

Cultivation of Sugarcane (*Saccharum spp*) in West Bengal

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Abstract

Sugarcane (*Saccharum spp*) cultivated in West Bengal as well as in India since long past. Cane is the major source of producing table sugar. Besides producing table sugar recently also a good source of producing fuel. The cane baggage also used for various purposes. In West Bengal major sugarcane producing districts are Murshidabad, West Midnapur, Malda, Nadia, Birbhum, and Burdwan. Only one sugarcane research station present in West Bengal at Bethuadahari, Nadia. Presently many sugarcane variety is cultivated in West Bengal like Co 62197, Co 7202, Co 7224, Co 7218, Co 62207, Co B 94164 and Co 62033 among them Co B 94164 common name is 'Madhuri' developed by Bethuadahari sugarcane research station in collaboration with sugarcane breeding institute Coimbatore. Sugarcane is grown manly on Ganga riverine, Vandhya riverine (which are under alluvial soil), Laterite alluvial and Buxa riverine land. There are many types of planting and irrigation methods used by farmers. Farmers use fertilizer and manure in cane field simultaneously. In this state as well as our country Sugarcane is ready for harvest in about 11-12 months after planting

Keywords: Bethuadahari sugarcane research station, Madhuri, Sugarcane, Sugarcane breeding institute Coimbatore, West Bengal

Introduction

Sugarcane (*Saccharum spp.*) is the main source of producing sugar in the world (Mirajkar et al., 2019). In comparison to other crops, sugarcane (Aakh) is a traditional crop in West Bengal (Fig. 1). Ritter (1841) in the first serious study of the origin of sugarcane proposed in Bengal, India, as the center of origin on the grounds that most of the wild species of the *Saccharum* complex were indigenous to India. Simultaneously, evidence is against *S. officinarum* evolving in India (Heinz, 1987). Sugarcane is not mentioned in the oldest Indian literature, the Rig-veda, dated about 1500 B.C. (Daniels & Daniels, 1975). It is also not present in the archeological record of north India (Hutchinson, 1976). *S. officinarum* appears first in the Atharva-veda, variously dated about 800-1000 B.C. (Chaitanya, 1977). Chaitanya (1977) has produced evidence to show that the Rig-veda was compiled in northwest India when the Aryans entered India c. 1500 B.C. It is likely that sugarcane was not present in northwest India in 1500 B.C. and that the Aryans eventually encountered it in Bengal in 800 B.C. (Heinz, 1987). It may have been present there from earlier times (Heinz, 1987). Sugarcane takes special emphasis to human from pre-historic era as because of its economic importance and sweet food called as gur. However, it is still not known when people first domesticated sugarcane from wild grasses to chew its sweet juice or when they first boiled the extracted juice to prepare the economically important gur (Ram & Kumar, 2012). British East India Company first brought in sugarcane varieties from other countries and cultivated first different parts of Bengal as because of tolerant to water logging, salinity alkaline conditions and resistant to the pest and diseases (Brewster, 1930).



Fig.1: Flowering Sugarcane plants

Productivity of the state

During 2015-16 approximately 0.20 lakh hectare lands in West Bengal was under sugarcane cultivation (Shukla et al., 2017). Among that 33% land was under ratoon crop producing and annual cane production during 2015-16 was 23.00 lakh tons with average yield 115.0 t/ha (Shukla et al., 2017). Sugarcane cultivate in more or less every district of

West Bengal. Major sugarcane producing districts are Murshidabad (37%), West Midnapur (16%), Malda (15%), Nadia (12%), Birbhum (9%), and Burdwan (7%) (Ram & Kumar, 2012) (Fig. 2 & 3)

