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WATER MANAGEMENT AND THE EFFICIENT CONTROL OF PEST AND DISEASES OF SUGARCANE

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ABSTRACT

Irrigation is needed for achieving high yield of sugarcane and its intercrops in Bangladesh. But heavy irrigation causes leaching of nutrients such as N, K, Ca, Mg, S, Zn etc. from the effective root-zone. Moreover, heavy irrigation, heavy rainfall or intensive rainfall during the monsoon uplift water table. As a result, water logging prevails and nutritional imbalance is created in the root zone. Thus growth is hampered and the biosphere is established in favour of pests and diseases. Hence, for both preventive and curative control of pest and diseases justified irrigation and drainage viz. efficient water management in the field is a must for sugarcane cultivation in Bangladesh.

Key Word: Irrigation, Drainage, Water management, Efficient control of pest and disease

INTRODUCTION

Sugarcane (*Saccharum officinarum* L.) is a tropical crop which is grown predominately between 30 ^{0} N and 30 ^{0} S Latitude. *However*, in Bangladesh like many other countries of this region, crop production is often restricted by limited seasonal rainfall. The climate in Bangladesh is dominated by *the* Indian Sub-continent monsoon system. Annual rainfall ranges from 1400 mm to 1700 mm in the dry Rajshahi (North-West) region to over 5000 mm in the wet Sylhet (North-East) region. About 90% of the annual precipitation generally occurs during four months, from June to September. Therefore, drought of varying intensities occurs in almost all parts of the Country during eight months from October to May. In November almost *the* whole country receives rainfall less than 50 mm (Karim *et al.*, 1983).

This situation of heterogeneous precipitation emphasizes the need for irrigation in the dry periods for successful sugarcane cultivation along with its intercrops such as vegetables, spices, pulses etc. Moreover, sugarcane, the perennial crop that remains in the field for nearly 12-15 months, also needs drainage during June to September (Pathmanathan, 1980). Hence, Barnes, A.C.1974 really quoted "Sugarcane requires large supplies of water to support its growth but like most other crops can't tolerate wet fit". Among the various factors so far identified as responsible for low yield of sugarcane in Bangladesh, irrigation and drainage are the most important ones. Adopting almost all technologies developed in Bangladesh Sugarcane Research Institute, some growers have produced over 200 t/ha in their respective fields. Hence, it is obvious that there is a glorious possibility to increase optimum average yield of sugarcane in Bangladesh.

MATERIALS AND METHODS

Graphical Assessment of Need for Irrigation & Drainage: Using crop coefficient of Sugarcane and potential evapotranspiration data taken from Karim *et al*, 1983, Monthly evapotranspiration of

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Sugarcane was calculated for Ishurdi, Pabna and Mymensingh. They Computed potential evapotranspiration by Penman method. Then Figure 1 and 2 were made for the two places using rainfall data (10 years average) taken from Karim and Akhand, 1982. They calculated average rainfall methodically for different districts. The data of respective districts were taken for making the figures. The results represent the average condition of sugarcane area of Bangladesh. Figure 1 represents the western part and Figure 2 represents the eastern part of Bangladesh. From the figures it is clear that irrigation and drainage are needed for successful sugarcane production.

It has been estimated that approximately 1.25 to 1.5 acre- inches of water passes through the plant in the production of each to*n* of millable cane. Using these figures, the water requirement for a sugarcane crop of 40 tons per acre would be 50 to 60 inches, i.e., 1270 to 1524 mm (King *et al.*, 1965). In accordance with the above reference, we may decide that the evapotranspiration (ET) or water consumption of sugarcane as computed for the selected area is appropriate. The ET for Ishurdi is about 1600 mm and for Mymensingh is about 1500 mm (Fig 1. and Fig 2.).

