POSITION PAPER

Droughts and Sugar Industry in Maharashtra – Are We Learning from History?

West Zone Water Partnership (WZWP)
12/31/2016

Global Water Partnership South Asia
India Water Partnership

Gomukh

IWP

WZWP

Acknowledgement

The West Zone Water Partnership acknowledges the contributions made by senior officials of: The Maharashtra Water Resources Regulatory Authority, Mumbai;, The Sugar Directorate, Pune (GoM); *Sakhar Sankul*, Pune; The Department of Agriculture and the Vasant dada Sugar Institute; Manjari, Pune and *Satara Sahakari Sakhar Karkhana* (SSSK), Satara for sharing their data and directly or indirectly participating in the research activities. We specially thank Shri. Suresh Kulkarni, Secretary (MWRRA); Shri.Pandurang Shelke (Jt. Dir, Development, Sakhar Sankul); Mrs.Shushma Jadhav (Statistics Department, Sakhar Sankul): Shri. Dilip Deshmukh (Dy. Dir. (Planning): Commissionerate of Agriculture, GoM, Shri. G. M. Kulkarni (Technical Officer) and Commissionerate of Agriculture, GoM.

We specially thank Dr. Ranjendra Jagdale (Dir. General, Science and Technology Park, Pune) for providing us with all facilities for the final workshop. Further, we thank all the participants of the final workshop who contributed to the discussion and reiterated the conclusions and recommendations which this report contains. Similarly, we thank Dr. D.M. More, Shri. K. J. Joy, Dr. N. J. Pawar, Shri. Vidyanand Ranade and Shri. Mohan Patil who submitted well researched papers which were discussed during the workshop.

The field research was carried out by Mrs.Gauri Noolkar, who was supported by Mrs.Chaitrali Kulkarni and Mr.Rugved Dongre. And finally we wish to thank Dr.Veena Khanduri (Executive Secretary, India Water Partnership, Delhi) for her cooperation and support for the research project; and Mr Shourjomay Chattopadhyay, Senior Research Associate, IWP for reviewing the position paper.

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List of Abbreviations

BCM: Billion Cubic Meter
CWC: Central Water Commission
GoM: Government of Maharashtra
MCM: Million Cubic Meter
MT: Metric Ton
MWRRA:Maharashtra Water Resources Regulatory Authority
TCD: Tonnes Crushed per Day
TMC: Thousand Million Cubic Feet
WRD: Water Resources Department
WUA: Water User Association

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Executive Summary

Several states of central and south India, including Maharashtra faced severe droughts between 2012 and 2015, leading to severe stress to the economy. In Maharashtra, the cropping pattern has become distorted due to market conditions as well as government policies. Further, the water guzzling sugarcane crop continues to consume the lion's share of irrigation water in the state, and is blamed for exacerbating the impact of the drought. The WZWP therefore took up this study to understand the impact of the sugarcane crop and the sugar industry in general, in order to identify the co-relationship between the distortion in the cropping pattern and its impact on droughts.

The position paper recommends that a serious consideration should be made for the location of new sugar mills in the state. Regions receiving less than 1,000 mm of rainfall should not be allowed to set-up new sugar mills. Further, existing mills in districts receiving low rainfall, such as Ahmed nagar (567 mm), Sangli (673 mm) and Solapur (614 mm) should be moved to other regions. The cropping pattern in the state, especially in the drought-prone districts should be adjusted to comply with the natural conditions in the region. Excessive release of water for sugarcane cultivation should be monitored and ceased under section 47, 48 and 49 of the Maharashtra Irrigation Act, 1976.

The study consisted of a literature review, primary and secondary data collection and interviews with stakeholders such as government officials, sugar factory managers and subject experts. While several of the co-operative and private sugar factories were assessed, the field visits were restricted to *Satara Sahkari Sakhar Karkhana*, in southern Maharashtra. The literature review, field visits and analysis was converted into a draft position paper and circulated among 25 concerned officials and subject experts for peer review and suggestions. This was followed by a workshop where a total of six papers were circulated in advanced and discussed in detail. The position paper was appropriately modified to include the major conclusions and recommendations emerging from the process, and it now forms the core of this report. The final paper, and especially the conclusions and recommendations will be sent to appropriate government authorities and the sugar industry, and to other members of IWP and GWP, assisting in policy advocacy.

Droughts and Sugar Industry in Maharashtra – Are We Learning from History?

Introduction

Though the paper revolves around sugarcane, its intention is to highlight the original objectives of water management that are rational distribution, use of technology for reducing natural inequity, ensuring equitable right to water, and eliminating the uncertainty caused by variation in annual monsoon. The distortion in priorities and policies regarding water management has been neglected by the government, affecting agriculture, human welfare and the natural eco-systems. These have benefitted a small section of the farming community – the sugarcane farmers, sugar factories, and distilleries.

The current drought year succeeding the previous drought year of 2013-14 is the fourth of its kind since the droughts of 1972, 1986-87 and 2009. However, the lessons from these droughts have not been heeded, and the distorted policy of water exploitation by sugarcane has remained to be unabated despite aggravating droughts and water scarcity. The focus is therefore on recommending corrections of the distortion in favour of other agricultural producers and the environment, and not on objecting to sugarcane cultivation and sugar production *per se*.

Water availability and distribution varies spatially and temporally. To cope with the inequity, local eco-systems have evolved and adapted over time to optimise the benefits that can be derived from whatever natural resources, including water, that are available. Agrarian societies devised the concept of impounding, storing and diverting water flows by building dams, bunds, dykes etc. This water was then taken by gravity through canals and used for the benefit of the largest possible number of households, farmers and other sectors situated downstream.

Similar fundamental objectives have been stated in the detailed project reports, while planning and executing dams and canals in Maharashtra, during and just after the British rule. While Maharashtra is primarily an industrial state, it still accounts for about 9% of the total agricultural income of India. The original objective behind dam building was to ensure protective irrigation i.e. water provision for one *rabi* crop after the *kharif* season, and all-round drinking water availability for the drought-prone areas in central and eastern Maharashtra. However, the artificially increased water availability led to the extension of cultivation of sugarcane, which is a water-intensive crop, not suited to drought-prone areas.