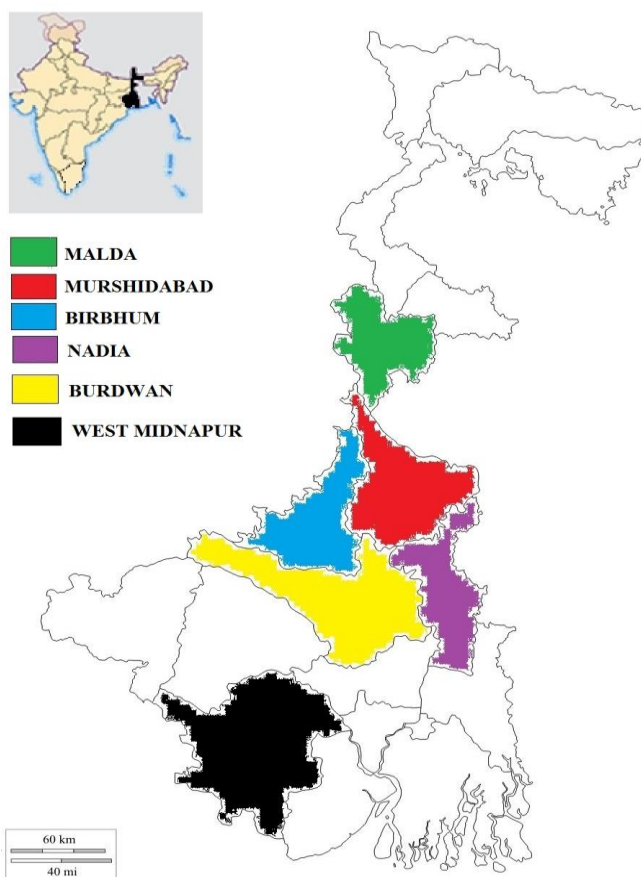


Fig.2: Major Sugarcane Cultivating district of West Bengal.

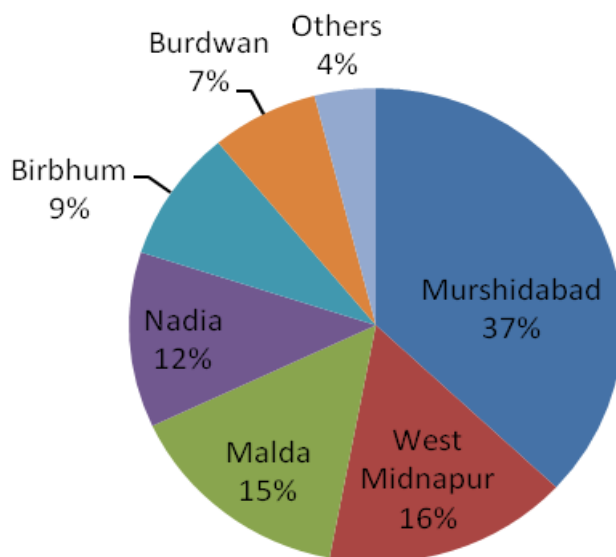


Fig.3 Major Sugarcane Producing Districts in West Bengal

Sugarcane Research Station

In West Bengal after independence, A Sugarcane Research Unit was established at State agricultural research Institute, Tollygunj, 230 A N.S.C. Bose Road, Kolkata 700040 in 1950. At the same year another sugarcane research facility was established at Burdwan under the supervision of Assistant Sugarcane specialist. The Tollygunj unit was shifted to the District Seed Farm Burdwan in 1956 to provide farm facilities. Later, to establish fully fledged sugarcane Research Station, both these units were transferred to Bethuadahari, Nadia in 1965. In that time to developed the station 100 acres of land was donated by the Ramnagar Cane and Sugar Co. Ltd, Plassey (now, Khaitan(India)Ltd.). During 1973, ICAR sponsored All India Coordinated Research Project on Sugarcane was started at this research station and this research station was recognized by the ICAR to be one of the premier research centers in the Eastern and North Eastern states (Ram & Kumar, 2012).

Sugarcane Variety developed and released by the research station

Six sugarcane varieties Co 62197, Co 7202, Co 7224, Co 7218, Co 62207 and Co 62033 were released in 1981 in West Bengal, among them Co 7218 is still popular for the earliness, quality, production of gur and chewing purpose. In 1983 CoJ 64 and Bo 91 was released (Table 1). Among them Bo 91 is still popular variety among the farmers because high sugar, tillering, best ratoon, high tolerance to water submergence and drought tolerance. Co767 was released in the year of 1987 but it covered only a small area (Ray, 2012).

Since, 2000 when sugarcane was included in the Seed Act 1965, a numbers of sugarcane variety were released and notified for North Central Zone ncluding West Bengal (Table 2). In 2002, Madhuri (Co B 94164) was released by the West Bengal state Variety Release Committee which developed at Bethuadahari in collaboration with SBI, Coimbatore under AICRP(S) and was notified by GOI in 2004. It is a high sugar, mid-late maturing variety and has rapidly become a favorite in mill area as well as in other parts of this state (Ray, 2012).

