11. MANGO PRODUCTION AND EMPLOYMENT OF PEOPLE IN THIS TRADE

11.1. Introduction

Mango is one of the most popular crops in the tropics, adapted to a wide range of soil and relatively easy to cultivate. It is universally considered as one of finest fruit in the world, and is called the "King of Fruits" in the orient and the "national fruit of India". If there was a competition to decide the best fruit in the world for taste and aroma, the Indian mango would certainly be one of the front-runners. In a year, India harvests more than 12 million tones of mangoes. Mango is not only delicious but also full of nutritional value. It is high in beta-carotene, a precursor of vitamin A and is a rich source of vitamin B complex. Physico-chemical characteristics of mango was studied by Ghosh, Dhua and Mitra (1985); Kundu and Ghosh (1992). Mangoes are mainly consumed fresh. One hundred grams of raw mango (edible portion) contains 81.7 gm water, 0.7 gm protein, 0.4 gm fat, 16 gm carbohydrates, and food energy of 66 calories. Mangoes are also relatively rich in other elements such as calcium, phosphorous, iron, potassium and magnesium. Mango is not just India's most important fruit, India is also the World's largest producer of this famous fruit accounting for approximately 52% of the total World production. The World production of mango is estimated to be around 23,851,997 MT and India produces 12,000,000 MT. Mango, *Mangifera indica* is endemic to South-East Asia. It is not exactly known when mango cultivation started in West Bengal but evidences indicates that the Landlords and Nawabs established mango orchards, introducing quality varieties from different places. Thus at present more than 200 varieties are found in the state. In Malda mango orchards occupy about 245.6 sq. km. which is 6.58% of the total land area (3733 sq. km.) of the district. Production varies from about 0.7 million MT in the off season to around 3.0 million MT in the on season. Mango is the chief cash crop of the district. Over 33% people are directly associated economically to this crop. The present chapter deals with the study of nature of mango production, variety of the fruits, involvement of people in this trade, medicinal use of this

fruit-plant, nature of mango orchard, problems and remedial measures for its production including management of insect and monkey pests.

11.2. Methods

Data on specific parameters recorded by various organizations in Food Processing Industries and Horticulture, Malda Mango Merchant Association, Meteorological Department, Govt. of India, Soil Department, Govt. of West Bengal have been considered. Records on block wise area under mango cultivation, yearly production etc. were collected from mango-planters guild, data on areas infested by monkeys were collected by systematic survey, from the mango-planters guild and responsible reports from the local people. Orchards, mango-processing industries, research centre, multi-purpose cold storages were visited regularly for gathering up to date information various aspects. Wooden packing box, bamboo basket manufacturing centers of district were visited in the mango season, rural medicine men and patients were interviewed from time to time, national and state level mango festival in the district were visited for acquiring various types of data.

11.3. Results and Analysis

11.3.1. Climate and Soil factors in Mango Cultivation

Mango is well adapted to tropical and subtropical climates. It thrives well in almost all the regions of the country from sea level to an altitude of 1500 metres. However, it cannot be grown commercially in areas above 600 metres. Temperature, rainfall, wind velocity and altitude are the main climatic factors which influence its growth and fruiting. It cannot stand severe frost, especially when the tree is young. High temperature by itself is not so injurious to mango, but in combination with low humidity and high wind velocity the trees affected adversely.

In India most of the mango varieties thrive in places with good rain fall (75 to 375 cm per annum) and dry season. Distribution of rainfall is more important than its amount. Dry weather before blossoming is conducive to profuse flowering. Rain during flowering is detrimental to the crop as it interferes with pollination. However, rain during fruit development is good but heavy rains cause damage to ripening fruits. Strong winds and cyclones during the fruiting season can play havoc as they cause execessive fruit drop.

Mango grows well on wide variety of soils, such as lateritic, alluvial, sandy loam and sandy. Although it grows very well in high to medium fertility soils, its cultivation can be made successful even on low fertility soils by appropriate management especially during early stages of growth. Very poor and stony soils on hill slopes should, however, be avoided. The loamy, alluvial, well drained, aerated and deep soils rich in organic matter with a pH range of 5.5 to 7.5 are most favourable for mango cultivation. Extremely sandy, shallow, rocky, waterlogged, heavy textured and alkaline or calcareous soils are not suitable for mango cultivation.

