is limited.

Therefore, it is necessary to develop clones which are tolerant to an extreme climate.

COCONUT

Sanathanie Ranasinghe of CRI says that there is enough scientific evidence to conclude that climate change is taking place, in the coconut growing areas.

Coconut is cultivated in all three agro climatic zones (ACZ) of Sri Lanka (30% in the wet zone, 50% in the intermediate zone and 20% in the dry zone), and new planting programmes of coconut are underway mainly in the northern and eastern provinces of Sri Lanka. Coconut performs well under a mean annual temperature of 27 0C – 29 0C and rainfall of 1250-2500 mm/year. Therefore, increased temperatures and the scarcity of water predicted as a result of anticipated climate change will be the most critical factors that would affect the yield of coconut.

It has been identified that reproductive development in coconut is more sensitive to high temperature stress and water stress than vegetative development and the principal harmful effects are reported on nut set. Nut setting is the most important yield determining factor in coconut and reduced nut setting due to heat stress and long dry spells are often experienced in coconut plantations in the dry-intermediate and dry zones, even those under irrigation. This could be either, due to unfavourable environment conditions during fertilization (pollen germination), or poor pollen quality.

Coconut palms produce approximately one inflorescence per month, leading to about 12-14 inflorescences per year. The stages of inflorescence development such as pollen formation (one month before inflorescence opening) and button nut formation (1-2 months after inflorescence opening) can be very sensitive to prevailing climatic conditions. Continuous exposure to heat or water stress can prevent the accumulation of starch and sucrose in the developing anthers, which is the main source of energy for pollen germination, resulting poor pollen quality. Further, high temperatures, low relative humidity and a high vapour pressure deficit at the stage of pollination may result in pollen drying - consequently resulting in reduced nut set. This is the situation normally observed in the February / March period of each year. The degree of sensitivity to high temperature can vary with the variety, depending on their tolerance to stress. Therefore, studies are underway to identify heat tolerant cultivars based on their reproductive survivability as a major adaptation strategy to climate change.

On the other hand, Coconut - as a perennial tree crop with 50-60 years of economic lifespan, has a great potential as a Carbon Sink for mitigating climate change. The Clean Development Mechanism (CDM) has presented as an opportunity for developing countries to get certified in order to negotiate subsidies from the Carbon (C) market. Productivity and net carbon balance of types of land used for coconut are key issues for the CDM. The potential role of coconut plantations in mitigating global warming is not adequately addressed by researchers.

The first study on carbon sequestration potential of coconut in Sri Lanka was initiated at the Coconut Research Institute (CRI) in 2009. The preliminary information revealed that a 25-26 yr old Sri Lanka Tall (commercially grown) plantation can sequester about 17-80 MT of Carbon dioxide ha-1 yr-1 depending on the agro-climatic and soil conditions. If the carbon is marketed at the rate of 11 US$ / unit, growers can earn about Rs 20,000 – 96,000 ha-1 yr-1 under CDM (pay for net ecosystem carbon balance of new plantations). The same coconut plantations contain a carbon stock of about 30 - 70 MT ha-1 (plant and soil) depending on the agro-climatic and soil conditions. The carbon sequestration potential in coconut plantations vary with the season of the year, age of plantation, variety and management and the studies at CRI are being strengthened and continue to collect information.

STRATEGIES TO ADOPT

Long term

- To develop a decision support system for contingency crop planning by using an interactive production specific methodology/ technique for systematic analysis of scaled (spatial/ temporal) and geo-referenced data/ information which will allow for the sustainability of logical niches based (area specific and broadly weather based) production system (garden level-cluster), independent of conditioning variables (policy, infrastructure, markets, ethno-demographics) and climate resilient.

Short term

- Development and analysis of a scaled and geo-referenced database of historical local (niche based) weather, soil, disease/pest incidence and yield in plantation crop growing regions.
- Assessing future climate scenarios by downscaling global circulation models (GCMs) to regional level by using regional model PRECIS (*Providing Regional Climates for Impact Studies*).
- Integration of Satellite data with regional weather data and creation of a spatial gridded database (1 km resolution) and use of this information in ecosystem model to generate Operational Weather Forecasts (short and medium range).
- Development of decision support framework/toolkit for Contingency Crop Planning for efficient management of plantations and make them climate resilient.
- Dissemination of specific weather based advisories to individual plantations, through GCM network, using a *'Cluster Approach'*.