Table 1: Sugarcane variety released before the year 2000

Sl. No	Variety	Parentage	Maturity	Year of release*	Cane yield (t/ha)	Sucrose (%)	Approximate area (ha) under variety in the state	Major Characteristics
1	Co 313	Co 213 x Co 244	Early	Before 1955	-	19-20	1570	Growth ring weak, bud shape obovate, bud groove absent, bud cushion absent.
2	Co 419	PoJ 2878 x Co 290	Mid-late	1955	53.30	18.19	6673	Growth ring weak, bud shape oval, bud groove shallow, bud cushion present.
3	Co 527	Co 349 x Co 312	Mid-late	1956	48.00	17.18	7000	Growth ring strong, bud shape round, bud groove absent, bud

								cushion absent.
4	Co 997	Co 527 x Co 617	Early	1962	49.20	18.90	-	Growth ring strong, bud shape rectangular, bud groove absent, bud cushion absent.
5	Co1008	-	Mid-late	1962	58.00	17.20	5000	-
6	Co 1148	-	Mid-late	1963	73.89	18.31	-	-
7	Co 1158	-	Mid-late	1963	66.40	16.00	-	-
8	Co 62010	-	Early	1967	63.94	18.70	-	-
9	Co 1132	-	Mid-late	1968	76.69	18.00	-	-
10	Co 1232	-	Mid-late	1968	63.90	18.80	-	-
11	Co 801	-	Mid-late	1969	62.82	19.40	-	-
12	Co 842	-	Mid-late	1969	-	-	-	-
13	Co 6315	-	Mid-late	1972	65.41	20.09	-	-
14	Co 6311	-	Mid-late	1976	71.01	19.90	-	-
15	Co 961	-	Mid-late	1976	-	-	-	-
16	Co 62033	Co 419 x Co 678	Mid-late	1981	75.15	15.86	-	Growth ring weak, bud shape obovate, bud groove absent, bud cushion absent.
17	Co 62197	CP 34120 xCo775	early	1981	70.29	16.75	-	Growth ring strong, bud shape triangular pointed, bud groove absent, bud cushion present.
18	Co 62207	-	Mid-late	1981	70.02	16.58	-	-
19	Co 7202	Co 449 x Co 658	Mid-late	1981	69.62	16.25	-	Growth ring strong, bud shape rhomboid, bud groove shallow, bud cushion present.
20	Co 7218	Co 449 x Co 658	Early	1981	98.19	17.08	-	Growth ring strong, bud shape oval, bud groove shallow, bud cushion present.
21	Co 7224	Co 740 x Co658	Mid-late	-	83.76	16.04	-	Growth ring strong, bud shape oval, bud groove shallow, bud cushion present.
22	Co J 64	Co 976 x Co 617	Early	1983	93.00	16.72	-	Growth ring not swollen, bud shape oval, bud groove absent, bud cushion present.
23	Bo 91	Bo 55 x Bo 43	Mid-late	1983	79.63	19.27	-	Growth ring swollen, bud shape oval, Prominent bud groove extending the entire length of node, bud cushion absent.
24	Co S 767	Co 419 x Co 313	Mid-late	1987	76.23	17.08	-	Growth ring swollen, bud shape oval, bud groove absent, bud cushion absent.

*Released in West Bengal

Source: Ram & Kumar, 2012.

Table 2: Sugarcane variety released after the year 2000

*Released in West Bengal.