Most of the favourable parameters are available in the district for the cultivation of mango. Average rainfall is about 140.0 cm, the mean maximum and minimum temperature is 36^0C and 16^0C and relative humidity varies from maximum 85% to minimum 57%. Sometimes strong winds along with heavy rainfall locally known as "Kalbaisakhi" occur in the mango season.

Agro-climatically Malda district falls under lower gangetic plain region (Zone-III) and sub-zone old alluvium and new alluvium. Organic matter is medium (ranging from 0.5 to 0.75),soil is acedic in nature with pH varying from 5 to 7. Thus climate as well as nature of soil promote mango cultivation in this district significally.

11.3.2. Cultivated land and nature of production

The mango cultivation land in Malda district is 37.55% and amount of production is 43.39% in the context of West Bengal and 1.61% cultivation land and amount of production is 2.48% of India. Almost every year the area of cultivation land increases (Plate.11.1). Table.11.1. shows areas under mango production and percent increase in area over the previous year in the district for a period of 10 years from 1993 to 2003, with an overall increase of about 2700 hectares. Percent year to year increase in area of cultivation varied from 0.04% to 4.69% but the rate was higher than 1% only in 3 years i.e. 1998-99, 1999-2000 and 2002-2003. Table.11.2 and Figure.3.7. shows block-wise total and percent area under mango cultivation in the year 2002-2003. Of the 15 blocks in the district mango cultivation is highest in English Bajar followed by Manikchak, Ratua-I and Ratua-II. Mangoes, however, are cultivated in all the blocks. Recently growers are interested to grow mango in the crop field as well. It is to be noted that paddy cultivation field is first choice of the farmers (Plate.11.2.).

11.3.3. Variety of Mangoes

As many as 41 species of mango are known to exist all over the world. Of these *Mangifera indica* which is endemic to India have about 1110 varieties and over 1000 to those varieties occur in India. Of the numerous varieties (Plate.11.3.) cultivated in India, twenty varieties are now accepted as commercially well established (Source : NHB Statistics, 1998). West Bengal is unique in having more than 200 varieties (Mukherjee, 1984; Maiti, Sen and Bose, 1979). In Malda district the varieties like Fazli, Langra, Himsagar, Laxmanbhog, Gopalbhog, Bambai, Kisenbhog, Zardalu, Ashwina etc. are commercially cultivated in Malda. Recently, Amrapali and Mallika varieties are cultivated in the district in massive way for their sweet flavour, aroma and taste. The Fazli variety is popular in the district and more than 38% mango cultivation land is occupied by the variety (Table.11.3.) followed by Ashwina (13.2%), Laxmanbhog (12.1%), Langra (11.8%).

11.3.4. Nature and number of mango orchard

Basing on size there are four types of mango orchard in the study site such as small (Plae.11.4.), moderate (Plate.11.5.), large and very large. The small orchard are within 2.0 hectares, moderate from 2.0 to 4.0 hectares, large from 4.0 to 6.0 hectares and very large covered above 6.0 hectares of land (Table.11.4).

It is to be noted that 14280.6 hectares of mango cultivation land is under the small orchard category followed by moderate (6560.6 hectares), very large (2175.3 hectares) and large (1543.6 hectares). Number of orchard in the small category is 1,12,350 which is 94.6% of the total orchard of the district followed by 5070 i.e. 4.3% in the moderate type. Only 840 orchards (0.7%) are in the very large and 450 (0.4%) in the large orchard category.

11.3.5. Involvement of people in mango trade

11.3.5.1. Selling and buying process of orchards

The process of selling and buying of mango orchards starts at the early mango season i.e. in the month of January-February when the new leaves appear on every branch of trees and the process continues up to the ripening of the fruits. About 1,82,000 people are involved in this process in the mango season in all the years which is 16.64% of the total people engaged in this trade (Table.11.6.).