The share of agriculture in Maharashtra's GSDP is 10.21% (Economic Survey of Maharashtra 2014-15, 2015). Sugarcane is one of the major crops of Maharashtra, and its share in the agricultural GDP of the state is 12.3%, while in the total GSDP, it is only 1.26% (Statewise Estimates of Value of Output from Agriculture and Allied Activities, 2013). Although 52% of the total state population is employed in agriculture (Economic Survey of Maharashtra 2014-15, 2015) only about 6% of all farmers cultivate sugarcane. However, they appropriate 76% of all the irrigation water (Pawar, 2014). By implication, sugarcane attracts a bulk of the agricultural infrastructure and investment of the state. Therefore, the argument that since more than half the population is involved in agriculture, any agricultural reform or subsidy/aid is beneficial to the farming community is not true, since only 6% of the farmers are directly benefitted. While the financial returns have made it a lucrative crop in the past, the production of sugarcane has not only distorted the investments within the agriculture sector of Maharashtra but has also affected the water scarcity issue in the region.

Efficient use of water for sugarcane, by using the drip and diffuser systems, can make more water available for providing additional irrigation to other areas as well as the domestic and drinking needs of masses.

Sugarcane Production in India: A Brief History of Sugarcane

The cultivation of sugarcane began in the eastern parts of India about 2,000 years ago. The first sugar mill utilizing the vacuum pan processing technique was set up in 1904, at Saran in Marhowrah in Bihar. The Indian Sugar Industry Protection Act was passed in 1932to assist the sugar industry to stabilize, develop, and compete with imported sugar. Subsequently the number of sugar factories in India rose from 111 in 1933-34 to 148 in 1940-41. Presently there are about 178 sugar factories in Maharashtra alone, out of which, 99 are co-operative and 79 are private. India is the second largest producer of sugarcane after Brazil. Uttar Pradesh, Maharashtra and Karnataka are the largest sugarcane producing states in India, accounting for almost two-third of the total production. Figure 1 highlights the trend in sugarcane and sugar production in India from 1995/96 to 2013/14. The drops in production in certain intervening years are linked to occurrence of droughts in the respective years.

The Paradoxical Location of Sugar Factories

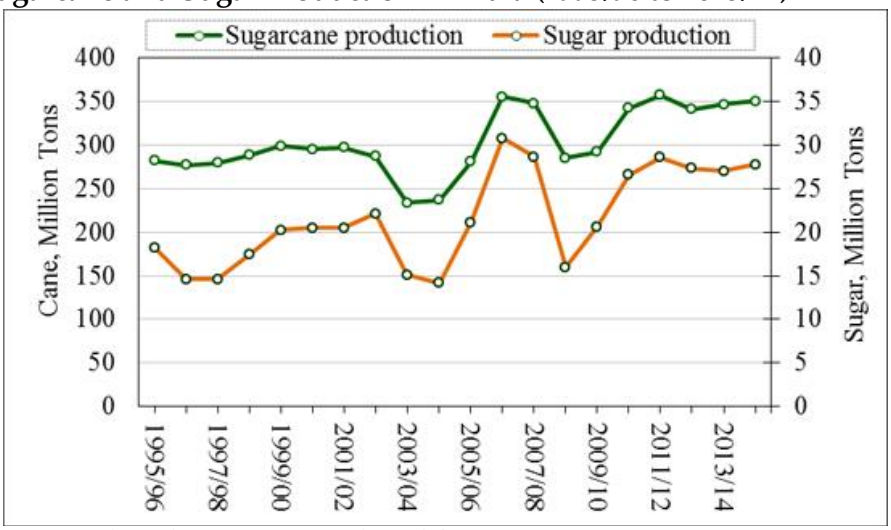
Even though sugarcane is categorised under the agricultural sector, it is also a part of industrial sector. According to the Economic Survey of 2014-15 conducted by the Directorate of Economics and Statistics of Government of Maharashtra, over the past 25 years, the sugar industry has attracted investment of about INR. 37,364 crores, i.e.3.5% of the total industrial investment in the state.

> 75% of sugar mills in Maharashtra are located in drought-prone regions

There are 178 sugar factories in the state of Maharashtra(List of Member Factories Report, 2015)out of which 99 are co-operative and 79 are private factories(More, 2015). Ideally, the sugar factories should be located in regions with assured water – through irrigation or rainfall. However, it is seen that numerous factories having high installed capacity are located in areas that are drought-prone and receive less than average rainfall. Currently, it is estimated that about three-fourths of the sugar factories (and sugarcane fields) of Maharashtra are located in drought-prone areas. The minimum average annual rainfall requirement to sustain sugarcane farming as per the Chitale Commission Report (1999) is 1,000 mm. The highest number of factories is located in Ahmednagar (18), Sangli (16) and Solapur (14). These three districts have a total installed capacity of 1,27,400 Tonnes Crushed per Day (List of Member Factories Report, 2015), which is one-third of the entire state's capacity. Further, these districts receive an annual rainfall of 567 mm, 673 mm and 614 mm respectively, and are one of Maharashtra's most drought-prone regions.

> Chitale Commission recommends sugar mill to be set-up in regions with greater than 1,000 mm rainfall

Figure 1 - Sugarcane and Sugar Production in India (1995/96 to 2013/14)

