

サトウキビ栽培におけるバングラデシュおよび

南西諸島の比較

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要旨

バングラデシュではサトウキビはその経済に重要な役割を果たしている。日本では、経済全体で考えるとそれほどではないが、しかし、南西諸島地域では、基幹作物として重要な位置を占めている。両国とも、サトウキビという点では同じ作物であるが、栽培の方法やそれに関連したものなどで、同様な、また、異なるそれぞれの問題が認められる。すなわち、両国ともサトウキビの生産量は減少しているが、日本では生産者の高齢化が主要な原因の一つであり、バングラデシュでは、稲や野菜の面積が増加していることがその原因の一つとなっている。自然的条件に起因する問題では、日本では、夏期の台風や干害、激しい降雨、やせた土壌などであるのに対し、バングラデシュでは、夏期における大量のモンスーンの降雨、冬期の干ばつ、やせた土壌などが問題となっている。

Similarities and Dissimilarities in Sugarcane Cultivation between Bangladesh and Japan

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Abstract

Sugarcane plays a very important role in the economy of Bangladesh, though a little that of the total economy of Japan. The crop is, however, the main industry for the farmers of the Southwestern most islands of Japan. There are some similarities but many dissimilarities in sugarcane cultivation practices and the

associated problems between the two countries. Sugarcane cultivation is declining in both the countries. The reasons for the decline is, however, different. In Japan, aging of farmers and shortage of labour force are the main reasons for the decline. Whereas, expansion of rice and vegetables cultivation, in the sugarcane areas, is in the behind of shrinking of cultivation in Bangladesh. Strong typhoon, drought, torrential rains and low fertility of the soils are the natural barriers for good harvest of sugarcane in Japan, while the associated problems in Bangladesh are too much monsoon rains during summer, long drought during winter and low fertility as well.

Introduction

Bangladesh is situated between latitudes 20.34`-26.39` north and longitudes 88.0`-92.41` east. Sugarcane cultivation is mainly limited to between 23.5`-26.39` latitudes. In Japan, the cultivation is limited to Southwestern islands, which are located within 24`-31` north latitudes and 123`-131` east longitudes. The region is considered as the northern most limit for sugarcane growing environment. The temperatures and precipitation differs greatly among the islands of Japan (Fig. 1 and 2). The climate of each island is unique. The climate of Ishigaki island and its surrounding is sub-tropical, while that of Tanegashima is temperate. Bangladesh belongs to subtropical climate and the environment of the whole country is suitable for successful sugarcane cultivation. However, the economic cultivation is limited to only upper half of the country as already mentioned. The farmers of the lower half traditionally prefer to grow other short duration crops. The soils of that part are relatively acidic, which lower sugarcane production seriously

While sugarcane is the second most important cash crop of the farmers, after jute, in Bangladesh, it contributes a little to the total economy of Japan. It is, however, the most important agricultural industry in the Southwestern islands of Kagoshima and Okinawa prefectures of the country. The total area of sugarcane is about 21 thousand hectares (ha) in Japan, while that about 160 thousand ha in Bangladesh. The trend in sugarcane cultivation in both the countries is declining. However, the reasons for the lowering of cultivation are different in the two countries. In Bangladesh, the land for sugarcane cultivation is occupying by rice and vegetables. The farmers prefer to grow those short duration crops, as they can be grown for more than two times in a year and have ready market. Contrary, aging of farmers and shortage of labours are the main reasons for the decline in Japan. Moreover, several strong typhoons in each year hit the Southwestern islands in

summer and autumn and cause severe damage to sugarcane. In Bangladesh the sugarcane areas are affected by drought in winter, while flood in many areas during summer.

Japanese farmers have adopted highly mechanized farming, while Bangladeshi farmers are maintaining the traditional practices. Yet, there are similarities in some of the practices use in sugarcane cultivation between the two countries. In this report, we tried to point out the similarities and dissimilarities in sugarcane cultivation practices and the associated problems between Japan and Bangladesh. Since the climatic conditions in Japanese Southwestern islands vary greatly, the practices of Ishigaki and Tanegashima islands were considered to represent Japanese sugarcane cultivation.