11.3.5.2. Security men in the orchards

As mango is the most important cash crop of the district protection of the precious fruit is essential and many people are employed in the mango season to take care of the intruders i.e. thieves, monkeys and other pests. About 291000 people are engaged in this job in the mango season. As the number of small orchards is highest requirement for security men (Plate.11.7.) is also largest (254580) i.e. more than 87% (Table.11.5.). It is to be noted that the population of monkey is higher in blocks with massive mango cultivation. So, it is common to find security men at work at armed with fire crackers, bamboo-stumps, bows and

arrows etc. in chasing away invading monkeys in the orchards during the mango season. Table.11.6. shows that over 26% people are engaged in this job during the mango season. Generally a number of temporary tents (Plate.11.7.) are erected within the orchards for the security men. In case of large or very large orchard the number of such tents may be even five in each (Plate.11.8.). In general four security men share a tent, two of them work in the day i.e. from 06.00 to 18.00 hours and the remaining two work from 18.00 to 06.00 hours. Usually female villagers (Plate.11.9.) serve as security men during the day session.

11.3.5.3. Plucking of Fruits

More than 17% people associated in this trade are engaged in this job (Table.11.6.). The process of plucking starts after the ripening of fruits (Plate.11.10.). During plucking the pluckers use a long bamboo pole fitted with a basket made of nylon nets on its tip and collects the fruits from the tall branches of tree within the net basket (Plate.11.11.). Finally plucked fruits are gathered beneath a tree (Plate.11.12.) in the orchard.

11.3.5.4. Packing and Transport

In this sector over 9% people are involved. Plucked fruits are packed in bamboo baskets (Plate.11.13.) or wooden packing boxes (Plate.11.14.). Packed fruits are then sent to the mango storage centre in bullock-carts or cycle vans (Plate.11.15.).

11.3.5.5. Mango storage centres

The number of mango storage centers (Plate.11.6.) in the district is nearly 1255. More than 8000 peoples are involved in these centres. All these are temporary centres. Collected packed fruits were sent to their final destination by diesel trucks (Plate.11.16.) in all parts of the state as well as other states in the country from these storage centres. Fruits were also sent by bullock-carts or cycle vans to nearly local towns and markets. Passam (1982), Hasabins and D'souza

(1987), Fornaris and Guadalupe (1989), Balasubramanium (1991), Chadha (1993) reported the utility of cold-storage and air conditioned packing houses.

In absence of such facilities in the district the farmers are compelled to incur the losses as the fruit is perishable in nature and cannot kept in good condition for a long time in ambient condition. The loss is substantial during excessive production periods specially in the on-years. Recently Food Processing Industries, Govt. of West Bengal took some steps towards proper storage of fruits in cold preservation system so that the financial loss of the farmers and businessmen can be abated.

11.3.5.6. Basket making

Manufacture of bamboo baskets and wooden packing boxes is a regular phenomenon in the district. Thirteen leading shaw-mills at English Bajar, Ratua-I, Old Malda, Kaliachak-I and Kaliachak-II blocks supply a major portion of wooden packing boxes. Besides this baskets of bamboo also play a major role for packing of fruits in this district. Making of bamboo baskets is an important cottage industry in many villages in the district in the mango season. Villagers from children to adult (Plate.11.17.) all are involved in this work. Sometimes villagers engage themselves in this job even in the mango orchards (Plate.11.18.). Basket makers constitute 1.55% while the wooden packing box makers make 0.1% of the total people in the trade.

11.3.5.7. Mango product industries

There are 13 registered small food processing industries in the district which process mainly mango. Among them Gita Fruit Products (Plate.11.20.) Malcos (Plate.11.19.), Shiva Mango Processing are important for varieties and qualities their products such as jam, jelly, pickles (Plate.11.22.) soft drinks etc. Both males and females (Plate.11.23) work in these factories. Besides there are about 80-90 unregistered cottage industries in the English Bajar, Old Malda and Ratua-I blocks which employ workers during mango season. Large mango product industries

employ more than 1000 people for mango processing jobs while the small cottage industries involved nearly 400 people. Government of West Bengal have taken active initiative for promoting the cottage industries through fruit processing and in this context Department of Agricultural Marketing trained (Plate.11.21.) over 8000 people who benefited much through this training over the last 10 years.

11.3.5.8. Research Activities and grafting

Horticulture research development farm Government of West Bengal has several research projects (Plate.11.27.) for promoting cultivation of mango in the district. Propagation of mango cultivation (Chakrabarti and Sadhu, 1983, 1984) is gaining momentum through grafting instead of normal seed germination. Grafting also ensures quality of fruits (Bhan, Samaddar and Jadav, 1969; Majumdar and Rathore, 1970; Tiwari and Rajput, 1972; Hoque and Hussain, 1974; Maiti and Biswas, 1980; Singh and Srivastava, 1981) generation after generations. There are 6 moderate size horticultural nurseries and nearly 70 small nurseries in the district (Plate.11.25.). Over 15,000 mango grafts (Plate.11.26.) are raised annually from this nurseries. Research and Development farms also produce mango grafts. More than 200 people are involved in research and grafting activities.