Sl. No	Variety	Parentage	Maturity	Year of release *	Cane yield (t/ha)	Sucrose (%)	Approximate area under variety in the state	Major Characteristics
1	Co 87263 (Sarayu)	Co 312 x Co 6806	Early	2000	66.3	17.4		Thick purple with green tinge present, growth ring swollen, bud shape oval, bud groove deep, bud cushion absent.
2	Co 87268 (Moti)	Bo 91 x Co 62399	Early	2000	78.9	17.5		Growth ring swollen, bud shape obovate, bud groove absent, bud cushion absent.
3	Co 89029 (Gandak)	Bo 91 x GC	Early	2001	70.6	16.3		Growth ring swollen, bud shape ovate with wings, bud groove shallow, bud cushion absent.
4	Co Se 92423 (Rajbhog)	Bo 91x Co 453	Mid-late	2001	70.1	17.5		Growth ring swollen, bud shape pentagonal, bud groove shallow, bud cushion absent.
5	Co Se 95422 (Rasbhari)	Bo 91 x Co 453	Early	2001	64.1	17.9		Growth ring swollen, bud shape oval, bud groove deep, bud cushion absent.
6	Bo 128 (Promod)	Bo 85 x Bo 43	Mid-late	2001	69.2	17.6		Growth ring swollen, bud shape pentagonal with wings, bud groove absent, bud cushion absent.
7	Co B 94164 (Madhuri)	Bo 91x Co 775	Mid-late	2002				Growth ring swollen, bud shape oval, bud groove absent, bud cushion absent.
8	Co Se 96234 (Rashmi)	-	Early	2004	64.1	17.9		Bud size medium, bud shape round, bud cushion absent, bud groove absent.
9	Co Se 96436 (Jalpari)	Bo 91 x Bo62198	Mid-late	2004	67.1	17.7		Growth ring swollen, bud shape obovate,

								bud groove shallow, bud cushion absent.
10	CoC (SC) 22	Co 8208 x GC	Mid-late					Growth ring strong, bud shape obovate, bud groove shallow, bud cushion present.
11	Co H 110	Co 1148 x GC	-	2005				Growth ring swollen, bud shape obovate, bud groove absent, bud cushion absent.
12	Co H 119	Co 7704 x GC	Mid-late	2005	82.8	17.5		Growth ring swollen, bud shape round, bud groove absent, bud cushion absent.
13	Co Lk 94184 (Birendra)	Co Lk 8001 x GC	Early	2008	76.0	18.0		Growth ring not swollen, bud shape pentagonal, bud groove absent, bud cushion absent.
14	Co 0232 (Kamal)	CoLk 8102 x Co 87267	Early	2009	67.82	16.51		Conidial internodes shape, heavy internodes waxiness, ovate bud and bud tip not touching growth ring.
15	Co 0233 (Kosi)	CoLk 8102 x Co 775	Mid-late	2009	67.77	17.54		Bud is round of medium size, bud groove and bud cushion absent and bud tip touching the growth ring

Source: Ram & Kumar, 2012.

Sugarcane Cultivation Climate and Seasons

Sugarcane mainly grows on tropical and subtropical areas of the world and the leading sugarcane growing countries are distributed in between the latitude 36.70° north and 31.00° south of the equator (Fig. 4) (Directorate of Sugarcane Development, GOI, 2013). In this geographical region this crop grows well because it is essentially a tropical crop that requires a long summer, prolonged sunlight

because it is a C₄ plant. State West Bengal (sub-tropical regions) got position in between 21°31' to 27°14' N latitude having adequate rainfall and fairly dry, sunny and cool but frost-free [Winter (December–January) is mild over the plains with average minimum temperatures of 15 °C (59 °F)] ripening and harvesting season. In this area most of the sugarcane is planted early in the spring i.e., January to March. After, 10-12 months (depending on the variety) when the crop ripe than it will harvest.

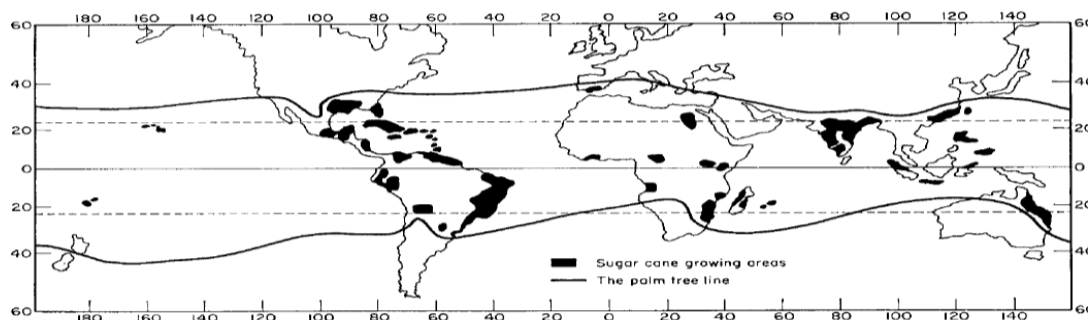


Fig. 4: World distribution of Sugarcane production [Source: Helmut Blume, Geography of sugarcane (Berlin, 1985), 22.]

