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A
TREATISE ON MANGO

BY

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PREFACE.

According to the custom of the literary world I cannot here refrain from saying a few words by way of preface, which I hope my gentle readers will give an indulgent hearing. It is about seven years since the manuscripts of this work were prepared, and about four years ago, I promised to bring it out shortly, but was somewhat disheartened at finding the indifference of the public at large in complying with my request by enrolling their names as subscribers to it. It is a great pity that mango, the king of fruits should be so neglected while the fruit itself is so great a favourite to all. As a proof of that apathy, it will be observed that within the last four years, not more than a dozen names were enrolled. My original idea was to make it illustrated and elaborate, but the meagre support of the public led me to drop the scheme of illustrations, and condense the subject-matter itself. An illustrated work on a subject like this would incur a heavy outlay which would necessarily require a large circulation. In view of the circumstances set forth above, I am obliged to bring it out in its present form, and that even in fulfillment of my promise.

The idea of this work first occurred to me soon after I arrived at Murshedabad in 1892 ; and I began at once to study the subject more closely

and to gather information on the subject as much as it lay in my power. The city of Murshedabad though now in its ruins, still maintains a high reputation for its mangoes, and the people of Murshedabad ought to be proud of so numerous kinds of choice mangoes strictly confined to their own gardens ; but it is to be greatly regretted that up to the present day no attempt has been made to make a complete collection of the scattered mangoes in one place. Nor has there been any endeavour to record the names of the mangoes indigenous to that place. I had therefore to undergo a good deal of trouble in collecting the names and description of the mangoes from different sources, still I must confess that the present work is an incomplete one. Considering the vast area which India occupies, and in which' mango is so largely distributed, the lists, which are embodied in it, will be found quite inadequate.

Before I conclude this, I have to thank Babus Mohesh Narain Rai, Pleader, Murshedabad, Hari Mohun Bannerji of Durbhunga, Raman Chundra Dutt of Mazilpur, Mr. Sobhan Ali Khan Sahib of Hajipur, Rai Setab Chand Nahar Bahadur and his son Babu Mani Lal Nahar, the Chairman of the Azimgunge Municipality, who have rendered me invaluable help by way of various informations and the lists of mangoes of their respective districts. My best thanks are equally due to the authors and editors of such works and

journals as I had occasion to consult from time to time, and quote passages where necessary. I am no less obliged and thankful to my esteem-colleague Mr. P. Lancaster, F. R.H.S. (Lond), and Babus P. C. Majumdar, Legal Adviser to H. H. the Nawab Bahadur of Murshedabad, and my kind friend Tulsi Das Mukerjea, M.A., for having kindly undertaken to revise and improve the manuscripts as well as for their valuable suggestions towards its improvement. I am also thankful to Mr. W. Gollan, Superintendent, Botanical Gardens, Saharanpur ; Pundit Gokul Das of Jodhpur ; and Mr. J. M. Gleeson, Superintendent, Agricultural Society of Madras for the necessary informations they have favoured me with.

28, Durjipara Street,
Calcutta.
December 25, 1897. }

THE AUTHOR.

To

MAHARAJA KAMAL KRISHNA SING BAHADUR,
SUSANG, MYMENSING.

DEAR SIR,

You have always taken delight in and evinced keen interest in my previous publications, and have had the pleasure of looking after my pursuits, living at a distance of hundreds of miles, and in return of that sincere

LOVE, AFFECTION, AND ADMIRATION

I regret my diffidence to adequately acknowledge them and even to express my gratefulness in suitable terms. But the publication of this 'Treatise on Mango' for which you alone were most anxious, will, I trust, give you some pleasure and that would be my best consolation. With this anticipation and in praying for your

HEALTH, WEALTH, AND PROSPERITY,

this little work is respectfully dedicated to you
by my humble self

The Author.

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A TREATISE ON MANGO.

HISTORY.

OF all the fruits, that India has been in possession since the ancient time, the mango stands first and foremost. Its bulk and substance, flavour and sweetness, have made it a household fruit to the people, and it is widely cultivated almost all over India, subject to the suitability of soil and climate.

We have at the present day hundreds of choice varieties in cultivation, but specialties occur in different provinces, and in the houses of Indian millionaires in which they are strictly confined. These are in no way true to their original characters, many changes having taken place owing to the method of cultivation, nature of soil, and successive crosses between the varieties themselves.

It is supposed by many that Hindoostan was not its original home, but that it had come from Lanka, now called Ceylon. This opinion is based on the Ramayana, one of the oldest historical lyric poems composed by Valmiki. The venerable sage was at his wit's end to say that Hanuman, the brave commander-in-chief of the armies of Ramchundra, when fighting in his

behalf with Ravana, the King of Lanka, to regain possession of Sita, Rama's beloved sweetheart, perchance met with an *Ámra Kánan*, i. e. mango-grove. Hanuman's natural relish for fruits prompted him to do ample justice to the mango with his vast number of cohorts ; and they were so much gratified with the deliciousness of mangoes that they could not but throw a few stones towards the Indian shores. This is all that we can gather about its primitive soil, basing upon the allusion made by Valmiki in his *Rámáyana*. Whether Hanuman actually introduced the mango into India or not, does not concern us much, but this is true that the mango was then known in India, and long, long before ; for in the age of the Vedas, which were composed long before the *Ramayana*, mention of the mango is found.

Mr. T. N. Mukharji wrote in his *Amsterdam Catalogue*,—"the *Ramayana* says that the mango was brought to India from Ceylon." He did not go in search of its antiquity beyond the age of the *Ramayana* which was composed according to Dr. W. W. Hunter's estimate, about 1000 B. C., while the Vedas are supposed by the modern antiquarians to have been written from two to three thousand B. C. No precise date has been agreed upon, and it is for this reason only that a wide difference of opinion exists. But, having regard to Dr. Hunter's opinion, our inference is that the mango was not unknown even in the Vedic age.

Fah-hian and Sungyun, the Buddhist travellers, referring to Buddha's penance, said that a mango grove was presented to him by *Amradarika*, the daughter of mango, as a shelter for his repose. Now it is clear that Buddha lived between 543-463 B. C. Dr. Watt in his Dictionary of Economic Products mentions that in the early part of the thirteenth century A. D. Ibu Batua, who then visited India made a reference to mangoes as having then been in use as pickles. In Kumar-sambhava and Sakuntala, from the pen of the Indian Shakespeare, Kalidas, who lived 1950 years ago during the reign of Vikramaditya, beautiful passages are found referring to mango-blossoms which he maintains as one of the "five-arrows" of the spring. From a romantic story connected with Suryya Bai, we are in possession of another poetical version of the origin of the mango. We take the following from the Pharmacographia:—"Suryya Bai, the daughter of the Sun, is represented as persecuted by a sorceress, to escape from whom she became a golden lotus. The king fell in love with the flower, which was then burnt by the sorceress. From its ashes grew a mango-tree, and the king fell in love first with its flowers and then with its fruits ; when ripe, the fruit fell to the ground and from it emerged the daughter of the Sun (Suryya Bai) who was recognized by the prince as his lost wife."