Comparative general cultivation practices

Land preparation for planting

In Bangladesh, high and medium high land are generally used for sugarcane. Now a days, these types of land are increasingly using for the cultivation of vegetables and other short duration crops. Therefore, sugarcane cultivation is pushing to medium to semi-medium high lands. Two varieties, ISD 20 and ISD 34, developed by Bangladesh Sugarcane Research Institute, are suitable for cultivation in the medium to low land. In Japan, relatively high arable land is mostly used for sugarcane cultivation.

Ploughing and harrowing are done by tractor in Japan. When the soil is hard to plough with tractor, excavator or subsoiler are used for deep cultivation. Trenches for planting are made with either a wheel tractor or hand tractor or power tiller. Contrary, in Bangladesh, the land preparation is made by ploughing, cross ploughing, harrowing and levelling with country plough and ladder. Bullocks or buffalos are the main source of draft power. Deep planting of sugarcane sets is desirable, though depth of ploughing is very shallow with country plough. A very few growers use tractor or power tiller for land preparation. Hand trenching with spade or, in a few cases, tractor trenching is made for planting sugarcane. In the case of acidic soils in Japan, the pH is adjusted to 6.5-7.0 by using calcium carbonate or calcium silicate before planting. In Bangladesh, there is a little problem with acidity in the sugarcane growing areas and thus, no chemical treatments are practised.

Sugarcane varieties

More than a dozens of sugarcane high yielding varieties are growing in Bangladesh. These are mainly ISD-2/54, ISD-15, ISD-16, ISD-20, ISD-21, ISD-22, ISD-24, ISD-26, ISD-28, ISD-29, ISD-30, ISD-31, ISD-32, ISD-33, ISD-34, ISD-35, ISD-36, L-Java-C and some other local varieties. There is no clear statistics on the area coverage by each variety. The main breeding focus in Bangladesh is to develop high yielding and disease resistant variety. In Japan, NiF8 is the main variety and covers 99% and 98% areas in Ishigaki and Tanegashima, respectively. NiF12 and others are also growing in a limited scale in Tanegashima. As the temperature in Tanegashima is rather low for sugarcane, the focus on the development of a variety is paid on cold tolerance, side by side developing high yielding varieties. Newly developed variety NiTn 18 is relatively cold tolerant compared to NiF8. The variety is on the way to its expansion in Tanegashima.

Planting time

Generally planting is done during August to 15 December in Bangladesh. Early planting is encouraged by the agricultural extension department. The temperature goes down from December (Fig. 1), and low temperature seriously affects the germination. In Japan, planting is done two times, during February-March and September-October, in Ishigaki, and only one time, February-March, in Tanegashima.

Since the temperature in Tanegashima is rather low during planting, mulching for 2-3 months is necessary for the protection of sugarcane seeds (sets) against cold damage. However, the mulches are not necessary for Bangladesh and Ishigaki island.

Planting of sugarcane sets

The whole stem of sugarcane is cut into pieces and each piece must have eyes. In Bangladesh, the stem is cut into pieces (sugarcane set) having single eye (bud), two or sometimes three eye buds. Generally single eye bud is used in ploy bag as seedcane, and later on the seedling is transplanted into trench. This system guarantees maintaining of 100 % plant establishment. Cane piece with two or three eyes are directly planted into trenches. In Japan, each set has two buds. The trench is made with a tractor and the sets are planted either by hand or with the tractor. Sets

are treated with chemicals, either fungicides or insecticides, to protect from the attack of insects and diseases. In Ishigaki, the distance maintains between line to line is 1.2-1.4 m, while that in Tanegashima is 1.0-1.2 m. Distance between plant to plant is about 30 cm in both the places. In Bangladesh, the recommended distance between line to line is 1.0 m and that for plant to plant is 45 cm. In Japan, the whole cane stalk planter is getting popularity for its precise planting and labour saving capacity. Another mechanical method for planting, in Japan, is the use of a harvester, which is now known as harvester seed planting. However, the method requires relatively more seed canes than the former one. Contrary, in Bangladesh the cane is planted absolutely by hand.