11.3.6. Events promoting mango cultivation and production

The gross annual turn over in mango trade is more than 70 crores per annum. Thus, the socio-economic condition of the district is largely dependent on this crop. For this reason a number of promotional activities are organized in the district with the help of Government (Plate.11.28.) such as national level show in 1995 and 2003 (Plate.11.30.) while the state level festivals in the year 2000, 2002 (Plate.11.29.) and 2005. A large number of mango varieties and different kind of mango products are exhibited and awarded in this shows and festivals. The Postal Department, Government of India started a special programme to facilitate parcel of mangoes to any destination in the state (Plate.11.24.). Recently Government of West Bengal undertook programmes for export of mangoes to foreign countries.

11.3.7. Mango as medicine

In India mangoes are in use for several kinds of ailments for a long time. It strengthens and invigorates nerve tissues, muscles, heart and other parts of the body. It cleans the body of the filth within and is an ideal antidote for all toxic effects inside the body (Hashmi, Herbs and Spices – Curative properties of mangoes; E-mail hashmi.com). Almost all the parts of mango tree : root, stem, bark, the blossoms, raw and ripe mango, seeds have curative and medicinal properties.

Recently various active components have been isolated such as retinyl palmitate, saponins, mango agglutinin, mangiferin etc. (Patel et al. 1988, Carlier et al. 1992, Khan et al. 1993, Zhu et al. 1993 and Wauters et al. 1995) from mango plant (*Mangifera indica*).

Many tribes as well as poor villagers of different parts of the world uses different plant parts (Bhargava, 1983; Mitra and Jain, 1991; Pal and Seal, 2002 and Schultes, 1992) for various health problems. In Malda district the socio-economic condition is weak due to lack of major industry and low educational level. Health services available to the people is far from adequate but even the meager health services available in the rural areas is not utilized properly by the people because of their uncertain financial and mental attitude. Most of them, however, readily visit the village medicine-man for their health problems. The rural medicine-men use locally available medicinal and other plants depending on the traditional knowledge on their application. The treatment of number of diseases such as dysentery, blood dysentery, diabetes insipidus, diabetes mellitus, gastric ulcer, burn injury, cold and fever, carbuncle, hair fall, dandruff etc. are treated by the medicine men. It is to be noted that in all medicine preparations contain certain mango tree parts i.e. raw mango, leaves, stems, inflorescence, barks, seeds etc. Sometimes in combination with other herbals.

11.3.8. Problems and remedies associated with mango cultivation and trade

11.3.8.1. Major problems faced by mango growers

The problems faced by the mango growers are :

1. Irregular bearing habits of mango.
2. Most of the big orchards of mango in the district are above 60 years or older.
3. The production of those orchards are very low.
4. Most of the owners sell their gardens on lease/contract basis before or during appearance of fruits.
5. Non-availability of good quality, high-yielding grafts/materials.
6. Absence of proper developmental management of orchards due to practice of lease system.
7. Indiscriminate use of pesticides.
8. Mango cultivation in low-lying areas.
9. Location of brick-fields near the orchards.
10. Lack of infra-structural facilities.
11. Lack of varieties suitable for processing and export purposes.

11.3.8.2. Remedial Measures

1. Plantation of high-yielding, improved varieties on a regular basis.
2. Grafts should be raised from selected high-yielding mother plants through clone selection.
3. Poor yielder (below 40 years of age) should be changed by top working.
4. Regular application of nutrients as per recommended dose.
5. Regular surveillance for control of pests and diseases.

6. Plantation of high-yielding improved varieties in suitable areas.
7. Large-scale distribution of planting materials of improved varieties.
8. Replacement of old and unproductive trees by high yielding improved varieties.
9. Development of infrastructure facilities including construction of cold storage, pack-house, processing centre etc.
10. Modernization of markets and marketing system.
11. Improvement of drainage system.
12. Setting up of research stations for development of mango varieties and cultural techniques.
13. Regular awareness programmes to motivate mango growers.
14. Establishment of surveillance units to encourage the growers for using pesticides in need-base manner.

