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Impact of climate change on the Sugar Cane cultivation in Sri Lanka

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Abstract

Sugarcane is a perennial crop grown in the intermediate and the dry zones of Sri Lanka for commercial purposes. Approximately 15,000 families are directly involved in sugarcane production for Vacuum-pan sugar mills while a large number of families produce jaggery and syrup as a cottage industry. There is a potential of producing an average of 56-112 /mt of cane yield/hectare from local sugarcane plantations.

As the scarcity of water and prolong drought periods severely affect the sugarcane crop, the rainfall and the shifts in monsoonal weather are considered as critical climatic factors for sugarcane. Weaker plants resulting from water scarcity are more vulnerable to pest and disease attacks in addition to the retarded growth and the yield. As the sunshine plays a major role in photosynthesis, extreme cloudy conditions interfere with the sugar production. (Cloudy weather and winds during North-East monsoon period has been reported as the cause for spread and establishment of the serious sugarcane pest wooly aphid *Ceratovacuna lanigera* in Sri Lanka)

Even though, the adaptation for such adverse climatic variations is limited in the present context, the change of planting and harvesting schedules to minimize the impact of drought conditions and the establishment of small ponds within plantation areas to maintain high ground water at level are recognized as possible adaptations. However, these adaptations cost some extra money to the growers though they do not involve new technologies. For allocation of area for the establishment of small ponds from their limited land should be addressed at policy levels which include compensation schemes. Farmers should be educated to practice cropping cycles and other related activities based on monsoonal rain cycles. Social and cultural acceptability could be a barrier which could only be addressed at policy level.

Any climate change through drought and water scarcity could definitely affect the sugarcane farming communities, their livelihood, income and employment through low yields as well as other risks such as accidental fires in plantations.

Keywords: Sugarcane, climate chande, adoption

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Introduction

Next to rice and wheat, sugar is an essential food commodity of the people's diet in Sri Lanka. The current requirement of sugar is about 622,000 tonnes per annum. Therefore, the sugar has been identified as an important sub sector in the economy of Sri Lanka. 575000 tonnes of sugar has been imported to the country during the year 2008, costing 22.33 billion rupees, which is nearly 0.51% of the GNP at current market prices. This is constituted 33% of the expenditure on basic food commodities (rice, flour, wheat and sugar) imported to the country (Central Bank, 2008) (Table 1).

The sugar sector offers a great potential for employment and some income generation, while developing the dry zone which consist of about 60% of the arable land area of the country. At present, nearly 15000 families are directly involved in sugarcane production in vacuum-pan sugar mills operated by two sugar industries in the Moneragala District. Many other families in Badulla and Moneragala districts produce jaggery and syrup as a cottage industry. In addition to direct employment, sugarcane farming and sugar processing systems provide employment opportunities indirectly to the people in the area (Keerthipala, 2007).

It has been reported in the recent past that certain agricultural regions of the world are subjected to significant temporal and spatial climate changes. The impact of this variability on yield and production of sugarcane is important as it directly affect the livelihood of low income communities in the sugar sector. As the sugarcane cultivation is mainly a rain fed crop in Sri Lanka, the cropping calendar also depends on the yala and maha rainy seasons. Therefore, an understanding about the links between climate variability and agronomy of sugarcane is stressed in term of cropping systems and management practices in order to achieve optimum conditions for sustained productivity.

Table 1. Area planted, cane yields, recovery and sugar yields in Sri Lanka (2000-2010)

Year	Cane area (ha)*	Cane yield (t/ha)	Sugar recover (%)	Sugar yield (t/ha)
2000	16799	67.5	8.1	5.5
2001	13619	61.2	8.5	5.2
2002	12872	43.0	8.8	3.8
2003	15736	60.6	8.1	4.9
2004	18149	57.6	8.8	5.1
2005	18306	58.0	8.2	4.8
2006	15712	56.0	8.5	4.8
2007	10611	48.0	7.7	3.7
2008	12119	56.0	7.4	4.1
2009	11642	47.0	7.7	3.6
2010	11310	51.0	7.6	3.9

*Area planted by the farmers registered with the sugar industries

Cropping cycle and operations

Sugarcane is a perennial crop. Farmers are able to obtain the harvest after 12 month cropping cycles. The seed setts germinate after 3-4 weeks of planting and the tillering of plants completes within 6-10 months. The cane after maturation will be harvested 12 months after planting and canes are transported to the factories for crushing. The remaining stubbles of the plant will be continued to grow in next cropping cycle. The major cultivation operations during the cropping cycle include the land preparation before planting, gaps filling after germination stage and harvesting of cane after 11-12 months period depending on the variety.