Manures and chemical fertilizers

Compost is applying in both Bangladesh and Japan. At harvest Japanese farmers take only the stalk (stem), leaving the leaves and trashes in the field. That trashes turn into compost. Contrary, Bangladeshi farmers use the trashes as fuel, leaving a little biomass in the field. Fertilizers are used in 2-3 splits in both the countries. The amount of compost applies in Japan is about 45 t/ ha during summer and that about 30 t/ha during spring planting. Farmers in Bangladesh use only about 10 t/ ha compost. In Bangladesh, the compost is made of mainly cowdung, while in Japan that is of both cowdung and plant materials as well. The chemical fertilizer of Japan is of complex in nature, which contains NPK together. While, in Bangladesh the NPK are used mostly in the form of urea, triple super phosphate (TSP) and muriate of potash, respectively.

Intercropping

Since sugarcane is a long duration crop, intercropping can profitably be grown without affecting sugarcane productivity. As the companion crops are grown at the early stage, in the big gap between two lines, they hardly compete with the main crop sugarcane. Crops like mustard, pulses (grain legumes), potatoes, different vegetables and spices are grown as intercrops in Bangladesh. Those crops grow for 3-4 months and then harvested, leaving sugarcane alone in the field. Contrary, no intercropping is practicing by Japanese farmers, and the reasons behind it is the shortage of labour and difficulty in management with machineries.

Intercultural operations

Weeds are the problem in sugarcane cultivation in both the countries. They are very competitive for nutrients with sugarcane plant, especially at the seedling stage. They must be controlled at least for few months after planting. In Bangladesh, farmers control weeds manually and no herbicide is used. Contrary, Japanese farmers use different herbicides for weed control.

Tillage is done at least twice in both Bangladesh and Japan. The first tillage is done when the stalk length is about 30-40 cm to loosen the soil and also making the field evenly flat. The second one is done when the stalk is about 60-70 cm to make ridge. In Japan the first and second tillage are made during March-April and May-June for spring planting and ratoon, respectively, while that are during October-December and February-April for summer planting, respectively.

Irrigation and drainage

The total annual rainfall in Bangladesh, Tanegashima and Ishigaki are about 2400 mm, 2300 mm and 2050 mm, respectively (Fig. 2). The rainfall should be enough for growing sugarcane. However, the rainfall is not uniform throughout the year and rather erratic. Rainfall in Ishigaki island is comparatively uniform than Tanegashima. In Bangladesh there is almost no rain during December and January.

In Japan, the irrigation is applied during the germination and rapid growth period of sugarcane. The irrigation system is highly mechanized, such as sprinkler and drip system. These systems evenly supply the water to the field and conserve the water as well. In Bangladesh, the irrigation is necessary during December through April, when the rainfall is minimal or nil. Flood irrigation is applied using deep tube well, shallow tube well and low lift pump. In Japan, irrigation is also applied in between a long gap of two rains during summer. While irrigation is not applied at all during summer in Bangladesh.

Sugarcane is grown mainly on high arable land in Japan, where it is rather easy to drain out the excess water from rain. Contrary, during rainy season in Bangladesh, particularly June to September, the rainfall is too high. During that time most of the cane growing fields remains water saturated. In some areas, the whole sugarcane fields go under water for several days, and in some cases for a month even. The crop is very strong against flooding, especially when there is current in the water.

However, water stagnated condition is harmful for sugarcane production. In summer it is hard to drain out the water from the field in Bangladesh.

Insects and diseases

Wireworms, white grubs, pink borer, sugarcane shoot borer and oriental chinch bug are very common insects and create heavy damage of sugarcane in Japan. While in Bangladesh, borer is identified as the most damaging insect of sugarcane. Alongside with chemical control, light trap, pheromone dispenser (Japan only), ploughing out of affected fields, etc. are the common measures taken by the farmers to control the insects.

In Japan, 2 virus, 4 bacterial, 21 fungal and 3 nematode diseases of sugarcane are identified. Out of those, smut, rust, leaf scorch, leaf blight, brown spot, red rot, ring spot and leaf sheath rot are the major diseases. While in Bangladesh, red rot, wilt and leaf blight are the major diseases. Generally, the infected plants are removed from the field and burned or buried into soil.

Ratoon

Usually 2-3 ratoons are profitably grown in both Bangladesh and Japan. For a good ratoon crop, the fertilizers are applied soon after the harvest. Ratooning management machine is used in Japan for both stubble breaking and fertilization. Ratooning management controls sprouting. Sprouts that developed from the deeper soils become bigger canes than that develop from upper zone. In Japan, the soil becomes compact due to use of machinery or rains. Subsoiler is used in that case to improve the soils. In Bangladesh soil mulching, with country plough, is done to loosen the soils.