11.3.8.3. Problems of insects and monkeys

Management of insects and other pests (Prasad and Fortune, 1989; Cunningham, 1991; Pena, Mohyuddin and Wysoki, 1996, 1998) is very important for mango cultivation. Mango hopper (*Idiocerus atminsoni*), Mealy bug (*Drosicha mangiferae*), Fruit fly (*Daccus dorsalis*), Shoot borer (*Chlumetia transversa*) and Bacteria (*Xanthomonas campestris*) are the most common pests that are responsible for remarkable damage to this crop. Proper management and use of pesticides in a scientific manner may help in preventing damages to this cash crop. Besides these mango-raiding by the monkeys, a common phenomenon in blocks with massive production of this crop is to be tackled seriously. Monkey (*Macaca mulatta*) prefer mango leaves, twigs and fruits and invade mango orchards in the mango season. Security men armed with crackers, bow-arrows, bamboo stumps need to be employed for protection of the orchards in the mango season. The present study indicates that the quantum of damage is not insignificant as they start damaging the crop from the inflorescence stage and continue up to the

ripening of the fruits. It is to be noted that population of monkeys is increasing gradually every year in the blocks with extensive mango cultivation areas. This is also a great problem for the mango growers of the district.

Table.11.1. Year-wise (1993-94 to 2002-03) area under mango cultivation in Malda.

Year	Area (in hectares)	% increase from previous year
1993-94	21910	0.04
1994-95	22000	0.41
1995-96	22200	0.90
1996-97	22400	0.90
1997-98	22420	0.09
1998-99	23000	2.59
1999-2000	24080	4.69
2000-01	24120	0.16
2001-02	24259	0.57
2002-03	24560	1.24

Table.11.2. Block-wise area under mango cultivation in Malda district for the year 2002-03

Name of the Block	Area (in hectare)	Percent area under cultivation
Bamongola	20	0.08
Habibpur	60	0.24
Chanchal-II	200	0.81
Kaliachak-III	220	0.89
Harishchandrapur-I	400	1.63
Gajole	430	1.75
Harishchandrapur-II	620	2.52
Chanchal-I	900	3.66
Kaliachak-II	1780	7.25
Old Malda	2000	8.14
Kaliachak-I	2000	8.14
Ratua-I	2150	8.75
Ratua-II	2160	8.79
Manikchak	3000	12.21
English Bajar	8620	35.09

Table.11.3. Variety-wise mango cultivation area in Malda district.

Name of the variety	Cultivation area (in hectares)	Percent area of the total cultivation land
Laxmanbhog	2982	12.1
Himsagar	1615	6.6
Langra	2907	11.8
Amrapali	1243	5.1
Fazli	9443	38.4
Ashwina	3230	13.2
Others (including Gopalbhog)	3140	12.8

Table.11.4. Classification of mango orchard according to size in Malda district.

Type of orchard	Size (in hectares)	Total area (in hectares)	% of total garden	Number of total orchards
Small	upto 2.0	14280.6	94.6	112350
Moderate	2.0 to 4.0	6560.5	4.3	5070
Large	4.0 to 6.0	1543.6	0.4	450
Very large	Above 6.0	2175.3	0.7	840

Table.11.5. Orchard-wise involvement of people in different sectors of mango trade in the district.

Category of Orchard	No. of Orchard	Grower	Security Men	Pluckers	Packing and Transport	No. of Storage Centre	Peoples in Storage Centre
Small	112350	71670	254580	182970	98760	840	5040
Moderate	5070	5480	14890	10130	3140	260	1610
Large	450	490	1270	1140	470	70	480
Very large	840	760	10260	1550	860	85	970
Total	118710	78400	291000	195790	103230	1255	8100

Table.11.6. Number of people and percent engaged in different sectors of mango trade in Malda district.

Category of involvement	No. of people engaged	% total in respect of total people in this trade
Grower	78400	07.15
Garden Sellers and buyers	182290	16.64
Security men in the orchard	291000	26.55
Pluckers	195790	17.86
Packing and transport	103230	09.44
Peoples in mango storage centre	8100	00.75
Mango product industries	1080	00.09
No. of trainee in food processing (last 10 years)	8400	00.76
Basket makers	16970	01.55
Wooden packing box makers	1140	00.10
Mango sellers in market	208570	19.03
Dried mango extract makers	380	00.03
Research activities & grafting	240	00.02
Different organization and folk medicine	230	00.02
Total	1095820	100.00

Plate.11.1. New plantations at Manikchak block.