About 300 years ago, Abul Fazl wrote in his

Ain-i-akbari that there was a considerable number of cultivated varieties of mango in India, and made a special mention that in the splendid orchard owned by Hossein, who lived between the reigns of Akbar and Jahangir, and who was physician and afterwards Governor of Agra, Behar etc. attached to the court of Prince Selim, Kairnah mangoes had a conspicuous place in Delhi.*

In order to show a continuous link of the existence of the mango in Hindustan from the very remotest age, I commenced my researches from the Vedic period rather than from the modern age.

From the facts mentioned above, it is evident that India does not owe to any other country for her mangoes, although special varieties might have been introduced after the liking of the people. De Candolle was also of opinion that its indigenous home was the foot of the Himalayas.

It would not be uninteresting to a British Indian subject and those taking an interest in British affairs in the East, to know that the events which led to the foundation of the British Empire in the East, had something to do with the mango grove at the field of Plassey about 30 miles southwest of the city of Murshidabad. On his march to Murshidabad, Lord Clive in 1757 A. D. encamped with his armies in the famous mango orchard, measuring 800 × 300 yards. I have been informed that even at the present day a few trees

*Blockmann's English Translation of *Ain-i-Akbari*.

of that time are still in existence, but I doubt whether any mango tree can live out a century and a half.

The innumerable varieties of mangoes which we at the present day enjoy, are, as has been said above, the result of cross in succession, difference of climate and soil, and human ingenuity and skill. From the diversity of treatment and other causes a wide gulf has been created between the cultivated and the wild varieties, the former having so far improved in all its merits that it is almost difficult to trace its remote parentage. Though so much change has taken place in the mangoes, still crude and wild fruits that come to the markets are to be found on the trees growing of themselves in remote jungles and wastes. These fruits never deserve a place on the tables, for they are not only diminutive in size but also extremely sour and fibrous, and having a disagreeable and resinous smell. But the cultivated varieties are now the glory and pride of our Indian millionaires, and the source of wealth and fine delicacy of the poor Indian *rayyats* and peasants.

BOTANY.

THE mango belongs to the natural order of Anacardiaceæ and was scientifically named *Mangifera indica*.

It is a tree of majestic stature bearing fruits

in abundance in tropical countries and in the plains of India. The leaves which are alternate, and reticulated, are from 6 to 9 inches long and from 2 to 3 inches wide ; shining, lanceolate, acuminate and glabrous, having agreeable resinous smell. Petioles round, smooth, about an inch or two long, and thickish at the base. At the extremities of the branches, flowers which are small, yellow and having stripes of red at the base, and are hermaphrodite are produced in bunches. Petals five, and fertile ; calyx five-leaved ; stamens arising from the inner side of the lobed disc. Filament single ; anther oval ; the young shoots of the tree are full of greyish sap of thick consistency, becoming a gum-like substance of reddish hue by exposure to heat and light ; the fruits are oval or round, sometimes flat, and the fibres within are replete with juice ; in its unripe condition it is green, but when ripe it turns out yellow, pink or red. The pulp is either sweet or sour or intermixed, of agreeable taste and fine flavour ; seed one-celled, two valved ; a crustaceous substance covering the shell.

There are two other species scientifically known as *M. oppositifolia*, and *M. sylvatica*, the former being native of Burma, and the latter of Sylhet where it is called by the natives Lukshi Am. They are both of inferior merits and do not deserve a place in the gardens.*

*Dr. Roxburgh's *Flora Indica*.

Mr. Lancaster says that the *Mariam* or *Mangifera oppositifolia* is well worth cultivation for fruits.

The mature wood, though not very strong, serves many useful domestic purposes, and furniture is made of it in different places. "The mature wood is dull grey, open yet durable, if not exposed to wet, to the effects of which it is very sensitive. It is the cheapest wood procurable in Madras; used for packing cases, boards, and rough work in general. Mr. Rodhe says it holds a nail faster than any other wood known to him.*

The kernel of the fruit is white but bitter in taste, and contains a large percentage of oil, and gallic acid as well. The bark and leaves yield a yellow dye. In Oudh and Dacca, the leaves are used by the poorer classes for tanning purposes.

GEOGRAPHICAL DISTRIBUTION AND SYNONYMS.

ITS distribution is not only confined to Hindoostan, for beyond its southern shore we find mangoes in abundance in Malay Peninsula, Singapur, Ceylon, Persia, and in the remotest continent of Africa. There are also a few indigenous varieties of this tribe, distributed in Cochin China, Sumatra, Java, Penang, the Malaccas, Mauritius and Mombassa.†

* Cleghorn's *Forests and Gardens of India*.

† Dr. Voigt's *Hortus Suburbanus Calcuttensis*.

Again, through human agency, mango trees have been introduced into the United States, Australia, and England. Such introduction does not deserve mention in this chapter, but for the sake of convenience on the part of the readers, who would at a glance be in a position to form an idea of its existence, either naturally distributed or recently introduced into different countries on the face of the globe.

India being a country with a variety of creeds and colours, speaking different languages, it has been an impossibility to maintain the uniformity of the name of the fruit ; still it is a happy accident that the names in different languages bear much similarity to each other excepting in a very few cases. I am greatly indebted to Dr. Watts for the following extract taken from his *Dictionary of Economic Products of India*.

“Vern.—*Am, amb, amchur* (unripe fruit), *am-ki-goothli* (seeds), Hind ; *Am, amra*, Beng ; *Uli, kol* ; santal ; *Fagacha, bacho*, garo ; *ghariam, am*, assam ; *Am, Uriya* ; *Tsarat-Pang*, magh ; *ambi, kurku* ; *Ama, Baigas* ; *marka*, gond ; *Amb, am, anv*, N. W. P. ; *am, amb, mawashi* ; P. B. ; *amb, amba*, sind ; *amba, am, ambecha*, Jhar, Dec. ; *Ambs, amu, am, amb*, Bomb ; *amba, mar* ; *ambo, guz* ; *Am, amb, anv*, Bundelkund ; *Maa, mangas, mam marum*, Tam ; *Elamavi, mamadi, mamid, mamidi, makandamu, guggun mamidi, tiyya mamidi, racha mamidi, movi, mamadi chitu, tya mamidi*, Tel. ;

mavina, mavu, amdu, domu, Etamba (wild), *amba*, (cultivated) Sing; Amra, chuta, (the juicy), *Madu duta* (messenger of Spring) Sans; *Amba naghyak*, Pers.;"

From the above it may be inferred that the term Mango or *Mangifera* was derived from *Mangas* of the Tamil language, and it is also possible that the Portuguese who came out to India in the early part of the 15th century and settled at Goa, a place peopled by Tamils transformed *mangas* into mango or *Mangifera*. But there exists difference of opinion as to its exact root, while the authorities have maintained the first part of the word almost intact; the latter part, we assume, has been added for the convenience of scientific illustration. Loudon is of opinion that the term *Mangifera* was derived from *Manga* or *Manghos*, the vernacular name of the fruit and 'fero' to bear.* But another authority of no less importance holds that "*Mangifera* derived from *Mango* the name of the tree and 'fero' to bear.† However, it may be safely concluded that *Manga*, *Mango* or *Manghos* must have been borrowed from *Mangas* of the Tamils or any other vernacular name of the tree.

Besides the general name of the mango by which it is known, we are required to deal with the different varieties that have been introduced by lovers of this fruit. Those names having no

* Loudon's Encyclopedæ of Plants.