RESULTS AND DISCUSSION

In 1990-91 an experiment was conducted in Jamalpur district to determine the effect of irrigation frequency on sugarcane intercropped with potato. Before the monsoon start ten irrigations (including 6 irrigations up to potato harvest) with 420 mm irrigation water (effective rainfall was 96 mm) applied. The pan ratio (IW/CPE) = 0.9 produced highest yield (103 t/ha). The yield was 37% higher over the treatment with 2 base irrigations- one light Irrigation at the time of transplantation of cane settlings (life irrigation) and another light irrigation was given at 20 days after transplantation for Urea application (Siddique *et al.*, 1998). In the 1994-95 crop year 8 irrigations before monsoon with 400 mm irrigation water (effective rainfall was 119 mm) produced highest yield (97 t/ha) of sugarcane intercropped with onion. The yield was 20% higher than 2 base irrigations (Siddeque *et al*., 2001). The agronomy and Soil Division of BSRI, Ishurdi, Pabna found 54% yield increase of sugarcane by irrigation over rainfed condition (Anon., 1991).

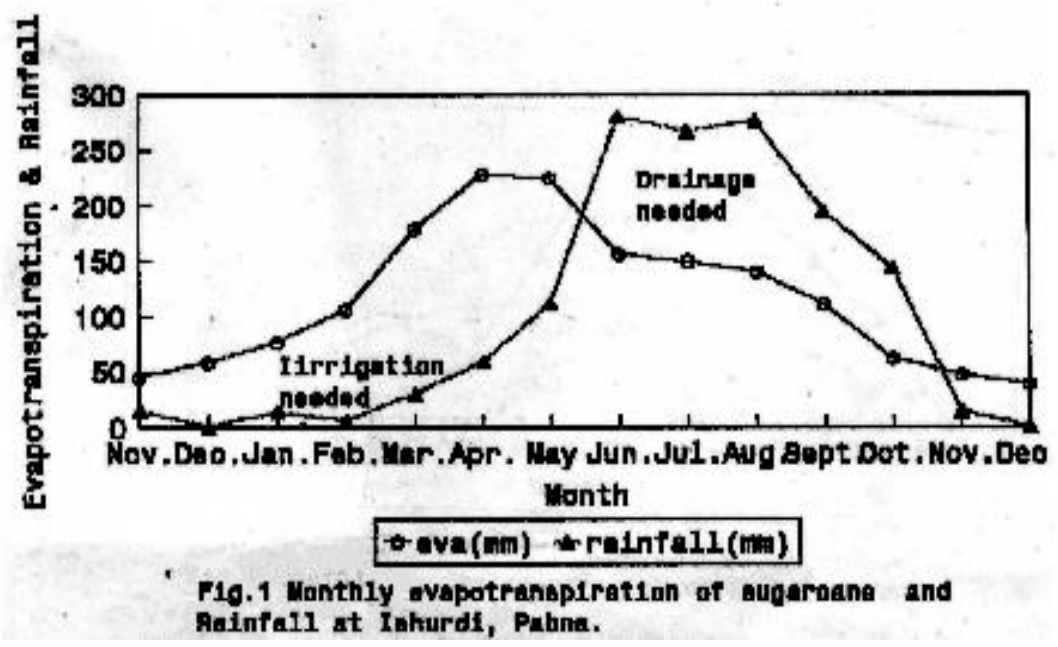

Fig.1 Monthly evapotranspiration of sugarcane and Rainfall at Ishurdi, Pabna.