Harvesting and yield

Sugarcane is harvested during December to March in Tanegashima, while that during October to January in Ishigaki island. In Bangladesh, the harvesting and milling continues from October to March. In Japan, sugarcane is harvested both mechanically and manually. Green-cropped type harvester is used for mechanical harvesting. In Bangladesh, however, the cane is harvested manually only with sickle. In Japan, all the harvested canes are transported to sugar mills by truck. The canes

are used for making raw sugar, brown sugar and refined sugar in the mills. In Bangladesh, only farmers in the mill zone areas supply the sugarcane to the mills and the canes are carried by bullock or buffalo run cart. In the non-mill zone areas the farmers make raw sugar ('gur') with their canes using traditional method. There is no raw sugar or brown sugar making mills in Bangladesh.

The average cane yield is 70 t/ ha in Tanegashima. In Ishigaki that is also 70 t/ ha from spring planting, but about 60 t/ ha from autumn planting. The average yield is however, about 55 t/ha in Bangladesh. The reasons for low yield is poor management practices compared to Japan and water stagnation during summer. There is also a big yield gap between farmers average field and that obtained from the field managed by farmers but with the advice of extension officials (demonstration field). Therefore, there is a scope to improve yield in Bangladesh by strengthening linkage between farmers and the agricultural extension personnel.

Problems associated with sugarcane cultivation in Bangladesh and Japa

Sugarcane region of Japan is located to the northernmost limit of sugarcane growing environment. The environmental conditions of the Southwestern islands are very harsh. Typhoons, droughts, torrential rains, low temperature during the winter, frost (Tanegashima only) and low fertility of the soils are the natural problems on sugarcane cultivation. Another severe problem is the aging of sugarcane farmers and shortage of labours for agricultural job. In Bangladesh, the sugarcane land is increasingly occupying by rice or vegetables, thus, sugarcane area is declining. Farmers prefer to grow those crops, because both the crops require less investment for cultivation compared to sugarcane and are of short duration. Sugarcane occupies the land for the whole year and farmers have to wait for more than a year for the return. Moreover, the farmers are poor and are unable, in many cases, to afford for the high cost incurred for sugarcane cultivation. Water stagnation or flooding during summer, drought during winter and spring, low fertility of the soils and absence of fair price of the canes are the barrier for potential sugarcane production in Bangladesh.

Conclusion

Sugarcane is the second most important cash crop of the farmers in Bangladesh, while it has a very little share in the Japanese total economy. However,

sugarcane is the most important crop of the farmers in the Southwestern islands of Okinawa and Kagoshima prefectures of the country. The climate of Bangladesh is very suitable for sugarcane, while the sugarcane regions of Japan is located in the northern most limit of sugarcane cultivation environment. Sugarcane is, however, not growing commercially in the South and Southeastern Bangladesh, mainly for the farmers tradition to grow other crops including rice and vegetables, and for relatively acidic nature of soils of those area. The sugarcane cultivation, from planting to harvesting, is highly mechanized in Japan, while remains traditional in Bangladesh. However, some cultural practices are similar between the two countries, e.g. planting in trench, fertilizer management, ratoon management, ridge making, loosening the soils, manual harvesting, etc. However, there are many dissimilarity in sugarcane cultivation practices between Japan and Bangladesh, e.g. time of planting, mulching (Tanegashima), types of fertilizers apply, using of trash, weed control, etc. In Bangladesh, intercropping of different short duration crops with sugarcane is profitably practiced, while that is not existing in Japan. Some insects and diseases are common, while many are different. Very strong typhoon, drought in between two rains at any season and low temperatures are the problems for obtaining good yield in Japan. Contrary, in Bangladesh, too much monsoon rains in summer and drought during winter are the main environmental problem for sugarcane cultivation. Sugarcane cultivation is declining in both the countries. In Japan, the decline is related to aging of farmers and shortage of labour force, while in Bangladesh, that is due to the expansion of rice and vegetable cultivation in the sugarcane areas. All the canes in Japan are sent to the factories for making either raw sugar, brown sugar or refined sugar. In Bangladesh, the canes are sent to factory for making only refined sugar, and there is no factory for raw and brown sugar. Raw sugar is produced by the farmers using their traditional method.