† Wight's Prodomus Flora Indiæ. Vol. I.

scientific reference, are here reserved for a separate chapter, but for the present it would suffice to assert that they are called according to the fancy of the growers in order to distinguish them from one another.

CLIMATE.

IN the different provinces of India though the Mango is cultivated to a more or less extent, the climatic condition of the locality should be taken into consideration. It is a fact that the trees are hard-wooded and can outlive the rigours of the seasons such as the hot winds of the Punjab, the severe cold of the North-Western Provinces, and the excess of rain of Lower Bengal; but regular plantations, in localities selected without having any regard for climate, often result in failure. Amateurs who out of fancy, curiosity, or pleasure, grow a limited number, may not have much difficulty in treating them with particular care and attention, and may expend any amount of money, no matter whether they succeed or not, but where profit is of the greatest concern, it would be wise to make a good choice of the land with reference to climate. The mango itself being a tropical tree, endeavours should at least be made to place it in the congenial condition of a tropical climate. It is neither possible nor practicable to secure identical climate

everywhere, but it must be our constant aim to adapt it to the climatic and other influences as much as possible for its growth.

In climate are included average temperature and rainfall of the year ; hence the latter form an important factor in gardening. Carelessness in the preliminary part of gardening business should be avoided. As the influence of climate has a great deal to do with soil and vegetation, it should be the imperative duty on the part of an energetic grower to make a special study of these matters. The growth of trees as also the excellence of fruits greatly, if not entirely, depend on climate. Generally, the fruits of Lower Bengal are far inferior in flavour and substance to those of the upper provinces. This inferiority is accounted for by the fact that Lower Bengal is most damp and swampy, whereas Bihar, the N. W. P., and Central Provinces, Khandesh and Bombay are dry, and in consequence, congenial so far as the fruits are concerned. The quality of the fruits is in a great measure due to difference of temperature and distribution of rainfall. Plantations laid out with mango trees with the exclusive object of fuel and firewood, would best succeed in the moist plains of Bengal which induce vigorous growth of trees ; but where the quality of the fruit is the particular object of the grower, the dry situations are most suitable. In the celestial regions of the Himalayas above the altitude of 4000 feet,

the mango can seldom grow or thrive under ordinary conditions.

Passing from the driest plains of Rajputana where rainfall averages under 10 inches, we find the same in the Central Provinces and Behar from 30 to 50 inches; while in Bengal Proper and in the lower regions of the Himalayas from 50 to 100 inches; again in Assam, Darjeeling and the Western Ghauts, it ranges above 100 inches.* From the above calculations and practical observations it may be fairly concluded that the provinces receiving varied rainfall of from 30 to 100 inches annually, are generally adapted for its cultivation, although with more or less advantage.

Dampness of climate not only invigorates the growth of trees at the expense of their fruits but is also ascribed as being the progenitor of weevils and insects that commit ravages to the fruits, and trees as well. This is especially the case with mangoes grown in the districts of 24 Pergunnahs, Nuddea, Jessore, Dinajpur, and East Bengal. Though some might have the misfortune of meeting with these evils, yet these may be averted or got rid of by having recourse to the precautions set forth in this book.

* Voelker's Improvement of Indian Agriculture.

SOIL.

AS plants and shrubs are susceptible of the effects of the soil, it forms an important part of my task to dwell at length on it. It must be borne in mind that the effects of soil on plant life are no less marked than the influence of climate, yet our control over the former is greater than on the latter, for we may, to some extent, make any soil suitable to our requirements according to the nature of crops to be grown thereupon.

In short, a soil may be defined as the combination of certain vegetable, mineral, and gaseous elements. Humus, clay, lime, and sand are the chief ingredients, and form the standard of the soil. Variation in their proportion makes a soil adapted to certain crops. Before proceeding with the selection of the soil, the nature of the crop has to be taken into consideration as well as whether the nature of the soil would suit the requirements of the crop in question. Among the manifold functions that a soil has to perform, support and nourishment are the principal ones. Let us now consider what sort of soil is likely to support a huge tree like our favourite mango, and what depth of soil would be necessary for its growth and proper nourishment.

Argillaceous and loamy soils having sufficient depth, are pre-eminently suited to it. We often find such soils appearing on the surface of any

land and very close below change into a different character. No reliance should therefore be placed upon any surface soil. For general purposes, a soil to a depth of from 4 to 7 feet should be carefully examined by digging a square hole which will present to the eyes of an observer the different geological strata which the area is composed of. Again, there are soils containing no parts of lime, and I therefore ask my readers to select soils having lime in it, at least 5 per cent. As I have said above, among other elements of a soil, clay, lime, humus, and sand are the chief, and no soil is rich which does not contain all these four constituents. Argillaceous and loamy soils, having a greater proportion of clay in them, have not only strength enough to support a tree but also to retain a greater quantity of moisture than any others. These soils are the best for huge trees. A mango amateur should not rest content with the surface soil as answering his purpose ; on the contrary, he should examine the subsoil also upon which the tree would depend for its existence ; for a deep-rooted tree would necessarily drive down its roots into a great depth for its sustenance. But should they happen to experience a disagreeable soil like sand, chalk, or marl a little below the surface, their growth is likely to be arrested, and as a consequence would become stunted and poor. It would be, therefore, expedient to examine the subsoil as much as the surface, and for

this purpose, a hole should be excavated in any part of the field to be planted on, to a considerable depth but must not be less than 4 feet. We have very little to do with the surface soil, for the roots live in it few years ; so we must pay particular attention to the subsoil. By examining the strata of the hole, if the subsoil be found to be of a very sandy texture, continuing to a great depth, it should be avoided if possible, or at measured distances holes, measuring 4×4 feet, the depth being determined according to the thickness of the sandy or limy strata as the case may be, should be dug down to the bottom of such subsoil and filled in with rich soil available. When laying out Raesbagh of her late Highness Nawab Raesunnessa Begum Sahiba of Murshidabad, I had to root out many old and decayed mango trees, which presented me an occasion to see their roots penetrate the soil to a depth of 10 feet even, and the trunk itself going down to 6 feet below the surface. This fact corroborates the necessity of a deep soil for mango trees. Another disadvantage of the subsoil close down the surface 'being sandy' is that the trees spread out roots horizontally at the risk of falling down uprooted by high winds and hurricanes. In spacious and large fields where a plantation is resolved upon, a single hole will not test the merit of the whole area, for great variation may occur even at short distances. According to the

dimensions of a field, holes might be excavated at the distance of every 1000 feet, so as to form a correct idea of the nature of the average soil.

In the black cotton soil of Bombay and *Kunkur* soil of Gwalior, mangoes have been found to succeed well. Mangoes of Bombay species that are grown in Bengal are really deserving of a prominent place in a garden, and it would be a great injustice to ignore their claims as such. The celebrated Alphonso of Bombay, which was first among its varieties, introduced into the gardens of Bengal, is an example of the noted kinds which Bombay may boast of. *Kunkur* or limy soil is also productive of good luscious fruits. Mr. Maries says :—"In Gwalior, we have fine fruit trees in *Kunkur* with enormous crops of fruit." From the facts described above, it may be concluded that almost all kinds of soils of India are suited to the cultivation of the mango with more or less advantage, having reference to climate.

SITUATION.