Important climatic conditions for the sugarcane cultivation systems

The temperature for optimum growth of sugarcane should be between 20° to 30°C. In rainfed sugarcane cultivation areas, the water requirement of sugarcane depends on the climate. Sensitivity to water stress is not constant throughout the growth stages. Some growth stages are more sensitive than the other. Adequate water availability is needed for germination and tiller formation phase. However water logging during the monsoons reduces the tillering ability and finally results in poor cane plant. Excess water during maturation phase affects the quality of cane harvest. Sugarcane is highly resistant to water stress; it could survive as low as 5% soil moisture by weight in the Reddish Brown Soils of the Dry Zone (SRI, 2007). However, the growth rate of sugarcane is low under water stress conditions. The optimum soil moisture for good growth ranges from 20 to 14 % by weight in the Reddish Brown soils of Sri Lanka. The germination, tillering, canopy development, grand growth period and the maturity of plants directly depend on the rainfall in plantation areas. As the scarcity of water and prolong drought periods severely affect the sugarcane crop, the rainfall and the shifts in monsoonal weather are considered as critical climatic factors for sugarcane cultivation systems. Weak plants due to water scarcity are more vulnerable to pest and disease attacks, in addition to the retarded growth and the yield. The populations and the damage by number of pests including termites, internode borers, mealy bugs and scales are higher during the drought periods. The plants with dry leaves are more vulnerable to the accidental fires which could cause serious impacts to the sugarcane farmers due to the destruction of their crops.

Sugarcane is a typical C4 plant and thus is an efficient user of carbon dioxide and sun shine. As the sunshine plays a major role in photosynthesis, extreme cloudy conditions interfere with the sugar production in sugarcane. Cloudy weather and winds during North-East monsoon period has been reported as the cause for spreading and establishment of pests. The establishment of a serious sugarcane pest wooly aphid *Ceratovacuna lanigera* during the years 2006 in Sri Lanka was supported by the cloudy weather and winds during North-East monsoon period (Kumarasinghe and Basnayake, 2009). In addition to the effect on plants, the quality and the sugar content of the cane can be lowered if the canes are subjected to rains within the two weeks before the

harvest. As such, the droughts due to shifts in the monsoon are considered as the most serious climatic effect to sugarcane resulting poor yields, occurrence of pests and diseases and accidental fires. According to Waidyarathne et al. (2006) the onset of monsoonal rainfall in Sri Lanka has been changed during the past period due to the climatic changes. Relative humidity, sunshine and winds during the monsoonal periods are the other important climatic conditions that affect to the production of sugar and spread of pest and diseases.

Options for adaptations against climatic changes

Even though, the possibilities for adaptation for such adverse climatic variations are limited in the present context, the change of planting and harvesting schedules to minimize the impact of drought conditions and establishment of small ponds within plantation areas to maintain high ground water level are recognized as possible adaptations. However, these adaptations cost some extra cost to the growers.

The possible options should be based on proper irrigation management practices. Therefore the promoting on-farm soil and moisture conservation methods, improving water use and conveyance efficiency, promoting micro-irrigation (drip, sprinkler etc.) and encouraging re-use of drainage water wherever possible are among the other priority areas for adaptations. As an additional option the Sugarcane breeding program should be strengthened based on the agro-ecological suitability to produce more drought resistant, high temperature, pest and disease and salinity resistant varieties.

Furthermore, irrigation management practices and, on farm rain water harvesting and runoff water harvesting methods should be arranged at institutional level. Also implementation of adjusted planting and harvesting time schedules to suit the monsoonal changes can be arranged at institutional level.

Rehabilitation of irrigation canal network and minor tanks to operate at their design capacity should be implemented as infrastructure modifications. Re-use of drainage water and construction of tail water recovery pits for lift irrigation with combination of naturally drained water are also considered as potential infrastructure modifications.

Barriers to such adaptations

However, reluctance of farmer communities to release presently occupying land for the establishment of small ponds from their limited allotments could be a barrier for adaptations. This problem should be addressed at policy levels and a compensation schemes for farmers might be a part of the solution to this problem. As the farmer communities have got used to the present cropping cycles of sugarcane and other related activities based on monsoonal rain cycles, the social and cultural acceptability of new adaptation measures will be difficult. The acceptability could be successful by convincing the farmers about the possible implications tof climate cahnge.

Socio-economic impacts of climate change

The possible impacts such as poor yields, occurrence of pests and diseases and accidental fires as a result of the change or shifts in the monsoons to sugarcane cropping systems will be detrimental to the farming communities, since they affect the livelihood. Poverty levels of farming communities can be elevated due to reduce income, inability to protect crops and disruption of other integrated farming systems such as the cattle.

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