Soil

The soil of this state is mainly six types Laterite, Red, Alluvial, Costal, Terai or Buxa reverie and Colluvial & Skeletal soil (Chakravarty & Chakravarty, 1957). Sugarcane is grown manly on Ganga riverine, Vandhya riverine (which are under alluvial soil), Laterite alluvial and Buxa riverine land. The largest cane growing area is Ganga riverine soil, because, these are calcareous and permeable and

retain moisture in the subsoil. These are work friendly, easy to work and do not suffer from water logging for long periods (Mukherji, 1956). Different types of soils are present in west Bengal and different soil contains wide variation of pH and micronutrients [(Chakravarty & Chakravarty, 1957) (Table 3)]. Ganga riverine, Vandhya riverine are well cultivated area, because pH of in this area is near to the neutral, and sugarcane grows well in neutral pH (Mukherji, 1956).

Table 3: Shows approximate chemical composition of the soil (Constituents as % of air-dry soil)

Soil	pH	CaO	K ₂ O	P ₂ O ₅	Carbon	Nitrogen
Ganga riverine	6.87 – 7.97	0.77 – 4.12	0.22 – 0.62	0.072 – 0.115	0.32 – 0.57	0.035 –0.065
Vandhya riverine	6.03 – 6.96	0.33 – 0.63	0.2 – 0.38	0.018 – 0.046	0.11 – 0.35	0.018 –0.043
Laterite alluvial	5.5 – 6.5	0.1 – 0.4	0.1 – 0.4	0.01 – 0.05	0.05 – 0.5	0.01 – 0.08
Buxa /Terai riverine	4.7 – 5.8	0.1 – 0.2	0.1 – 2.0	0.10 – 0.2	0.80 – 3.0	0.09 – 0.2

Field preparation

Now a days the general procedure of preparing soil for planting sugarcane in West Bengal is to ploughing the field numbers of time by tractors, so that bring it to a fine tilth. The ideal cane seed bed should have finely powdered surface drainage. Prevention of water logging by adequate drainage is one of the most important factors in successful cultivation of sugarcane. Planting may be done after soaking of rain also. The soils are drained below the depth of cultivation by open drains spaced at regular intervals. We are following the general practice of North India, where is to prepare the land to affine tilth and it necessary give a preliminary irrigation.

Sugarcane Planting Methods

Generally sugarcane is planted during January to March. Before planting the cane were cut down in 3 budded or 1 budded pice, and these pieces are sterilize by using different formulations of mercuric chloride, Bavistin and Streptomycin (Thorat et al., 2016). Initially buds were planted in plastic bags with soil and proper nutrients. After germination of young plant from the piece are transferred to the field. In West Bengal sugarcane seed germination rate is 25-30% (Verma, 2004). But, when the material is sufficient the canes were cut down in 3 budded pieces and sterilize as earlier. Then put it down parallel one after one in the ridges of field. One thing must be keep in mind that the germinating bud present on the node portion of the cut cane must be on the upper

surface of the soil, so that they easily germinate and grows. Different types of planting methods used in sugarcane cultivation but in our sate generally following methods are practiced.

Planting in flat beds

It is very popular method on Northern India and in some parts of Maharashtra and West Bengal (Singh, 2010). Shallow furrows 8-10 cm deep are made. Distance between two rows should be kept 75-90 cm. Generally 3 budded setts are used to plant in the end to end planting system (Singh, 2010). The furrow is covered by 5-7 cm of soil and field is leveled by planking (Singh, 2010). The furrows are deeper, about 10-20cm. in depth, while in the third furrows up to 45cm. in depth are made (Singh, 2010).

Ridge and Furrow Method

The method is generally adopted in areas with moderate rainfall but have drainage problem in some areas of district of Malda (Singh, 2010). Deep furrows are opened in 'v' shape 10-15 cm deep (Singh, 2010).

Distant Planting Method

This type of planting method was developed by Indian Institute of Sugarcane Research (IISR) Lucknow. In this method single sugarcane bud planted in nursery field and after 45-60 days these setts are transfer to the main cultivated field.