RAISED and well-drained plots of ground free from the shades of other trees and surrounding jungles, should be selected. Free ventilation and direct sunshine are also to be secured. Where these advantages do not exist, steps must be taken to secure them. Low land where water

accumulates during the rains may be utilized by raising it above the general surface of the surrounding country. For the sake of convenience a tank may be excavated and the earth out of it spread over the field as necessity directs, but in the case of small gardens, trenches all round would be advantageous both for draining off the superfluous water, and for raising the land with the earth dug out of them. Trees in and close to busy towns do not find a happy home there, as they are always subject to smoke of chimneys and dirt of roads both of which are injurious to vegetable life. The efflux of these in a thickly peopled and manufacturing town deposits itself on the leaves of trees, hinders them greatly from assimilating gaseous elements from the atmosphere and from respiration to their best advantage. The more the pores of the leaves remain free from all these nuisances the more vigorous will be their growth and prosperous their health. As an example, I should point out to my gentle readers the awkward and miserable condition of the trees growing on the road sides, and it would not be long before they could arrive at a conclusion that dirt and smoke are the most formidable enemies to plant life. Many have orchards in and around Calcutta, where mango as well as other trees have been growing, but bearing scanty fruit. This is assuredly due to constant presence of the dirt, smoke, and other impurities of the

atmosphere, which give rise to the underground growth of the trees at the cost of leaves and branches. Again, when the trees blossom, fertilization becomes almost an impossibility, because of the filthy deposits that almost wholly cover up the face of the buds, pistils, and pollens remaining inert and dull. This is one of the principal causes of the falling off of the blossoms from trees.

In Lower Bengal the soil of which is almost always sufficiently charged with moisture, a mango plantation seldom requires irrigation; while in the Upper Provinces and in the hilly tracts where earth is naturally dry and the heat of the sun is in excess, arrangements for properly irrigating the orchards should be made. Tanks or deep wells are necessary for the purpose, and for the sake of convenience they should be within the fields or close by, for the scorching heat of the sun during the months of April, May, and June, which works upon the soil in radiating moisture from itself as well as from the trees, makes the constant watering of the fields absolutely necessary. Roots cannot be expected to feed and nourish under such circumstances, with the necessary quantity of moisture already existing in the soil, for the quantity of sap, which the sun absorbs from the trees and soil, is far greater than what the trees are supplied with through the roots.

Now it remains for me to treat of the aspect. We must see to the access of the morning sun to our

orchards ; and for the fulfilment of this particular object, we must be careful in keeping the east as free and open as possible, for nothing is more beneficial and conducive to plant life than the morning rays. The morning sun mingled with cool breezes is highly refreshing not only to the vegetable kingdom but also to living beings. The southern aspect is equally necessary for the ingress of warmth which keeps the soil always impregnated with heat necessary for the development of trees. This also keeps the soil free from superabundance of moisture and dampness. Such sites as have the east and south open are the best for the successful cultivation of the mango.

FOGS, DEWS, AND RAINS.

NOTWITHSTANDING all care, trouble, and expense, our expectations are frustrated, though fortunately, not often, by fogs, dewes, and rains. In Bengal and Assam, rains are not scarce even in the cold season when trees are in blossom. Urban fog being rich in sulphurous acid is detrimental to the young leaves and buds, but the fogs of districts far away from towns are much less injurious than those of the former. Trees in towns are particularly subject to them. Constant impurities, which the chimneys of metropolitan and busy towns emit, are the sources from which fogs accumulate the sulphurous acid. Trees like the

mango with thick or ripe leaves are less susceptible of the arid influence of urban fogs, but the blossoms can hardly stand their effects. In January when trees are in full season with blossoms, the atmosphere is sometimes so full of thick fogs that the rays of the sun cannot penetrate it, and as a consequence the greasy substance of the fogs destroys the blossoms. Whoever has seen a mango tree during its blossoming season must have marked the blackish substance on the leaves of trees, and blossoms also to fall off in heaps. This black substance is nothing but the decomposed matter of the fog and sulphuric acid. Leaves thus discolored by its action remain for some time on the tree, but defoliation soon follows. The matter dealt with in this chapter alone is deserving of more elaborate treatment; but it is impracticable to handle it satisfactorily within the limited space of the present work. I, therefore, deliberately leave it to others who may like to make a wider and more searching investigation into the subject. I may mention here in the interests of horticulturists that the fog question has drawn the attention of the Royal Horticultural Society of London, and investigations are being made by experts there to ascertain the effects of fog on plant life*.

Besides other chemical actions, bearing a close

* Royal Horticultural Society's Journal, Vol. XVI, pt. 1.

relation to fogs, excess of dews is apt to wash away the pollens, depriving the pistils of the power of fertilization ; so that the flowers drop off and and a failure of crop ensues. Moisture on the flowers from whatever sources it may be is detrimental to fructification. Rains likewise do the same injury as is done by fogs and dews ; moreover, a heavy shower or two when the trees are at rest before the period of flowering is likely to promote a leafy growth and extra vegetation and thus retard the blossoming tendency of the trees. The evils arising from these causes can hardly be eradicated, and we know not if any remedy has yet been devised. But so far as the fog is concerned, we anxiously watch the proceedings of the Scientific Committee of the Royal Horticultural Society, where experiments and observations are in progress by Members of the Committee, and we eagerly await their decision. We know not why our agricultural and horticultural bodies should not take up the subject and advance the efforts of the London Society whose indefatigable exertions would thereby be materially helped.

PREPARATIONS FOR AN ORCHARD

PRELIMINARY preparations for making an orchard consist in clearing jungles and weeds and ploughing the land over and over again so as to render the soil friable and sufficiently capable of

absorbing atmospheric elements that constitute the important food for plants. Plants would seldom or never thrive in a soil that has been lying waste and uncultivated for a long time, although such land is considered more fertile and productive than ordinary ones under cultivation. I must confess that the belief is not unfounded, and in support of the fact I may here lay down the result of my personal observations extending over twenty years in different parts of India *viz.*, no soil could be more valuable and rich than a virgin one, that has, from its prolonged rest, become impregnated with invaluable organic elements which would have otherwise been exhausted by rotation of crops year after year. Notwithstanding the existence of the component parts that constitute a rich soil, they are required to be made active by bringing them to the direct influence of air and light. The mere presence of organic and inorganic elements does not in itself increase the fertility of the soil. It is, therefore, necessary that there should be thorough decomposition by repeatedly inverting the soil by means of the plough. Shroetky says,* "Most exhaustive experiments have proved that plants are incapable of absorbing in a pure state these four elements which constitute their organic parts: a plant may be set on pure carbon, supplied with

* "Principles of Rational Agriculture."

pure oxygen, hydrogen, and nitrogen and will yet die from want of nourishment. Therefore, no plant can absorb and assimilate these substances in their elementary form ; it is only from certain now well known compounds that it is able to absorb them ; and these great suppliers of all organic plant food are carbonic acid, water, and ammonia." Soils when turned over by means of the plough, expose their ingredients of carbon and oxygen to the influence of moisture and atmosphere ; and a slow decomposition takes place by the combination of atmospheric oxygen, and the carbon and hydrogen of vegetable matters present in the soil. Inorganic substances as well remain dull until they are rendered soluble by exposing the soil to heat, moisture, and air.