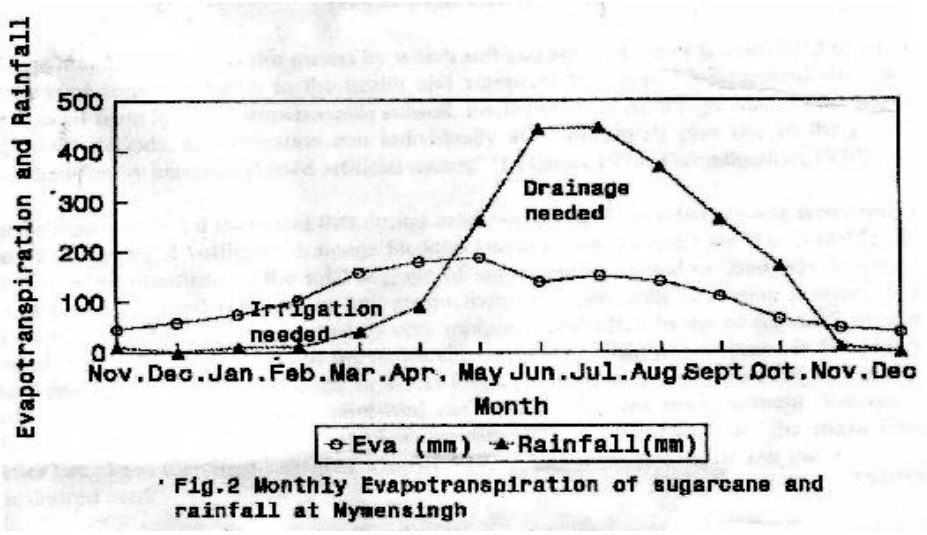

Fig.2 Monthly Evapotranspiration of sugarcane and rainfall at Mymensingh

From the Figure 1 and 2 it is evident that during monsoon (June-September) excess water may certainly cause water logging if sufficient drainage facilities (natural and artificial) are not available. Rahman and Alam, 1985 quoted "Estimates show that about one-third of the total acreage of sugarcane is planted on land where water remains stagnant for long period resulting in low productivity. Besides, with increasing pressure of land for food crops, sugarcane is being pushed to very marginal land often prone to seasonal inundation and unprecedented flood. Rather one of the major causes of poor yield of sugarcane in Bangladesh is the vulnerability of the existing varieties to water-logging". During the last decades, communication has been improved and kacha roads are made without drainage facilities. Thus more and more areas have been brought under water-logging condition.

In the above circumstances, serious nutrient deficiency symptoms of the sugarcane under water logged condition and healthy appearance of cane on well drained land are noticed in many parts of Bangladesh during post-monsoon period.

Water Management to Control Insect Pests: In Bangladesh the major sugarcane pests are borers (top shoot borer, early shoot borer, stem borer and root stalk borer); Soil insects (termites, white grub, nematode etc.) and suckers (Pyrilla, scale insects etc.). "It is well known that when there is a soil moisture stress, incidence of shoot borer in sugarcane increases. When irrigations were given after 25% of available moisture was depleted at Anakapalle in India, the percentage of dead heart incidence in a normally manured crop was noted to be 16.46 as against 31.09 when irrigations were given after 75% of available moisture was depleted. Crops in water-logged fields are found susceptible to top shoot borer" (Lakshmikantham, 1983). "Proper irrigation and drainage have been found to be useful in suppressing pests like borers (shoot borer, inter-node borer & stalk borer), sucking pests (scale insects, mealy bugs and white flies), soil insects (white grubs) etc. But increased soil moisture level (heavy and excess irrigations) and water-logged conditions are found to favour some species of borers (top borer) and sucking pests like white flies" (Easwaramoorthy and Jayanthi, 1986).

Extensive research in light of water management as a tool of pest control have not been undertaken. However Entomology Division of Bangladesh Sugarcane Research Institute has recommended that root stalk borer (root borer), termites (white ants) and white grubs may successfully be controlled by flood irrigation (Anon., 1980). In possible cases, severely infested fields of root borer should be sub-merged with water for few days (Anon., 1993).

It has been observed that soil insect pests like white grub, termites, nematodes multiply abundantly during dry periods in sandy to sandy loam soils of sugarcane belt. In irrigated conditions their flourishment is reduced to a great extent. Rather the timely application of granular pesticides becomes ensured and their performance increases.

Water Management to Control Diseases: One of the most important causes of low yield of sugarcane in Bangladesh is due to diseases specially the red rot. Resistant varieties so far been imported from abroad have been affected by this disease within a short time in the Quarantine station. Sometimes some varieties came out to the main station of sugarcane research institute, but could not survive for long time.

ÒPoor drainage and excess moisture in heavier soils contribute to the development of red rot disease in infected seed pieces and plants" (Barnes, 1974). "In two seasons characterized by severe drought in a district in India incidence of wilt occurred in an epidemic form. This was the experience in Mauritious also. Canes grown in fields subjected to water-logging are reported to be susceptible to red rot" (Lakshmikanthan, 1983).