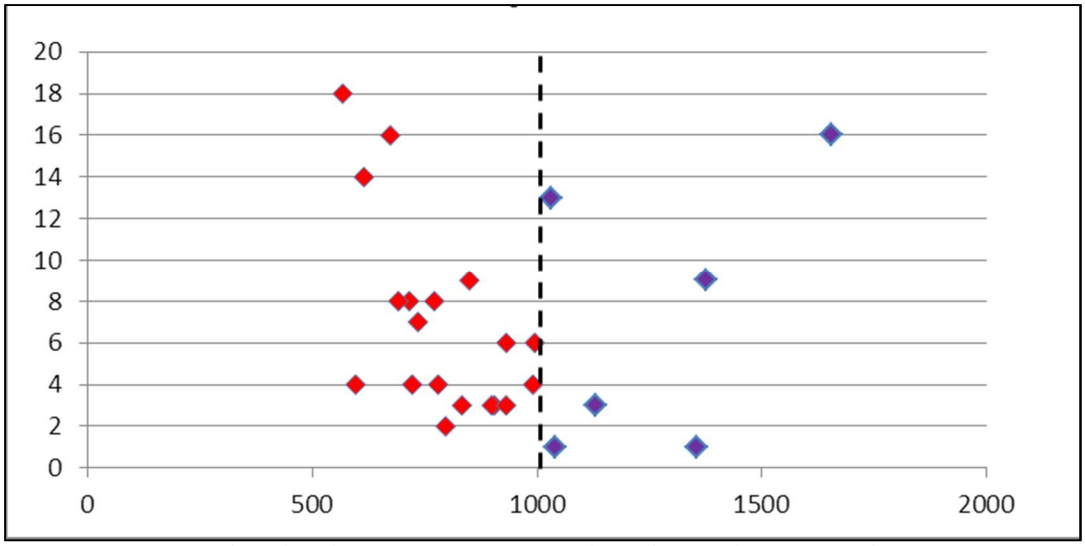


Source: Industry and trade sources, retrieved from http://www.thecropsite.com/reports/?id=3819'.

The graphs below (Figure 2 and Figure 3) highlight that 75% of the sugarcane factories are located in regions receiving less than 1,000 mm of annual rainfall.

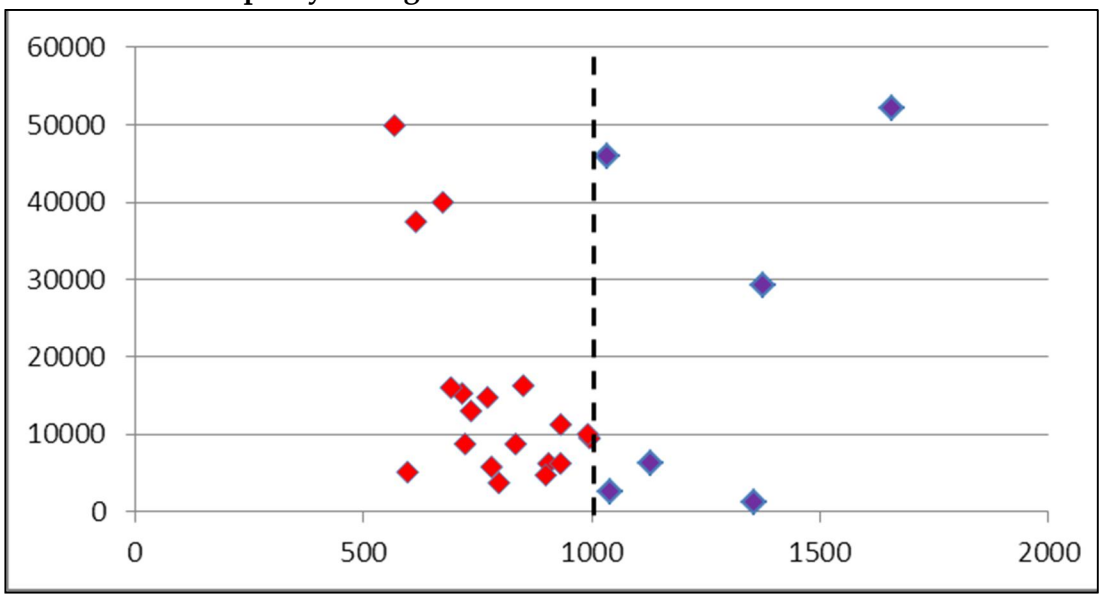
Sugarcane is a water intensive crop, requiring an estimated20,000 m^3 of water per hectare(Shrivastava, 2011). Ideally, such crops should be cultivated in areas with high water availability. While the determination for factory location is primarily a policy decision, the determination of the factory's capacity is an investment one.

Figure 2 - Number of Sugar Factories and Annual Average Rainfall at Their Location



Source: 2nd Water and Irrigation Report, 1999, List of Member Factories Report, 2015 and National Climate Centre, IMD, 2015

Figure 3 - Installed Capacity of Sugar Factories and Mean Annual Rainfall



Source: 2nd Water and Irrigation Report, 1999, List of Member Factories Report, 2015 and National Climate Centre, IMD, 2015

Permitting sugar factories to be set up in areas which are naturally unable to sustain the crop is a serious lapse not only in policy making, but also for long-term ecological health and consequently, socio-economic health of the region.

Problems of Marathwada

The region of Marathwada in Maharashtra, comprising of the districts of Aurangabad, Beed, Hingoli, Jalna, Latur, Nanded, Osmanabad and Parbhani, are the most drought prone region in the state. The average annual rainfall in Marathwada is 810 mm, which is below the 1,000 mm requirement for sugarcane cultivation. Yet, the region hosts 49 sugar factories with a combined installed capacity of 93,250 TCD(List of Member Factories Report, 2015).

Marathwada has a total of 1,064 large, medium and small dams. Created Irrigation Potential of all state level projects is reportedly 10.5 Lakh ha. There are approximately 12 to 15 thousand Minor Irrigation projects creating further potential irrigated area of 4.5 Lakh ha. The presence of such numerous water resources projects does not guarantee proper water availability and access to all stakeholders throughout the year. This can be attributed to improper management of water resources as well as lack of proper feasibility studies on the need, specification and location of such projects. For instance the Jayakwadi Dam having a storage capacity of 2.9 BCM, looses 1.07 MCM per day due to evaporation that is further exacerbated due to its shallow reservoir construction. Further, construction of numerous dams upstream has reduced the inflow into the dam, thus reducing the live storage considerably.

Major share of the available water in the region is allocated for industrial consumption and sugarcane cultivation. On the other hand the objectives of the dams in the region were to provide assured drinking water supply and protective irrigation water (i.e. for one *rabi* crop after *kharif* season) in drought-prone areas. Further, a number of inter-basin water transfer projects were proposed to augment the water scenario in the region. For instance, the Krishna-Bhima water transfer project was supposed to reduce the inequity between Bhima and Lower Godavari. In totality, it is proposed that 198 MCM of water would be transferred to Marathwada, as against the original proposal of 1,580 MCM.