There can be no divergence of opinion regarding the necessity of bringing the soil into close proximity to and action of the atmosphere. Even the very poorest and most exhausted soil undergoes a great change for the better and derives immense benefits from this procedure. Although an exhausted soil may thus be improved, yet it is preferable to manure the land, if not in its entirety, at least those spots in which trees should be planted.

Now the land thus cleared, ploughed, and manured should be allowed to remain fallow no less than three months : it would be better if this period be extended before planting commences.

In the interval the land may be ploughed once every three or four weeks. These operations might be taken in hand during the dry season, which generally commences from November.

Excavation of tanks or wells and arrangements for drainage as also for fencing might be advantageously undertaken during this part of the season; for there will be plenty of time in accomplishing these works before the rains set in. Instead of doing anything by haphazard, I would advise the amateur to move on slowly and gradually. Benefits derivable from the preliminary measures can not be over-estimated, but we deplore very much that people do scarcely pay heed to these points which experience has repeatedly proved so absolutely necessary for a rich and successful mango plantation.

PLANTING.

The season for planting commences in July with the first shower of rain. About a fortnight or month previously, holes measuring 3×3 should be dug every 40 feet in all directions. Equidistant parallel rows produce nice effects in viewing all orchards when the trees shall have grown up, whereas planting at random would simply bespeak the absence of taste of the owner. Poor and narrow ideas having relation to neither

choice nor judgment should be studiously avoided, for all gardens or orchards should be nice-looking and well laid out.

The distance to be allowed in planting might be best determined by growers themselves, as it considerably varies in accordance with the climate and soil of a district. Personal experience of the growth of trees in the locality would be, in my opinion, the best guide as to the quantity of space required to be left between two trees. In Calcutta and its vicinity the space allotted for mangoes is generally $25' \times 25'$; the growth of the trees in such localities being not so exuberant as in the districts of Maldah, Murshidabad and Durbhanga, where mango topes sometimes require a space of 50 ft. asunder. But, to my utter surprise, I saw in the above places where mango forms one of the main crops of the season, many an orchard solely devoted to its culture and occupying a vast area of land, so thickly planted with mango trees that the orchards themselves have now become recesses of gloom even during day-time and the branches of trees are interwoven with each other to the great detriment of their further growth and development. As an inevitable consequence of such injudicious planting, the lower portions of all trees and branches are devoid of leaves, and the intervening space within is a reservoir of obnoxious gas and nursery of malarial germs. These impurities not only injure the health of the trees

but greatly affect human constitution of the locality also. From a sanitary point of view, local Municipalities ought to have a strict eye upon these points of vital importance.

Want of sunlight and free ventilation frustrate the aims of the growers by impoverishing the health of trees and by depriving them of their powers of bearing fruits. A thick canopy over an orchard is a great barrier to atmospheric elements and the sun. As this drawback was not rare in Raesbagh, I caused some of the trees to be cut down to the very roots in order that the remaining ones might have the advantages of atmospheric elements. In their former crowded condition, they bore only a few leaves on the uppermost and lateral shoots, and, in season, a very insignificant number of degenerated fruits. By adopting the above method, I not only succeeded in bringing round the surviving trees to healthy bushes, but they in grateful acknowledgment of my services bore fruits profusely and of improved quality.

Among the mango orchards of extensive area having rich collections of the choicest varieties may be mentioned H. H. the Nawab Bahadur's Mabarak Manjil, a park which was at one time a rival to many of Calcutta, and Asafbagh, formerly belonged to Rajah Prasanno Narain Deb Bahadur of Calcutta, Nawab Bagh and Khanpur Bagh of Her Highness Nawab Raesunnessa Begum Saheba (deceased)

and Rai Luchmipat Sing Bahadur's famous Katgola Bagh where some discipline in planting was observed. But in almost all other orchards the manner of planting verily suggests that those trees came up from seeds sown broadcast or recklessly scattered or thrown away in numbers perhaps by crows and other birds. In these orchards one may easily find trees in groups having 3, 4, 5, or 6 feet space between each other. What can be expected from these orchards? I emphatically reply, awkward trees and worst fruits. But the orchards now being laid out are not so indiscriminately planted as heretofore. It is my conviction and belief that the people of Murshidabad, if they turn their attention and energy to the systematic cultivation of mangoes, and mangoes only, can turn it to good account and may be proud of the distinct varieties they alone possess.

Never plant indiscriminately, nor be miserly in allotting sufficient space for each tree ; and I can verily assure that they will not, in return, be ungrateful in compensating you for the rent of the little space they occupy nor for the trouble and expense incurred in treating them. It is far better that an orchard should have a limited number of fruitful trees than many trees stunted and barren.

Systematic planting consists in the selection of healthy trees, according to growth, variety, and season of ripening of the fruits. Injudicious

planting results in the awkward appearance of an orchard when the trees shall have grown big ; the loss of names, if not properly marked, the incumbency of extra labor in assorting fruits and the last and not the least, the setting in of the fruiting season without any regard to the respective periods of ripening for which they are individually appreciated. There are tall and erect varieties that require less space while others are of a bushy or spreading habit, and require more space. Again there are varieties that come early, the second-early next, and the third late into season. If trees be planted in a mixed bed neglecting these specialities the rapid-growers or bushy ones are likely to take up more space than had actually been allotted and thus deprive others of the same advantages. Next, the period of season is most likely to be forced upon some late varieties in treating the early kinds. It is therefore absolutely necessary to be particular in these points, which are of the greatest magnitude to the horticulturist. Mr. Maries of Durbhangha, referring to the laying out of a mango plantation very rightly observes:—"In laying out a plantation of mangoes, the trees should be so arranged that the season of ripening comes in order; the early mangoes planted to the east, medium in the middle, and late mangoes west".*

* Dr. Watt's Dictionary of Economic Products of India.

PLANTING.

With the first shower of rain in July, plant one graft in each hole along the rows; but remember never to plant when the soil is wet, as this would so much compress the soil that the new and tender roots of small trees would be quite incapable of breaking through. The ignorant plant-hawkers of Calcutta, generally, make balls of earth round the roots of plants which they sell, with so stiff a loam that the balls remain for years as they were first made. The earth thus made into balls is neither penetrable by roots nor is it possible for human hands to remove them without injuring the roots. Year before last I had bought a few fruit grafts from Calcutta plant-dealers, and planted them as usual but some of them never started for the following fifteen months; on the contrary, some of them died outright. On examining the roots of the dead trees I found, to my great surprise and disappointment, that the balls remained as stiff and compact as they had been, and no trace of the roots penetrating through the loam was visible. However in putting a graft into the hole, try to remove as much superfluous soil from the ball as practicable and keep the joint of the graft entirely or half immersed in the soil, and then fill up the intervening space with half moist, rich, loose mould, better if mixed with decayed vegetable refuse. Press the soil firmly but gently, taking care not to hurt the roots.

The empirical method of planting grafts in

Maldah and Murshidabad districts is greatly reprehensible. As it is not the cause itself, but the effect of the defective system of grafting that such method in planting is pursued, it does not come under the category of this chapter, but is reserved for a separate one on grafting.

Over-immersion of the stem into the soil has many disadvantages. Firstly, it causes them to send down roots below at the sacrifice of the fruiting tendency of the trees. Secondly, the roots remain almost beyond reach of atmospheric influence; third and lastly, the underground portion of the stem becomes a prey to the attacks of worms, insects, and whiteants, and is likely to rot from the effects of constant dampness. But the grafts of Murshidabad and Maldah are what we strongly disapprove, for their point of union is far above the base, making trees grow upwards instead of spreading side shoots from the lower parts of the stem.