Ring-Pit Planting

This method is very popular in Tillah soil in Assam, West Bengal and also in Kerala hilly tracts (Singh, 2010).

Skip Furrow Planting

It is hybrid of flat and trench method. In this method trenches are dug 45 cm apart and a gap of 90 cm is left after each two rows of cane (Singh, 2010).

Nutrient Management with doses for sugarcane cultivation

Sugarcane being a giant crop producing huge quantity of biomass generally demands higher amounts of nutrient elements (Prabhakar et al., 2018). A large number of research experiments have clearly demonstrated that for producing higher cane and sugar yields on a sustainable basis application of adequate amounts of fertilizer nutrients viz., N, P and K is essential (Prabhakar et al., 2018). Fertilizer used in sugarcane cultivating field according to the specific requirements of crop and type of soil (Table 4).

Table 4: shows the quantities of macro and micronutrients contained in the entire plant cane.
Source, Malavota, 1994

Plant parts FW (mt ha ⁻¹)	Roots 1.5	Millable stalks 102	Leaves 27	Total 130.5
Kg/ha				
Nitrogen	8	83	77	168
Phosphorus	1	15	8	24
Potassium	4	109	105	218
Calcium	2	30	45	77
Magnesium	1	29	18	48
Sulphur	2	25	22	49
Chlorides	--	--	1	1
Silicon	--	98	150	248
Iron	4.93	3.80	7.90	16.60
Manganese	0.084	1.17	1.98	3.24
g/ha				
Boron	34	214	144	392
Copper	13	201	105	711
Molybdenum	--	4	10	14
Zinc	72	437	336	845

Time and method of application of macro-nutrients

The efficiency of placing fertilizer depends on several factors, such as process of contact between the element and the root, distribution of the root system; type of crop (cane-plant, ratoon) and spacing, type of fertilizer and rate of application. Barber (1966) and Barber & Olson (1968) have shown that root interception, mass flow and diffusion make the

following percent contributions to the total of the element which reaches the root surface: N-1, 99, 0; P-2, 4, 94; K- 2, 20, 78. Application of nitrogen and phosphorus fertilizer by placement in soil instead of by broadcasting resulted in a significant improvement in cane yield. Application of this fertilizer by placement in soil is effective than foliar spray in West Bengal. When and how much quantity and macro-nutrients are used for sugar cane cultivation is shown in table 5

Table 5: Fertigation Schedule for Preseasonal (14 to 16 months) Sugarcane (e-Extension Centre, 2020)

Days After Planting	Nutrients (kg/ha/day)		
	N	P ₂ O ₅	K ₂ O
1-30 Days	1.5	0.15	0.25
31-80 Days	2.0	0.60	0.30
81-110 Days	2.5	1.50	0.50
111-150 Days	0.75	0.50	1.00
151-190 Days	--	--	1.80

Quantity used for micro-nutrients

In the absence of any one of these essential elements a plant fails to complete its life cycle, the disorder caused can be corrected by the addition of

that element. These are Iron, Manganese, Boron, Zinc, Copper, Molybdenum and Chlorine is used by field crops in very small quantities (Table 6) and hence called as micronutrients.

Table 6: Range of micronutrient concentrations required for normal plant growth
(Source: Directorate of sugarcane development. 2013)

Trace elements	Critical Concentration in ppm (parts per million)
Fe (Iron, non-calcareous soil)	4.2
Fe (Iron, calcareous soil)	6.3
Mn (Manganese)	2.0

B (Boron)	0.1 to 1.0
Z (Zinc, Loamy soils)	1.2
Z (Zinc, Clay soils)	2.0
Cu (Copper)	1.2
Mo (Molybdenum)	0.01 to 0.05

Irrigation methods

Fresh cane contains more than 70% water and less than 30% dry matter (Singh et al., 2014). In West Bengal 75% of total area under the cane crop is under irrigation (Singh et al., 2018). Three main methods of irrigation methods present in India i.e., surface irrigation, sub-surface, and overhead or sprinkler. The first method i.e., surface irrigation method is very common in India as well as West Bengal. Some other types of irrigation method are applying in some places of Bengal these are Flood irrigation, large furrow system, wakhura system, contour furrows system, serpentine method, drip irrigation (Kanchannainwal, 2009).