Over Exploitation of Water Resources

The cultivation of sugarcane in Maharashtra is predominantly dependent on irrigation (76% of irrigation water in Maharashtra is consumed by sugarcane).Sugarcane covered about 6% of the total net sown area in 2013-14 (Economic Survey of Maharashtra 2014-15, 2015).18-20% of the gross cropped area of the state is irrigated. If it is assumed that all sugarcane fields are under irrigation, then it is implied that i) large proportion of water is consumed by land under sugarcane and ii) other crops, especially food grains not only suffer from scarce irrigation but are also vulnerable to the variance of monsoon in the region.

The area under sugarcane cultivation has doubled from 536,000 ha in1990-91 to 1,041,000 ha in 2010-11. As of 2014-15, an estimated 987,000 ha of land is under sugarcane cultivation. While productivity increased between 1960-61 and1980-81, it has been dropping steadily since then, clearly indicating the damage done to fertility and productivity due to excessive cultivation(Economic Survey of Maharashtra 2014-15, 2015).

For seasonal (12 months-18 months) sugarcane cultivation in Maharashtra, about 1,400-2,000 mm of water is sufficient under surface irrigation conditions. However, in numerous instances it is seen that farmers often use 3,000-4,000 mm of water for their fields. Water logging and salinity are major contributors to declining fertility levels of the soil. An estimated 6% (4,26,000 ha) of land in Maharashtra is water logged, and 0.45% (35,000 ha) is affected by salinity(Sharma, et al., 2009).It has been noted that despite dropping productivity, the area under sugarcane has steadily increased. This trend is not being addressed properly by policy makers, and due to the superior financial returns in comparison to other crops, it is being rampantly cultivated, even in drought-prone areas.

Kisanveer Sugar Factory, Satara

The factory has two units in the district of Satara - one in Bhuinj and one near Pratapgad. The mill crushes an estimated 15-16 lakh MT in a normal year, as compared to 11 lakh MT during a drought year. The average recovery rate of sugar at the mill was 11.43%. The factory further produces 22 MW electricity (7 MW used internally and 15 MW sold to the Maharashtra State Electric Board), bottled drinking water, ethanol and about 1,200 tonnes of vermi-compost annually. The mill also runs emergency medical and fire-fighting services, provides accidental insurance cover to its almost 50,000 farmer-members, and holds agricultural fairs and tree plantation drives for about 540 villages in the area. The factory further aims to improve the recovery rate of sugar, maximize energy conservation in different production stages and reduce dependency on external sources of water by improving utilization of water generated in sugar production. Officials from the factory claimed that water conservation was not a major focus area due to the abundant nature of the resource. Further, they did not monitor amount of water consumption in the entire process.

Inter-state Comparison

Maharashtra and Uttar Pradesh are the largest sugarcane producing states in India. A comparison between the two states reveals that the recovery of sugar from sugarcane and duration of crushing period in Maharashtra is greater than that in Uttar Pradesh. This is frequently cited as an indicator of efficiency of the sugar sector

in Maharashtra, and consequently, the justification for its location and expansion in the state. However, the water requirement per kilogram of sugar produced in Maharashtra (2068 litres)is double of that in Uttar Pradesh(1044 litres) (Thakkar , 2013). Further, the average water productivity of sugarcane in Maharashtra is 0.403 T/ha/month/'000 m^3 water, while that of UP is 1.11 T/ha/month/'000 m^3 water (Thakkar , 2013). Thus despite better quality, production of sugarcane in Maharashtra is inefficient by 175.43% (Thakkar , 2013). While UP is endowed with perennial supply of water through the Himalayan rivers and good groundwater situation, the same is not applicable in the case of Maharashtra. However, aspects such as water productivity, natural capacity, structure of local eco-system and equitable distribution of water among others are frequently placed secondary to 'rapid industrialisation' and consequent financial gains.

Faulty cropping patterns – a great opportunity cost

The emergence of sugar factories and sugarcane production in water deficient and drought prone areas also signals a serious lapse in devising appropriate cropping patterns in the state. A well designed and efficiently implemented cropping pattern would be in sync with the local environment, climate, soil type, water quality and availability. It would promote and develop water conserving crops in areas that are water deficient and drought prone. This would assist in increasing the agricultural productivity which, apart from sugarcane, is low for other crops in the region. An estimated 32 BCM of water, which is consumed by sugarcane can be used to cultivate 45 lakh ha of other locally suitable and drought-tolerant crops. A properly managed cropping pattern would contribute significantly to increasing production, productivity, overall income and overall growth of the agriculture sector of the state.

Benefits to agriculture notwithstanding, this would have multiple and significant benefits for water conservation. The cultivation of water-conserving and drought-resistant crops would directly contribute to reducing agricultural water consumption and wastage. It would also reduce groundwater exploitation and quality deterioration. The available water could be allocated for other crops and human population in drought-hit areas. The impacts of droughts, even during years with good rainfall, could be minimised by devising and implementing cropping patterns responding favourably to climatic, soil and water patterns in the region.

Policy failure

The drawbacks of faulty cropping pattern, skewed water distribution and recurrent droughts have been observed over a significant period of time. However, the political will to correct these drawbacks at a policy and executive level is conspicuously lacking. Instead, it is frequently observed that strong political and

personal interests, rather than farmers' motives, play a huge role in the continuation of water exploitation due to sugarcane cultivation.

Sugarcane is a profitable crop due to the assured return on investment, pre-determined prices, consistent supply of input, especially water; guaranteed sale to sugar factories, and low requirement of labour. Further, due to lack of technology which affects the viability of pursuing other crops, farmers have had to opt for sugarcane due to its assured returns. Further, industrial products like liquor, based on molasses have made sugarcane a coveted crop. Finally, the social stature and prestige of sugarcane farmers in Maharashtra has been, more often than not, measured by the amount of sugarcane production.

Policies have been crafted in such a manner that encourage plantation of sugarcane. Political pressures and economic enticement playa pivotal role in the unabated cultivation of the cash crop. Farmers have been motivated to plant sugarcane crops in order to take loans. Further, there have been numerous instances of cooperatives influencing canal construction in certain regions and exerting their control over land, water and the political system. This control has expanded to affect numerous issues such as access of fertilisers, pesticides, mechanisation among others.

