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TECHNOLOGIES FOR IMPROVING PRODUCTIVITY AND SUSTAINABILITY OF SUGARCANE IN INDIA: A GEOGRAPHICAL STUDY

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INTRODUCTION:

Agricultural development is critical to developing countries, especially to the least developed of them. Although agriculture still remains the largest employer, the largest source of exports and foreign exchange earnings for the most developing countries its contribution to GDP is declining gradually. About 75 percent of population below poverty level within the worldwide resides in rural areas and most of them are hooked in to agriculture. While agriculture declines relative to the rest of a growing economy as incomes improves, its growth is absolutely critical in the early stages of development and it can often drivport-led growth. But whatever the stage of development is the socioeconomic stability of a nation is determined by prosperity of agriculture sector. A vibrant agricultural sector is therefore crucial to reducing poverty through economic growth, as well as improving global food security and conserving natural resources. Agricultural trade reform, to rose integrate this sector into global markets is equally crucial to developing countries for variety of reasons. Agriculture has the highest levels of trade distortions and therefore has the greatest potential for gains from reform. And domestic reforms are necessary to implement trade reforms to benefit developing countries more than developed countries.

Sugar is an universal sweetening agent and sugar in some form has become a ‘must’ in human diet whether taken directly through various sweet preparations, or indirectly through various carbohydrate containing food stuffs. In every home sugar is known for various sweet dishes and confectionary articles. Sugar as sucrose is important for energy and metabolic activities. Sugar

may be formed in roots of beet carrot and turnip, stems of sugarcane, sorghum and maize in flowers of palms and in fruits. Sugar may be found either in the forms of sucrose or glucose or fructose, hexose and maltose. Sucrose is a commercial sugar.

The sugarcane plant belongs to the genus "Saccharum" which originates from the family of grasses. The genus Saccharum is itself divided into five species. They are as follows: i) Saccharum officinarum, ii) Saccharum barberi, iii) Saccharum sinense, iv) Saccharum spontaneoum and v) Saccharum robustum,

OBJECTIVES:

1. To know the Method of production and productivity in India.
2. To ascertain problems, prospects and method of sugarcane cultivation.

HYPOTHESES:

1. Most of the farmers in the study area are engaged in agriculture.
2. Irrigation is the most important input in the sugarcane cultivation

DATA BASE:

The present study is based on both the primary and secondary statistical information in addition to the detailed schedules used for collection of primary information. The schedule is used to collect the information pertaining to farmers cultivating method, input costs, socio-economic background, resources used in cultivation etc. Secondary data is collected through annual reports of District Statistical Office

A. Description of Water Use Efficient Production Technologies:

The technologies identified for higher water use efficiency and selected for demonstration at farmers' fields in participatory mode are described as follows:

1. Ring Pit Method of Planting: Nearly, 9000 pits per ha of 75 cm diameter and 30 cm depth are made by pit digger. In addition to this manure, 8 g urea, 20 gDAP,16 gMoP and 2 g zinc sulphate are also added in each pit. Twenty, two

budded sets are placed in each pit like spokes in a cycle wheel. The chlorpyriphos solution is applied on the setts and 2-5 cm soil cover is made over the setts. One irrigation just after planting and blind hoeing prompt germination. Thirty days after germination, 16 g urea is applied in each pit and half of the soil remaining at periphery is filled back in the pit. In the month of April-May, the remaining soil is filled back in the pit and 16 g urea per pit is also applied. The filling of soil is completed when all the mother shoots have emerged. The crop under ring planting consists mainly of mother shoots, which are thicker and heavier than tillers. Ratoon yields are also higher because of deeper planting of plant crop.. For this reason, with the ring planting 25-30 per cent irrigation water is saved. Higher sugarcane yield and reduced quantity of irrigation water results in 30- 40 per cent higher irrigation water use efficiency.

2. Skip Furrow Method of Irrigation: In this method of irrigation, instead of irrigating all the rows and inter-row spaces, one row is skipped and irrigation is given in alternate rows. With this technique, limited water may be used to irrigate larger area. In this method, sugarcane is planted in flat bed as usual and after germination, 45 cm wide and 15 cm deep furrows are made in alternate inter-row spaces. At the time of irrigation, the furrows thus made are irrigated.

3. Trash Mulching: Sugarcane trash is a waste material available after harvesting of the crop. Trash is spread 10 ha-1 in the alternate inter-row spaces in ration crop at the time of its initiation. Because of trash mulching, effectiveness of irrigation is increased as the evaporation losses of moisture from soil surface reduced considerably. Sugarcane crop yield and water use efficiency increases by 26 and 40 per cents, respectively, due to trash mulch as the trash mulch keeps the soil moisture at a higher level for a longer time as compared to uncovered soil surface. Increase in sugarcane yield due to trash mulch is attributed to favorable moisture condition, increased microbial activities and addition of water-soluble nutrients from the trash. In the long run, soil organic carbon content is also improved.