After planting has been done according to the principles delineated above, the trees should have profuse watering which must be repeated every fourth, fifth, or sixth day as weather may direct. In unfavourably dry seasons when the heat is scorching, a *tatee* or light thatch of grass may be suspended over the head of each tree for protection, and the trees should be bathed once or twice every day when the atmosphere is above normal temperature ; and for this purpose morning and evening

would be most desirable. . Neither bathing nor watering should be allowed to the trees when the atmosphere is too hot, as this is likely to produce counter-effects from the tender roots and leaves being severely injured.

To keep up constant moisture at the roots and to save the troubles of shading and watering the trees, it would be a wise plan, inexpensive at the same time, to plant plantain trees round the newly planted grafts for the first few years. In rare cases in Murshidabad and Maldah this system is in practice, but I am quite at a loss to understand why the people should not adopt this simple plan. However, care should be taken so that the plantain bushes do not overcrowd the grafts, and remember that these bushes must be thinned from time to time as space will be required by the young tree.

In October, November, and December also planting may be performed, but the trees planted now would necessarily require more care and attention until the rainy season sets in; but those who can not personally supervise the works done by *malies* (gardeners) who often neglect in carrying out the directions given by their respective masters, would do well to wait till the following July.

The season for planting *gootees* and seedlings is the same as for grafts, but in planting a *gootee* take care niether to plant it in deep nor in

shallow holes. When planting a seedling, the tap-root should be cut off carefully so that the tree may not suffer in the least from its effects.

IRRIGATION.

THIS important part of orcharding is much neglected in India, although its necessity has long been an admitted truth. It is really a deplorable fact that we suck the trees without giving them food for support. An investigation into the degeneration and diminution in the quality and quantity of fruits arising from the effects of drought and non-irrigation would amply justify the demand for water of trees, especially during the hot months in the Indian sun. Air and moisture are the principal elements upon which the trees subsist. I have dwelt at great length on air and atmosphere in the previous chapter and it now remains for me to say a few words on the necessity of moisture.

Want of sufficient moisture in the soil induces a tree to send down roots below the ordinary depth in search of food, *i. e.* water which forms the chief food of the vegetable kingdom. This tendency which it is forced to put forth has very baneful effects in making underground growth of the roots, and in forcing the trees to vegetate and leaf instead of fruit and flower. Besides, from want of moisture, the surface soil becomes stiff and hard, and powerless to absorb atmospheric

matters or elements necessary for the development of the soil itself and for the support of the trees alike. It must be noted that the soil and the atmospheric elements have no power of combination without the medium of moisture. It is therefore necessary that the orchards should be regularly irrigated from March till the end of June. This would not only keep them cool but would also invigorate their growth and improve the quality, and increase the size and quantity of fruits.

Mango-trees generally take rest after they have made their autumnal growth and remain inactive until the blossoming period which usually commences in January. During this state of rest, they should not be watered, as the soil is then sufficiently charged with moisture, which will be quite enough for supplying the trees with the quantity of water necessary for their inert life. Notwithstanding this, if they be subjected to watering, they will most probably ignore the fruiting tendency, and start up into a fresh leafy growth for the season. But, when they are in full blossom and approach to fruiting, watering would be of the greatest advantage in developing the minute fruits and in enabling the trees to strengthen their stalks.

If it does not suit the convenience to flood over the entire area of the orchard, the trees should, at least, be individually so watered that ten to fifteen feet of ground round each tree

become wet to a considerable depth. It is better that no watering should be given at all than moistening the ground superficially. The period of interval for repeating may be determined according to the nature of the soil and the moisture at the roots ; but the soils of Lower Bengal do not require more watering than once every three weeks while those of the N. W- Provinces and the Punjab once every week.

Water being of paramount importance in gardening, orchards should have easy connection with adjacent rivers, canals, tanks, or wells to avert the dearth of water as it sometimes happens. For irrigation purposes the country system of *dinghi* is most convenient and economical.

PRUNING.

THE system of pruning fruit trees has been in practice in India since a very remote age, but the causes that led to its adoption are very little known ; hence we see a good many defects in the mode of pruning.

The object of pruning is to give trees rest by artificial means for a limited period, the ultimate aim being to bring them again to fresh vigour and life.

The operation of pruning may be performed during the months of October, November, and December ; but the time must vary with reference to

the season of fruiting; early varieties first, then medium, and lastly the late ones. If all the trees are pruned at one and the same time there is a likelihood of their coming into season all at a time irrespective of group and natural season by which each group is characterized. This improper method of pruning indiscriminately tells heavily upon the quality of the fruits; for early varieties may go to flower late, while the late ones early, if they flower at all or be inclined to vegetate. To avoid such disappointment, it is advisable to prune the early varieties in October, the medium in November, and the late in December.

The root and shoot are both subject to pruning. Before commencing with the operation of pruning, dig up the soil at the base of each tree to a depth of a foot, taking the circumference considerably wide, and let it remain so for a week to dry. In the meantime remove all the sickly and decayed shoots from the tree. Then after a week cut off some surface-roots and remove the soil from the roots, so that air may have access to work on them as also on the soil. The main roots should never be disturbed. In this state trees should be allowed to remain from 3 to 4 weeks, after which fill up the gap of the soil at the roots with fresh earth and well rotten manure.

Trees in orchards are pruned in the shape of surface ploughing which has but a nominal effect on them, and, in my opinion, is a little better than

nothing at all. By turning the country-plough over the soil of an orchard, the earth only receives superficial scratches, and loses capillary connection with the subsoil. The solitary benefit that the tree may derive from ploughing, is that a very thin layer of the surface becomes loose and enables it to absorb an insignificant quantity of gaseous substance from the air, but it is seldom that even the very fibrous surface roots get any advantages of pruning. The owner of a garden should, therefore, take the trouble of making his men understand the object and method of pruning. I have had on many occasions heard gentlemen speak of the sheer inutility of growing fruits, less of fruit trees being given a place in a garden. Some of them even do not hesitate to say that fruit trees should be grown by *Malis* and lower classes of people and not by gentlemen in their gardens. The cause of this narrow idea of gardening may be reasonably assigned to the backwardness in orcharding, which forms one of the principal branches of horticulture.

Now it must be noted that no tree under five years of age or sufficiently mature in bearing should have their roots pruned. Trees of immature growth, when pruned and treated likewise, are likely to flower and fruit earlier than they would otherwise do. But they are greatly benefited by occasional stirring of the surface soil at the base.

MANURING.

MANURE forms the chief food for the nourishment of plant life and it is supplied by nature through the medium of the soil. Although trees are so supplied for their natural growth and fruiting, still it does not appear to be sufficient for practical purposes. The object of manuring is to give them what they want for the production of a crop. Those who take crops without giving them in return any sort of manure may be said to rob the trees of their stock. Hence it must be understood that the trees we intend to get a good crop out of, should be sufficiently fed with nourishing food. Manure improves the health of trees, develops fruitfulness, and enhances the merits of fruits.