Farmers with small land holdings face numerous obstacles to financial growth, even for those involved in sugarcane cultivation. The access to water and other resources has been skewed towards large land holders. The requirement of owning land to be a member of the WUAs (Water Users' Associations) is based on the incorrect assumption that all farmers own land. Those who do not own land and those who are not in the command area of dams are outside the ambit of water rights and benefits. Landless farmers, especially farm labourers have no right at all. Farmers growing other crops such as grapes, turmeric etc. do innovate, but they happen to be in a small number.

Money lenders and money lending institutions contractually bind farmers to cultivating sugarcane. The idea that being a part of the sugar lobby is imperative to ensure that one is on the right side of the political power was systematically sowed in sugarcane producing regions. Indebted farmers were then dependent on sugarcane for the financial resources needed to pay off their loan. Further, when factories are unable to provide economic bonuses and incentives, farmers have to resort to intensive cultivation. Intensive cultivation takes a toll on water and soil resources, which adversely affects production and financial gains, leading to a vicious cycle. Due to low financial returns from sugarcane, farmers have started moving out of sugarcane production and are increasingly opting for alternative, equally lucrative crops.

By and large, the government tries to help by reducing water rates and ensuring almost free water supply. Despite low costs, water is a key input. Due to the low cost of water and its inherent ease of availability farmers have no incentive to use water efficiently. This in-turn affects the farmers who suffer by facing lack of fodder for their cattle, and hence has adverse impacts on other allied activities.

The skewed allocation of resources, efforts and infrastructure to sugarcane plantation and sugar production is fundamentally contrary to the principles of irrigation engineering, which since the British period have stressed on limiting the entire sugarcane sector to not more than 25% of water and land. Sir Visvesaraya, a prominent irrigation engineer of that period, focused on perennial but efficient water supply and advocated measured supply of water to crops, and especially in case of sugarcane, limiting the supply to 25% of the available water resources (More, 2015). However, in reality, three quarters of the total available water resources are allocated to sugarcane, allowing it to centrifugally suck in the bulk of the resources available to the agricultural sector. The ultimate result of the control of the sugar industry on natural resources is its strong influence on water policies, practices, administration, implementation and enforcement of related laws.

The narrow minded approach towards water and agricultural policies with an excessive focus on securing financial interests has led the political class to cause three-fold distress - to water, agriculture and industry. An ideal policy would have been to demarcate drought-prone and water deficient areas as ‘no-sugar’ areas, and promote water-conserving crops and efficient water management techniques in such regions. A more practical policy option would be to strive for more equitable distribution of water and promote efficient water management techniques. The absence of any effort towards proper implementation of awater-conserving policy is a strong indicator of political apathy towards the larger goals of development and welfare of the masses.

The roles of MWRRA and WRD

Numerous incidences have highlighted that the focus and efforts of the WRD and MWRRA have been towards supporting sugarcane production. The WRD has allowed for the diversion of substantial water resources to the sugar industry. Over time, laws and policies have been incorporated in such a way that sections not conducive to the sugar industry have been either circumvented or simply ignored. The MWRRA, which has been established for ensuring appropriate planning and implementation of water resources projects, has not been able to maintain regular and effective checks on water storage, supply and distribution activities in the state. On the other hand evidence points towards the exploitation of MWRRA provisions for sugarcane growth. Both entities (WRD and MWRRA) have focussed on micro-

managing issues and technical details rather than focus on the larger goal of water management for the region.

The current scenario – what can be done?

The unrestricted focus on sugarcane production and the consequent exploitation of water is not a new occurrence in Maharashtra. The central districts of Maharashtra, especially those in the Marathwada region, are drought prone and experience scanty rainfall well below the state average. Two-third of the applications for new sugar mills in Maharashtra are located in the Marathwada region.

The analysis leads to the conclusion that the sugar industry due to its high water consumption and its establishment in the drought prone region has had an effect of aggravating/exacerbating drought conditions in Maharashtra. The current drought year succeeds that of 2013-14 and is the fourth of its kind since the droughts of 1972, 1986-87 and 2009. However, the lessons from the past events have not been heeded, and the distorted policy of water exploitation by sugarcane has been continued unabated despite aggravating droughts and water scarcity. As of 27th January, 2016, about 480.72 lakh tonnes of sugarcane was crushed in Maharashtra, and 5.17 MT of sugar was produced(रा□यात४८१लाखटनउसाचेगाळप, 2016). This is on the backdrop of a national surplus of 10 MT (Parija & Mishra, 2015), and a consequent fall of 37.5% in sugar prices from Rs. 32 to Rs. 20 per kilo (based on Wholesale Price Index) in 2015. Theoretically if half of Maharashtra's sugar production were exported, it would result in a virtual water export of 16 BCM.

The nexus between the legislators, bureaucrats and the sugar lobby has been able to influence and distort the State Water Policy regarding distribution of water. Such structural distortion in the allocation of water needs to be corrected so that the physical, social and economic burden of water scarcity is shared equitably between different stakeholders.

Average Annual Rainfall in-
Marathwada – 882 mm
Vidharbha – 1,034 mm

While the causes of water exploitation by sugar industry have remained consistent, the major changes have occurred in the scope and intensity of its impacts. The usage of water in the sugar industry has always been excessive, but in recent years, the exploitation has assumed huge proportions and has become rampant. The amount of land and water resources facing degradation are increasing, while the rate and intensity of degradation is increasing as well. There has been a noted shift in the monsoon pattern. This has exacerbated the uncertainty and vulnerability of agriculture, especially rain-fed, and severely impacted water availability for other crops.

The decadal population growth of Maharashtra has declined from 22.57% in the 1990s to 6.74% in 2011(Maharashtra Population Census data 2011, 2011). Coupled with increase in area under water scarcity and drought, this has led to larger proportion of people residing under vulnerable conditions. On the backdrop of the current back-to-back drought of 2014-15, it is important to carefully plan and envisage a sustainable action plan for the near future. Firstly, it is important that the government formulates and enforces strict rules regarding water use in the sugarcane plantations and sugar industries, and encourages the use of water-conserving technologies. Secondly, devising rational cropping patterns and water-conserving and economically viable substitutes for sugarcane should also be prioritised in the medium term. Finally, water supplied to sugarcane needs to be measured.