4. Irrigation at Critical Growth Stages: In the areas of limited water supply, ensuring irrigation at critical period of water need of the crop and deferring the same at somewhat less critical period, improves yield and irrigation water use

efficiency. These critical stages for sugarcane are emergence, first order of tillering, second order of tillering and third order of tillering. If two irrigations are available, then the irrigations are provided at second and third order of tillering. If three irrigations are available, then the irrigations are provided at all three orders of tillering. If four irrigations are available, then the irrigations are provided at all the four critical stages.

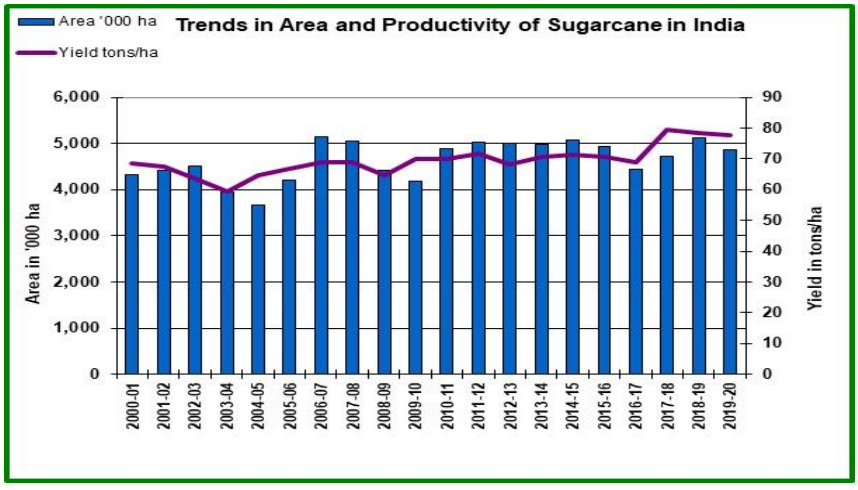
Table No. 1

Area, Production and Productivity of sugarcane in India

year	Area '000 ha	Yield t/ha	Sugarcane (million tons)	Sugar (million tons	Recovery%
2012-13	4998	68.3	341,198	25,141	10.03
2013-14	4993	70.5	352,141	24,360	10.23
2014-15	5067	71.5	362,333	28,313	10.37
2015-16	4927	70.7	348,448	25,125	10.62
2016-17	4436	69.0	306,070	20,262	10.48
2017-18	4732	79.6	376,905	32,328	10.73
2018-19	5114	78.3	400,157	*N.A.*	*N.A.*
2019-20	4867	77.6	377,766	*N.A.*	*N.A.*

Source: Agriculture Department of India.

The table shows the area production and productivity in India. The table show 2012 to 2020 year and its production is 68.83 to 77.56 sugar production seen to have increased from 25,141 to 377,766 is possible for maximum use the technology. The recovery was 10.3 percent in 2012 year and increased to 10.73 percent in 2017-18 year



Sugarcane requires considerable quantity of water. The annual water requirement for this crop is 1400-1500 mm in sub tropics. Majority of the farmers irrigate sugarcane unscientifically and therefore, irrigation efficiency at farmers' fields seldom exceed 35-45 per cent. Though, India is placed among the countries having highest irrigated area but the productivity of irrigated land in India is very low as compared to the other countries. In the country 95 per cent of the farmers are irrigating their crops with surface irrigation method with 30-40 per cent irrigation efficiency. To increase irrigation efficiency of surface irrigation methods, voluminous work has been carried out by the research institutions of National Agricultural Research System

B. To Work out The Economics of Demonstrated Technologies at Farmers:

Believing through seeing' and 'learning by doing' accomplished through demonstrations help KVKs in technology integration. This process arouses interest and improves the adoption, because it is based on the principles of 'learning by doing' and 'seeing believes'. Technology demonstration is the most effective way to show how a thing works, how to do the work, principals involved in an operation and to show the end results of the technology/methodology adopted. On the idea of purpose that technology demonstration is conducted it's classified into (i) method demonstration and (ii) result demonstration

1. Method Demonstration: A method demonstration is conducted to elucidate the way to perform a specific operation consistent with its principles in order that it's administered systematically and yields better result. Through method demonstration we teach the learners about the way to do something. The learners are going to be shown the proper method for doing an old practice or taught a few new practice that are introduced to them. The method demonstration teaches new skill and helps the learner to get practical knowledge about something they have to practice or neutralize their day to day life

Purposes:

Some of the precise purposes that the demonstration is beneficial are urea molasses treatment of paddy straw, compost pit, biogas plant, pesticide spraying, milking operation, sanitation methods, seed treatment, milk collection and storage, de-beaking of poultry, egg preservation, cattle feed preparation, operation of improved implements, sericultural operation, beekeeping, grooming

2. Result Demonstration:

The values of a replacement practice are often realized better by seeing the top product or outcome as compared with the prevailing practice. Therefore, in extension education the result demonstration is a crucial tool to convince the farmer about the worth of a replacement idea or innovation that are introduced to them as an option to their existing practice. Unless the farmers see the result or results of the recommended practice as compared with their existing practice with their own eyes and knowledge , it becomes difficult for the extension worker to form the farmer to adopt the recommended variety or practice. From the above discussion it's understood that result demonstration is:

The method to show the worth or end product or outcome of a practice or an idea.

i) Conducted mainly to point out the differences between two practices especially when one is taken into account more superior to the opposite in giving the result or outcome.

ii) To compare the results.

Purposes:

The result demonstrations could also be used for one recommended practice or a series of practices that are available sequence with reference to a drag . For example, it's easy to conduct the result demonstration for showing an increased yield of a hybrid seed as compared with an area variety than to point out the increased milk yielding potential of a crossbred cow thereupon of an indigenous one. Here, the time framework required for the previous operation may be a

maximum of three months whereas a minimum period of three years are necessary to point out the Some of the recommended jobs that result demonstration is beneficial are compost production, improved seed, fertilizer application, plant protection

3. Front-Line Demonstrations:

Front-Line Demonstration (FLD) may be a concept of field demonstration evolved by the Indian Council of Agricultural Research during the inception of Technology Mission on Oilseed Crops during mid-eighties. The field demonstrations conducted under the close supervision of scientists of the National Agriculture Research System is named front-line demonstrations because the technologies are demonstrated for the primary time by the scientists themselves before being fed into the most extension system of the State Department of Agriculture.. They can conduct FLD on any technology assessed and refined and located undoubtedly suitable by the other agency involved in developing technologies for regions/agro-climatic zones that include or are similar to the KVK microlocation. The main objective of Front-Line Demonstrations is to demonstrate latest crop production technologies and its management practices within the farmers' field under different agro-climatic regions and farming situations. While demonstrating the technologies within the farmers' field, the scientist are required to review the factors contributing towards higher crop production, field constraints of production and thereby generate production data and feedback information. Front-Line Demonstrations are conducted during a block of two or four hectares land so as to possess better impact of the demonstrated technologies on the farmers and field level extension functionaries.

4. FLD v/s Other Demonstrations:

The Front-Line Demonstrations are different from the traditional demonstrations conducted by the extension functionaries

1. Front-Line Demonstrations are conducted under the close supervision of the scientists of the National Agriculture Research System

comprising of KrishiVigyanKendras, ICAR Institutes, National Research Centers, Project Directorates and the State Agricultural Universities and its regional Research Stations..

2. Front-Line Demonstrations are organized during a block of two to four hectares involving all those farmers whose plots fall within the identified demonstration block.
   by the farmers themselves.
3. Training of the farmers related to the Front-Line Demonstrations may be a prerequisite for conducting such demonstrations.

5. Typology of Frontline Demonstrations:

Frontline demonstration is a long term educational activity conducted in a systematic manner in farmers' fields to show worth of a new practice/ technology.. Only proven technologies (based on OFT results) are selected for field demonstrations. Field demonstrations educate farmers through results obtained in terms of varieties resistant to disease and pest, quality of the grains and overall higher yields. In addition, it also educates the farmers in term of input-output ratio and economic gains in terms of net returns.

CONCLUSION:

1. All the modern instruments/implements available in the market are employed by the farmers. But most of the modern implements used by marginal and small farmers are hired due to the in economic holdings.
2. Most of the land holdings of sample farmers is irrigated and average land
3. The cost of cultivation of planted crop is higher than ratoon crop. The cost of cultivation is inversely related with the size of holding. Major cost of cultivation are farm yard manure, fertilizers and labour charges in case of variable costs while electricity and machinery charges are the major heads of fixed cost.
4. Tractors and bullock carts+ tractors are the important means transportation in the study area

IMPLICATIONS AND RECOMMENDATIONS:

1. Government and other agricultural organizations required to give higher education for study area farmers to produce more.
2. Modern technology required to use for produce more and reduce cultivation cost
3. The findings of the study revealed the 'lack of knowledge' as the pivotal reason among the important reasons for non-adoption of partial adoption of recommended sugarcane cultivation practices. This poses a real challenge to the extension agency to increase the knowledge level of farmers through organized training programmes
4. Testing all the technologies developed through the central institute and local sugarcane Research stations by factory.
5. Tapping the underground water resources or construction of storage tanks to improve the percolation of water in the seepage wells.

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