Extensive researches have not been taken regarding the effect of water-logging on the propagation of diseases. But it is identified that diseases like red rot and wilt cause major damage to the standing cane of BSRI farm due to water-logging during rainy season from long since (Anon., 1990-93). Incidence of red rot is also observed in sugar mills area in water logged condition. In the year 1985-86 seeds infected by red rot were planted in three locations (Thana of Rajshahi sugar mills area) as registered seed plot. Due to severe crisis of seed due to flood those were planted. After harvesting, the sugarcanes of the seed plots in two locations were found damaged about 50% but in the remaining plot sugarcane did not show any symptom of red rot incidence. There was optimum yield in that plot which was well drained by deep canal on two sides. Rather the soil type was sandy loam whereas the other two plots had clay loam soil. The matter clearly indicates that well drained soil is one of the best solutions to control red rot though further investigation is needed. Moreover, wilt may come in epidemic form after prevalence of water logging.

Sometimes effect of irrigation is not observed, why?

Sometimes it is reported that irrigation has no effect on cane yield when compared with adjacent rainfed plots. Sometimes the observations are made in the experimental plots also. In 1981-82 crop year, Agronomy Division of BSRI conducted two experiments to find the effect of irrigation. In one there was no significant yield deviation of sugarcane in irrigated plots over non-irrigated ones. Soil moisture depletion in the non-irrigated plots was 40% of available moisture. After investigation it was found that a continuous water supply occurred from the main canal to the experimental plots through sub-soil. The other experiment (Anon., 1983) produced a bit lower yields in irrigated plot than in non-irrigated plot (other variables remaining same). That was due to moisture supply from adjacent irrigated plots. In both the experiments the impermeable substratum below the soil was the barrier to achieve the effect of irrigation. In 1989-90, BSRI (Anon., 1991) had two experiments in the same locality. Experiments were conducted both in irrigated and rainfed conditions. In one experiment, irrigation had significant effect but in the other, irrigation had no effect. On the contrary irrigation lowered the recovery of sugar significantly. However the authors pointed out that soil erosion, uprooting of newly planted cane settlings and wash out of basal fertilizers due to flood irrigation in coarse textured soil of experimental plots were the causes of this. When no effect of irrigation is found, there exist one or more reasons behind, which are as follows:

(a) There is no drainage facility to remove excess irrigation water, applied unwisely.
(b) There is no need of irrigation water as there is moisture entry into the plot from outside or high water table.
(c) The irrigation is followed by heavy rainfall and the plot has no drainage facility.

In any way if nutrients like N, S, K, Ca, Mg, Zn etc. are washed out by irrigation water or rainfall through leaching or percolation (Dakshinamurti and reddy, 1975, Pinna and valdivia, 1977) and nutrient-loss by stagnation of water occurs, irrigation can not give positive result. Even in some cases adverse effect is a must. Because Lakshmikantham (1983) reported that application of excess water is not conducive to optimum yield. Sizable amount of dead canes are found at harvest and one of the important causes for this phenomenon appears to be excess water application and its stagnation especially in monsoon months. He agreed with Sir T. S. venkaraman that 'while sugarcane loves moving water, it can not withstand wet fit'.

CONCLUSION

In Bangladesh supplemental irrigation is necessary for successful cultivation of sugarcane as well as the intercrops. Irrigated fields should be leveled with requisite grade to have benefit from surface irrigation. Identifying the area suffered from surface and sub-surface water logging (stagnation) feasibility study is required for planning drainage. Resistant varieties should be selected for the area prone to water logging and flood. For the sake of crop nutrition, crop control from pest and disease incidence, we must emphasize on water management i.e. justified irrigation and well planned drainage. For this, we must know when to irrigate, how much water to be applied, how much and how swift the excess water to be removed and what are the economic ways? To solve the problems the country needs experts, trained workers as well as farmers. We all are liable to solve the problems.

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