While the paper stresses on efficient and optimum use of available water, it needs to be pointed out that it is equally important to aim for increasing crop productivity. Efforts to improve productivity and better access to technology will enable sick factories to become operational, and to continue functioning while consuming less water. This will not only make the sugar industry sustainable, but it will also benefit both sugarcane and non-sugarcane farmers through healthy economic returns and equitable allocation of water. The ultimate goal would be to incentivise other farming options and secondary employment opportunities to reduce reliance on sugarcane.

Key Findings

Based on the work undertaken, the following recommendations are presented-

a) The government should have strict and effective enforcement mechanism for rules and regulations regarding water and technology use for sugar factories, especially in drought-prone areas.

b) Factories that have been non-functional should be closed and financial dues to be cleared through revenues from the process of asset liquidation.

c) Shifting the sugarcane & sugar factories to locations with assured rainfall - 50 out of 75 applications for establishment of sugar mills are located in the drought affected Marathwada region. Since current level of sugar production in the state exceeds demand, it is recommended that no new licenses should be given for setting-up of new sugar mills. Consequently, if mills are to be established, the same should be done in regions with assured rainfall exceeding 1,000 mm.

d) Conditions for extending the period of existing factories - Following conditions should be levied for extending the period of current factories in the entire state - a) FRP (fair and remunerative price) to be guaranteed by the

factory owners, b) compulsory usage of water recovery technology to be put in place in order to minimise the water usage. These conditions should be applied across the state, not just in drought-prone areas.

e) The excessive release of water for sugarcane should be stopped forthwith by using sections 47, 48 and 49 of the 'Maharashtra Irrigation Act, 1976'.

f) Area under sugarcane should be reduced. The same can be done to the tune of 30% without reducing the output of sugarcane from the state.

g) Enforcing the directive regarding the use of drip and sprinkler irrigation techniques would assist in greater water saving.

h) Promotion of water efficient technologies such as drip irrigation for sugarcane cultivation.

i) Cropping pattern for areas released from sugarcane should be monitored. Such regions should be brought under crops such as sweet sorghum, millet and sugar beet among others. Sweet sorghum, having a four month growing period and water requirement of 8,000 m^3 can be cultivated in the Kharif season (Reddy, Ramesh, Reddy, Ramaiah, Salimath, & Kachapur, 2005). Further, sugar beet with a growing period of 5-6 months and water requirement of 800-850 mm (Tropical Sugar beet, 2014) can be a substitute for sugarcane. These are drought-tolerant, salt-conserving and water-tolerant crops. However research for the long-term viability of such crops needs to be undertaken.

j) In the medium and long term, rational cropping patterns should be planned and implemented, and the subsidy to sugar industry should be phased out.

k) Ensuring Volumetric Supply of Water -Enforcing of volumetric supply of water to sugarcane fields should be undertaken. While there is no practical way to enforce volumetric supply of groundwater, this can definitely be applied in case of supply of surface water.

l) Reclaiming water logged areas for cultivation – There are regions in the irrigation command area that face water logging, while adjoining areas face drought-like conditions. An economic solution would be to drain excess water from water-logged areas and use the same for agriculture.

m) Employment generation should include restoration and development of Grasslands, degraded *zudpi* (bushy) forest areas, river and stream beds, so called wastelands, buffer zones of forests etc., on which rural non-farming communities also subsist.

n) **Strengthening the Water Users Associations:** Currently most of the WUA's are weak or in a non-operative state. While various studies have been made which point out the weaknesses and corrective measures required, there is a need to invest in capacity building for these WUAs.

o) *Jirayat* (Non-irrigated) Farming of sugarcane for jaggery should be advocated. Though the yield of such practice is low, research on the same could be undertaken.

Researching Alternatives to Sugar

The current level of sugar production in Maharashtra would satisfy the estimated demand in 2030. A brief survey, conducted in Pune and Ahmednagar Districts, indicate that Sweet Sorghum (Jawar), a widely consumed cereal is not a viable option for substitution of sugarcane. Further, Sugar Beet is not known to farmers locally, and agro climatically not suitable and hence, is not a suitable alternative for cane.

Report on Workshop - Drought, Sugar and Sugar Industry in Maharashtra

The workshop was held by 'Gomukh Trust' 15th December 2016, at Science and Technology Park, Pune University. Experts from different fields were present for the workshop, which commenced at 2.30 p.m., and ended at 6.30 p.m.

The workshop started with a quick introduction of the experts. Dr. Suresh Kulkarni, (Secretary, MWRRA) initiated the proceedings with presentation on his paper titled 'Will Irrigating Sugarcane by Drip Quench Our Thirst?' He mentioned that nearly 4% area of sugarcane uses 71% of total irrigated water. He emphasized MWRRA's approach towards implementing the concept of (Automated) Volumetric Release of Water and Pricing. He said that Think Tanks and CSOs should guide the Government and concerned authorities about water uses and related issues. He gave example of China and Bangladesh, where there is a cap on how much water is to be given for irrigation. He highlighted that water required for 1 ha of sugarcane can satisfy the requirement of thousand people.

Mr.Dilip Deshmukh (Deputy Director, '*Sakhar Sankul*') recommended that NGO's should share their respective papers (Published/Non Published) with the Government to strengthen policies. The Department of Agriculture advocates amongst farmers that 'Irrigation of the Crop, and not the Soil' is the need of the hour.

Professor Mohan Patil (Member, Council for Equitable Water Rights) presented a case study entitled 'Moisture Irrigation System and Zebra Pattern of Crops'. The experiment highlighted a unique technique wherein the requirement of water for sugarcane crop would be 4,000 cubic meters per hectare annually. The establishment of Water Users Associations (WUAs) on the lines of '*Pani Panchayats*' was suggested. The main driver for sugarcane cultivation is its price.The Government should focus on the implementation of existing laws instead of introducing new ones. The volumetric supply of water for agriculture could be revolutionary. The location of sugar factories should be looked into in detail.Sugar production in India is supposed to be the costliest world over. The viability of sugarcane cultivation in the north-eastern states should also be considered. Third, it was suggested that sugar factories which are closed down should be converted into Agro-based Industries. He firmly said that the government should limit the land to be given for growing sugarcane.