For young trees, well-rotten cow-dung or oil cakes suit best, but the larger ones will be greatly benefited by the application of stronger and more substantial manures, such as old stabling, salt, sulphate of lime, and bonemeal. When bonemeal is to be applied, it should be mixed with other manures in order that it may soon decompose and effect readily. As superphosphate of lime is not available everywhere, it would be an economical plan, though troublesome to a certain extent, to prepare it at home. As for its preparation, I am indebted to Mr. B. C. Basu, of the Agricultural Dept., Government of Bengal, who writes in his

Notes on Indian agriculture :—"superphosphate of lime, briefly spoken of as super can be made either from bone-meal or bone-ash by treating it with sulphuric acid. It is not quite easy to make super from raw bone-meal, that is from meal prepared from "raw" bones from which the fatty matters have not been removed by steaming or boiling. Both the fatty and nitrogenous matter of raw bone-meal tends to protect the phosphate of lime and other mineral ingredients from being acted on by the acid and to make the mass slimy and inconvenient to deal with. It is preferable, therefore, to prepare superphosphate of lime from either bone-ash or steamed bone-meal. The process of manufacture is very simple and is as follows :—Take a large earthen vat and fill it about two thirds with a weighed quantity of raw material—either steamed-meal or ash. Add enough water to saturate the mass, and stir it well. For every maund of the raw material, weigh out about 20 seers of *chamber*, sulphuric acid or about 15 seers of strong acid (oil of vitriol), and gradually pour it over the mass under treatment. As the acid is being added, and for some minutes thereafter, have an assistant to turn over the mass which will boil and froth up, with a shovel, until the bone material and acid have become uniformly mixed throughout. Care should be taken not to spill the acid which is a violent caustic and cauterises the skin almost like red hot iron. After a few

hours the mixture will be found to have set into a solid mass like cement. Now turn it over on clean ground in the sun and spread it out to dry. After drying in the sun for 4 or 5 days the clods which might have formed, require only to be crushed by a mallet before the manure is ready for use."

Chlorine or common salt is a valuable medium as manure, as also a vermin-killer. For agricultural purposes *Khari-nimak* is generally in use, and may be had from the bazaars. It is less expensive than the purified salts of Liverpool. A half-basketful mixed with other manures will be quite enough for each tree.

Manure prepared from rotten vegetable refuse is also very valuable, so far as the growth of a tree is concerned.

Trees should be manured after they had been pruned and undergone necessary treatment in that connection. The space at the roots from which old soil has been previously removed, should be filled up with rich manure and fresh soil. Some people are of erroneous belief that a basketful or two of manure given close to the base will answer the purpose of manuring ; but this faulty system of manuring at the base has very little or no effect at all. The fact is that the roots can never be expected to remain interwoven just below the surface close round the base or foot of the tree ; hence it is unquestionably true that roots never remain idle, and would go as far as they possibly

could in search of food. The distance to which trees spread out roots and rootlets cannot be ascertained accurately, but is subject to be determined according to the age and growth of trees.

The quantity of manure to be applied at the roots may be determined by the grower himself, according to the strength and requirement of each tree. Over-manuring sometimes forces a healthy tree to superabundant growth or causes decline to others on the one hand, and on the other tends to check fruitfulness and to decrease the size of fruits. Not only the strength and requirements of a tree have to be taken into account, the capacity of manure should also have careful examination. Strong and fresh manure smelling obnoxiously, has injurious effects on plant life. A healthy and well grown tree will best receive from 2 to 10 basketfuls of manure-mixture without the risk of any danger. For weak and young trees 2 to 6 will suffice, but it must be milder, and this may be done by adding ordinary garden soil in greater quantity than the manure itself,

Referring to the cultivation of mango in the Punjab during the reign of Emperor Akbar, Abul Fazl wrote:—"They also put milk and treacle round about the tree which make the fruits sweeter."* I have never tried this, and I cannot, therefore, say anything about it from my

* Blockmann's Translation of *Ain-i-Akbari*.

personal knowledge ; but mango growers would do well to make an experiment in this connection. Mr. Sobhan Ali Khan, a rich Zemindar of Hajipur in the Patna Division has kindly supplied me with the following information. He says :—"A Fakir planted a mango tree which accidentally did not grow straight but the fruit turned out to be exceedingly good. After the death of the Fakir the tree came into the possession of Maharaj Bhup Singh of Patna, who ordered that milk and sugar to be given round the root of the tree every year in the fruit season, and the outturn of the mango became more and more delicious." This is by the way the history of the famous *Langra* mango.

After manuring the trees properly, watering will be necessary, but it must not be done heavily until blossoms have been formed into fruits. The water now required, will be very moderate, the object being simply to moisten the manure applied. The affinity which it bears to water is too close, and it is beyond the capacity of the manure to effect any action until coming in contact with water. This clearly shows the necessity of water after manure has been given, but that should be regulated with the advancement of the season, beginning at first with moderate quantity and increasing it as necessity directs. On upland, dry or porous soil from 6 to 8 waterings during the entire season of fruits if rains be scarce at that time, will keep up ample moisture for the crop. But

in cases of such lands as are already overcharged with it, as is the case with the lowlands of south and east Bengal, no watering is at all necessary except for wetting the manures. An attempt to force the trees to come into bearing earlier than usual by the early application of manure, although they were still at rest and slumber, would most probably tell severely upon their fruiting tendency. Work and rest are the alternatives in nature, and every created thing, having life, is subject to that law. Mango trees work for the autumn growth in the rains and go to rest then for a short period until the blossoming season approaches. In the meantime, they gather fresh vigour and strength which were exhausted in the autumn, for another growth for blossoming and fruiting, and also mature themselves for the same. It is evidently true and corroborated by facts of everyday life that they are much less inclined to come into bearing before the branches are matured. It has often been seen that mango trees that make growth after the rainy season is over, seldom come into bearing for the season; in order to check that tendency, it becomes incumbent to expose the roots to the sun for some time and to place at their disposal such quantity of manure as would compensate the loss thus caused.

There is a class of careless people who would not only be apathetic in manuring, but also

deprive the trees of the advantages derived from the leaves they put forth throughout the year, by collecting the same for other purposes. If these leaves are not collected and taken away, they may live and feed on their own properties to some extent. It is indeed very cruel, and I should say a horticultural crime to take crops year after year without supplying the trees with some nutritious food for the restoration of health which undergoes fatigue and exhaustion by overwork. Apart from the philanthropic view of the question, if I may call it so, we are also to lose greatly and materially by the degeneration of the fruits and diminution of the yield where trees are neglected in respect of manuring. The question of expense forms an excuse to many, but I am pretty sure that the average outturn of three successive years more than compensates it.

PROPAGATION.

GENERALLY two methods are adopted in propagating mango trees, by seeds and by grafting. The *gootee* system is seldom practised. There are advantages peculiar to each.

Plants raised from seeds are called seedlings and grow bigger and with more vigour than those propagated artificially. Notwithstanding those advantages why a seedling is not preferred is a

question that requires careful investigation, and I hope I shall be pardoned if I take up a little more space than usual in dealing with this subject.