Plate.11.2. Cultivation of mango in a paddy crop field at English Bajar block. This practice is becoming popular recently.

Plate.11.3. Varieties of mangoes in a Mango Show, at English Bajar blcok, 2002.

Plate.11.4. Small orchard at Old Malda block.

Plate.11.5. Moderate sized orchard at English Bajar block.

Plate.11.6. Men with packed mango baskets at mango storage centre.

Plate.11.7. Security men with bamboo pole in a small garden at English Bajar block.

Plate.11.8. Security men infront of their temporary tents in a large garden at Ratua-I block.

Plate.11.9. Security women at their tent in a small garden at Old Malda block.

Plate.11.10. Men plucking fruits in a large garden.

Plate.11.11. Mangoes in the net-basket at the tip of the bamboo poles used for plucking.

Plate.11.12. Plucked fruits are huddled beneath a tree in the garden.

Plate.11.13. Packaging of fresh fruits in the bamboo baskets beneath a tree.

Plate.11.14. Mangoes are packed in wooden packing boxes in a garden.

Plate.11.15. Packed boxes are carried by cycle van to the storage centre.

Plate.11.16. Diesel truck are used for transport of mango boxes to long destination.

Plate.11.17. Villagers (children and adults) are involved in basket making at Amriti, English Bajar block.

Plate.11.18. Villagers busy in basket making in a large garden at Ratua-I block.

Plate.11.19. Malcos, a food processing industry at Old Malda block.

Plate.11.20. A leading food products company at Bachamari, Old Malda block.

Plate.11.21. Government Food Processing Training Centre at Malda Town.

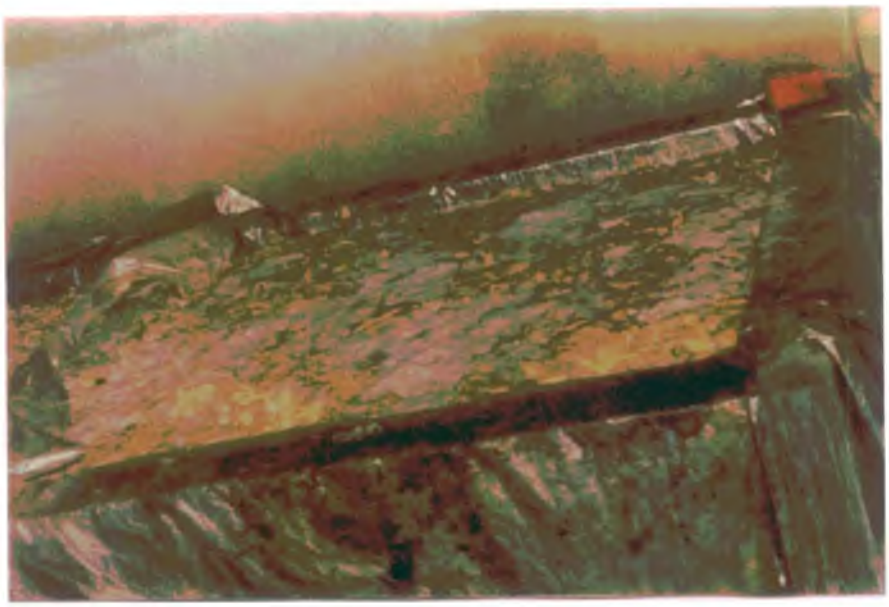

Plate.11.22. Storage chamber of sliced mangoes for preparing pickles in the GITA food products factory.

Plate.11.23. Women slicing the mangoes in the GITA food products factory.

Plate.11.24. Postal Department of Malda district arranged for parcel of mangoes under Mango-Post Scheme.

Plate.11.25. Grafting of mangoes in a small nursery at old Malda block.

Plate.11.26. A large tree supporting numerous grafts in a nursery at English Bajar block.

Plate.11.27. Government Food Processing Industries & Horticulture office where horticultural research activities are undertaken, at Madhabnagar, Malda town.

Plate.11.28. All India Show for mango and mango products, 1995 at English Bajar Town.

Plate.11.29. State level mango festival at Malda district town in 2002.

Plate.11.30. National level mango show at English Bajar block in 2003.