Professor N.J. Pawar highlighted reasons for envisaged failure of cultivating sugarcane in the Konkan belt. Increased extraction of deep groundwater and a low capacity to hold water from rains makes the Konkan region unfavourable for cultivating sugarcane, as shown by the farmer's preference. While drought maybe caused by mismanagement of water and inappropriate cropping pattern, alleviation of the situation requiresa broader strategy involving restoration of eco systems and creation of secondary income opportunities among others. Some best practices of the same have been noticed in Sangli, Miraj, Agrani and Yerala sub-basins.

Prof. N.J. Pawar presented a paper on the profile of soil structure in Maharashtra. He articulated that soil structure and water are co-related. Maharashtra predominantly has rocky terrain. In Marathwada and Vidarbha, irrigated farming is witnessed, even where the soil is not favourable. Although the Konkan region experiences heavy rainfall during the monsoon season, after December, there is a shortage of drinking water supply. This can be attributed to the low water retentively of the soil in the region. He advocated for the cultivation of short-term crops in drought prone regions and long-term crops in regions with assured rainfall. Crop pattern should be decided on the basis of (a) Zoo-geographic zones (b) Agro-climatic zones, and (c) Sub-surface/geologic zones, which characterize the nature of aquifers, . The mapping of aquifers should be prioritized and usage of deep aquifers should be restricted to meet domestic demands during droughts. The case of 'Saravadi' village in Latur District was presented, where the local population stopped cultivation of sugarcane, thereby ensuring sufficient drinking and domestic water supply during the 2015-16 drought year.

Conclusions

a) Currently, about 32 BCM of water is being consumed by sugarcane in the state. Use of drip and sprinkler technology can reduce the water requirement

to about one-third i.e. approx. 10.66 BCM. Theoretically, even if half the irrigated area is brought under micro-irrigation systems (MIS), it will save 5.33 BCM of water which can potentially irrigate over 10 lakh ha of additional land.

b) The country already faces a sugar surplus of 10 MT (Parija & Mishra, 2015). Consequently sugar prices have fallen by 37.5% from INR. 32 to INR 20 per Kg (based on Wholesale Price Index). Even if half of the excess sugar is exported, it would tantamount to virtual water export of at least 16 BCM of precious water during a severe drought year, which is unacceptable in areas where there is a shortage of drinking water.

c) It is apparent that reducing the area under sugarcane, and using water efficiently, may save considerable amounts of water, but this measure by itself would not give economic relief to the drought affected population.

d) In order to give relief, a package of other measures like inducing small/large scale industries to get established in these areas, increasing employment opportunities by providing incentives to the service sector industry, and providing FRP support to other agricultural crops like oil seeds, lentils, millets etc. need to be undertaken.

e) The effect of tilting the focus towards water resources for sugarcane cultivation has severely manifested in the declining levels of water supply available to other crops. About 32 BCM (by conservative estimates) of water gets used up by sugarcane fields through surface irrigation. The same amount of water can irrigate45 lakh ha of other crops at 7000 m^3 of water per ha. Further, even sugarcane utilizing drip irrigation would consume 8000 m^3 of water per ha.

f) In Maharashtra, it is not unusual to spot villages surrounded by lush, green sugarcane fields but having no drinking water. Local populations have to face drastic water cuts and have to rely on water tankers for drinking and domestic water supply, while sugarcane fields continue to guzzle enormous quantities of water. The result is that while a handful of sugarcane farmers benefit from an assured produce and grow richer, the majority of the population has to suffer from lack of water supply for their farms and hardships in acquiring drinking water. The coveted financial gains are concentrated in the hands of a few, rich farmers and do not contribute to agricultural and overall prosperity of the region and sustainability of the agrarian system and farmers. This scenario is not new; rather, it has persisted for the past few decades. However, the scope of the problem has increased to include more and more of the masses, while inequality has become more acute.

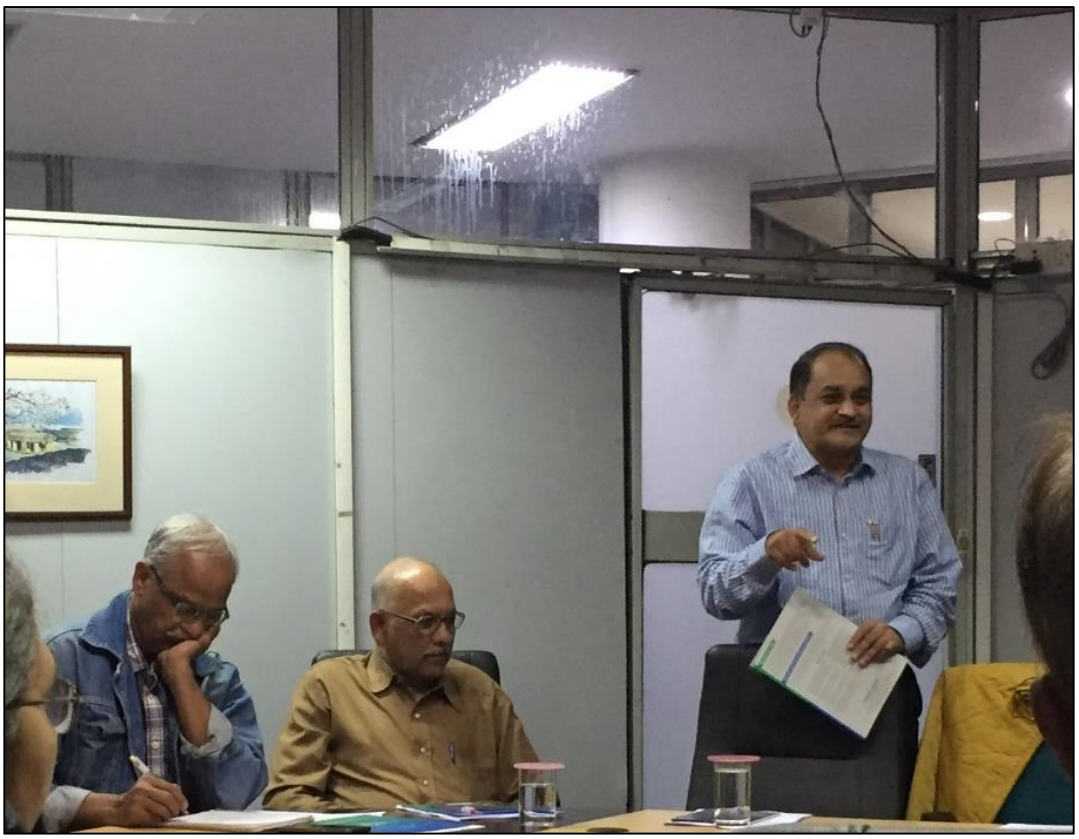
g) Repair, maintenance and Restoration of water-distribution system – The WRD should ensure supply of pre-defined volume of water to WUAs. To achieve the same, existing canals, distributaries and minors should be repaired to usable state.