Weeds in Cane Fields and its control

More than 200 weedy species, only *Cynodon dactylon* (Bermuda grass), *Panicum repens* (torpedo grass), *Imperata* sp. (lalan grass), *Ipomoea* sp. (cat morning glory), *Cyperus* sp. (purple nut grass) are perennial weeds propagated in sugarcane fields (Peng, 1984). Such species *astropic ageratum*, nut grass, barnyard grass, torpedo grass and sour grass adapt themselves to both lowland and upland fields (Peng, 1984). Use of herbicides, for pre-emergence control of weeds in cane fields, there should be other effective measures at our disposal for post-emergence situations (Peng, 1984).

Major diseases of sugarcane

Indian sugarcane are affected by more than 55 diseases due to fungi, bacteria, viruses, phytoplasma and nematodes (Yadav et al., 2019). *Alternaria* leaf spot, arrow rot, banded chlorosis, banded sclerotial disease, basal stem, root and sheath rot (*M. sacchari*, *Mycelia sterilia*), black leaf spot, black rot, brown spot, brown stripe, bulaklak (bunga), bunch top (witches' broom), cane-killing weed, collar rot, downy mildew (*Peronosclerospora sacchari*, *P. philippinensis*), dry rot, ergot, eye spot, false floral smut, *Fusarium* sett or stem rot, grassy shoot, gumming, *Helminthosporium* leaf spot, knife cut, leaf scald, leaf scorch, leaf-splitting disease, leaf spots, leafy tuft, limestone chlorosis, midrib blotch, mosaic, multiple buds, *Periconia* leaf spot, *Pestalotia* leaf spot, *Phyllosticta* leaf spot, pineapple disease, pokkah boeng, ratoon chlorosis, ratoon stunting, red rot, red rot of leaf sheath, red spot of leaf sheath, red stripe, rind disease, ring mosaic, ring spot, root rot (*Pythium*, *Rhizoctonia*), rust (*P. kuehni*, *P. melanocephala*), *Schizophyllum* rot, seedling blight, sheath rot, smut, sooty mould, spike, stem galls, stinking rot, streak, striate mosaic, tangle top, target blotch, wilt, yellow spot (Ricaud et al., 1989). In our state Red rot of stem, arrow rot, Smut, Red stripe diseases are common in sugarcane.

Harvesting

In our state as well as our country Sugarcane is ready for harvest in about 11-12 months after planting depending on the variety and the season (Manjunath et al., 2011). The mature cane

shows yellowish with prominent eye buds (Manjunath et al., 2011). The mature cane sound metallic when tapped with fingers. Crop matures or not it can be determined by the using of hand refractometer if refractometer data shows above 19 that mean the crop is ready to harvest. The cane should be cut as close to the ground level as possible with the help of a sharp knife without damaging the eye bud below the soil (Manjunath et al., 2011). If the cane is harvested above the ground, the yield is reduced, sugar is lost in the lower portion, as the lower portion contains more sugars and there is lodging as well as poor tillering in the ratoon (Manjunath et al., 2011).

Aim of the Study

It includes information regarding the commercial varieties of sugarcane cultivated in West Bengal. Also includes the information about sugarcane origin centre, domestication in our country, cultivation practice, biotic and abiotic factors required for the cultivation of sugarcane in West Bengal.

Conclusion

India is the second largest producer of sugarcane next to Brazil (The economic Times, 2018; Smarter global sourcing - Tridge, 2019). India fulfills 18.4% of worlds table sugar (Smarter global sourcing - Tridge, 2019). West Bengal contributes 0.674% of total Indian sugarcane production (Shukla et al., 2017). Sugarcane cultivation in West Bengal as well as in India is a profitable cultivation but sugarcane farmers' chose to suicide across the India. We do not see the opposite picture in our state also. Though there are many reasons behind it. Sugarcane scientists developed many sugarcane varieties for a particular region for India. In future sugarcane scientists have to produce more specific and resistant (soil, pH, environment, temperature etc.) sugarcane variety so that a particular variety gives its optimum output to a particular region or geographical area. On the other hand providing motivation and scientific knowledge to the farmers is also crucial to enhance cultivation specially sugarcane crop. It is also keep in mind to the farmers that they are not solely depended on sugarcane farming as his only source of income; rather earned some income from other sources annually.

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