h) Recharge of groundwater should be taken up during 'good monsoon' years.

Annexure I: Workshop Participants

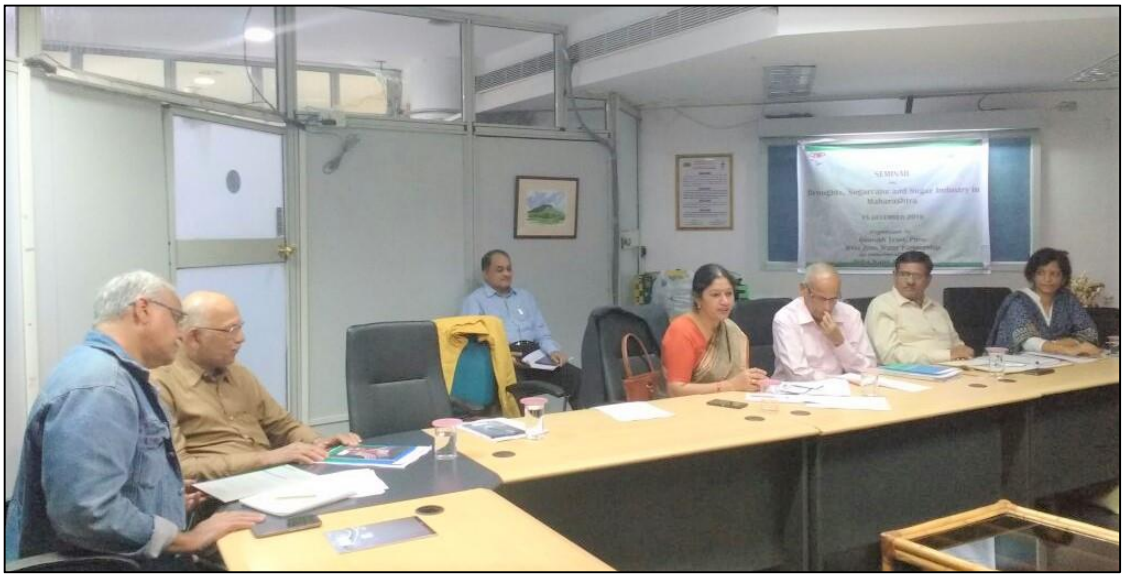
1. Prof. Vijay Paranjpye, Coordinator, West Zone Water Partnership
2. Dr. Rajendra Jagdale, Director General, Science and Technology Park, Pune.
3. Dr. Sonali Shinde, Pani Panchayat.
4. Dr. Suresh Kulkarni, MWRRA, Mumbai
5. Dr. D.M. More, Maharashtra-Sinchan Sahayog
6. Dr. Veena Khanduri, India Water Partnership.
7. Anant Gogte, Gram Vardhini.
8. K.J. Joy, SOPPECOM
9. Aarti Kelkar - Khambete, India Water Portal.
10. Suniti S.R., National Alliance of People's Movement.
11. Mohan Patil, Council for Equitable Water Rights
12. Dr. N.J. Pawar, Professor of Pune University, Member of Council for Equitable Water Rights, Ex Vice Chancellor of Kolhapur/Shivaji University.
13. Dilip Deshmukh, Deputy Director of Planning, Commissionerate of Agriculture, GoM.
14. G.M. Kulkarni, Technical Officer, Commissionerate of Agriculture, GoM.
15. Jitesh Memane, Council for Equitable Water Rights, Pune.
16. Sushma Sharma, India Water Partnership, Delhi.
17. Anubha Aggarwal, Research Assistant, India Water Partnership, Delhi.
18. Sonali Bhattacharya, Science and Technology Park, Pune.
19. Rugved Dongre, Research Assistant, Gomukh Trust.
20. Gauri Noolkar, Research Assistant, Gomukh Trust.
21. Chaitrali Kulkarni, Research Assistant, Gomukh Trust.

Annexure II: Photographs



Dr.Rajendra Jagdale, Director General, Science and Technology Park Pune, while welcoming the delegates and briefing them about the work done by the STP.

Dr. Suresh Kulkarni explaining his views on the role of MWRRA and amelioration of the drought through delivery system correction and participatory irrigation management by WUAs



Dr.Veena Khanduri assuring participants that the recommendations will be advocated with relevant ministries in Delhi.

Professor Mohan Patil, presenting his experiment on 'Moisture and Zebra Pattern Irrigation'

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About India Water Partnership

India Water Partnership (IWP) is a Non-Profit Organization, accredited with the Global Water Partnership (GWP), Stockholm. IWP is hosted by WAPCOS, a public sector undertaking under the Ministry of Water Resources, River Development and Ganga Rejuvenation. IWP works towards water security in India by utilising the concept of Integrated Water Resources Management (IWRM). IWP carry out dispassionate analysis of various water related issues and steer the policy discourse on social, economic, ecological and scientific basis. IWP serve as an independent voice on water management issues, outside the government, forecasting and identifying the potential challenges. IWP works towards these goals through research, advocacy and implementation on the ground with the help of its network partners.