There are many trees and shrubs, the seed of which sometimes, if not often, fails to germinate in a foreign soil. They become delicate and lose the power of standing on their own roots. With all possible care the seed might be made to germinate, and the seedling to live, but being susceptible of the effects of a new soil or climate it is apt to lose its original merits, and may turn out a quite different variety either superior or inferior to the parents. Consequently a great change in the quality of the fruit is most possible and is often met with. As an inevitable consequence, we at the present day possess so many choice varieties of the mango, and it is also hoped that the more the attention and care bestowed in raising seedlings from selected varieties, the more will the novelties be achieved which may stand in rivalry with, or excel the universally favoured *Fuzli* of Maldah, *Langra* of Benares, and *Kalalahar*, *Kohitoor*, *Bimli*, *Ro'gni* and *Annanas* of Murshidabad. The change in the true character of the seeds, oftentimes, although not hybridized or crossed by human agency, takes place when they are yet in embryo through the instrumentality of the wind, and bees, wasps, ants and numerous other insects that feed on the blossoms. Again, difference in climate and in the nature of

the soil may subject a seedling to change its parental character.

From the foregoing observations, it may not be supposed that such a variation is sure to take place, but what I mean is that, there is every chance of a change taking place in its relation to the mother tree. Another point, not of greater magnitude though, for non-preferment of seedlings is that they take comparatively a longer period, ere they come into bearing, but that objection has neither weight nor importance, because of the compensation which is realizable, when some novelties will appear, or from the abundance of fruits which is to follow. I at least attach no credit to the grower or propagator of such graft as bears 2 or 3 years since the day of planting, for this takes place as a matter of course, but he who would succeed in raising even a single novelty, surpassing the existing ones in excellence, shall have sympathy and approbation, no doubt, of the entire community and shall win a lasting reputation for himself.

An amateur would hardly risk his pleasure or purse by planting trees raised from seeds, for they are almost invariably uncertain about their yield. Mr. Ingledew of Mysore is of opinion that "the produce of the seedling mango is very uncertain and less to be depended upon than that of most other seedlings in the quality of fruits ; and it is probable that not one in several thousands of these

trees will bear good fruit in ordinary situations.”* From my personal experience I am enabled to strongly maintain that a seedling can never be entirely depended upon in producing fruits of merit similar to that of the parents. As I have shown above, it is by mere accident that one may obtain a seedling out of many, retaining parental habits and merits. From the Report of the Botanic Gardens in the N.W.P. for the year 1854 the Rev. Mr. Firminger quotes :—“Mr. J. Homfray has likewise in his garden a grafted tree, received from the Botanic garden, of the Mazagon mango, stones from the fruit of which he planted, and one or two trees raised therefrom, produce fruit exactly alike and fully equal in every respect to the fruit of the parent tree.†” Again, what opinion the same Mr. Humfrey advanced before him was as follows and should be read with interest. The Rev. gentleman further observes :—“In a conversation I had with Mr. P. Homfray many years after he made the above communication, he told me that he had since sown the seeds of other kinds, but had not met with the same result from them. The seedlings did not yield fruit equal to that of the parent tree. The Java kind, however, always came true as a seedling.”

Apart from the controversial part of the subject, let us now turn to the subject itself. The

* Journal of the Agri-Horticultural Society of India.

† Firminger's Manual of Gardening.

seeds of choice and selected sorts may be better utilized than throwing them away or mixing with insignificant kinds. From these seeds, though equally good varieties may not turn out, there is a possibility of some new or distinct varieties being obtained.

For seedling purposes, fully developed and well ripened seeds of available good kinds should be procured in the season, *i. e.* in the months of July, August, September and October, and washed clean of the consistency that might stick thereto, and dried in the sun or air. In the meantime suitable holes to receive the seeds should be filled up by adding to the soil old and well rotten vegetable refuse. To keep up an equilibrium of light, moisture, and temperature, a shady place should be selected where no danger is to be apprehended from the seed being trampled over by human feet or visited by other animals. Under favourable conditions, they are likely to break within a month or so.

The seeds or stones as they are sometimes called, should be sown about 2 inches below the surface, and six inches asunder, and covered over with fibrous vegetable mould. If sown during the rains, no watering is required but the bed should be often examined whether it requires water or not. Constant moisture hastens germination on the one hand, while on the other rots the stone itself. Transplantation being not

necessary until the next autumn, it should have careful treatment in the way of weeding, hoeing and watering. Stunted and weak seedlings must be rooted out and thrown off.

As transplantation promotes the growth of young trees, seedlings should be transplanted several times until the third year since germination. In sifting a second or third time cut off the tap-root carefully and put the plants into a new bed. This operation is technically termed 'Castration,' the object being to induce them to make surface roots rather than underground, the former tending to fructify more profusely than in the latter case. By this operation tall and barren trees have been observed to change their shape and to bear fruits, although it is risky to work upon well rooted and grown up trees, and it is more so when undertaken by a novice. The best and safest procedure would be to 'castrate' the plants when they are too young and in good vigour. Besides the increase in the yield of the trees thus castrated, they form very handsome bushes, spreading branches even from the very lowermost portion of the trunk as is done by a grafted tree.

At least a month or two before the commencement of the rainy season, seedlings required for grafting purposes, should be lifted up from the ground and potted off singly. Let them establish themselves in their new homes and await the season. By lifting seedlings earlier, we save

much of our future troubles that are likely to follow by the death of the unestablished plants grafted. In each lifting a certain percentage, which may be considerable or small, must die ; so they must be given some time between the time of lifting and grafting in order that one may be ensured of the exact number of the surviving plants.

Pots required for potting must be of good size and well burnt, and should have large holes at the bottom. The size must be proportionate *i. e.* neither too long and narrow nor very wide and flat, and see that the plant might get sufficient space to live in it for some time. The necessity of well burnt pots is apparent from the fact that they have the power of retaining excess of moisture due to constant rain, and are able to withstand the danger of being broken as it happens in the case of insufficiently burnt pots. The largeness of the hole at the bottom of a pot should not be considered as of minor importance, for it is regarded as the main passage for the egress of water that accumulates in the pots. If this is not properly attended to, the soil in the pot would soon become damp and uncongenial to its occupier. Another disadvantage that it brings in is, that the water which the pot receives from above, does not find its way to enter into the soil, inasmuch as the capillary tubes either remain overflowed with accumulated water, or become

compressed by its pressure from above. These fundamental principles of gardening should be carefully studied without which one would have to trouble himself much in carrying out its operations successfully.

The operation of grafting strictly speaking 'inarching,' should be performed during the rainy season which commences in July and lasts up to the middle of October. Be it remembered that the period from the beginning to the middle part of the season is the best and most suitable for the purpose. There are some who are apt to believe that trees might be grafted even at the very close of the season which then approaches to cold,—a period when the sap of a tree would not like to run the risk of being confronted with the chill that surrounds and fills the space within and without the slit or joint of the graft. Moreover, in the cold weather, the sap of the stock and scion as well, becomes thick and inert which prevents the point of union from being supplied with the necessary amount of moisture, the want of which brings in a thin layer on each of the two slits. Hence it must be distinctly understood that if, during the thin and active state of the sap which is the only medium for uniting the two together, grafting operation is performed, the result would be satisfactory and successful.

As to the selection of seedlings there exist conflicting opinions, some prefer half-ripened

wood of the previous year ; while others prefer hard and thick wood even five years old. But both parties have strong arguments in support of their respective opinions which we will discuss later on. My partiality for young plants of the previous year has been extreme for more causes than one, the first and foremost among them being their readiness for uniting with the scion in a short time, and as a consequence, requiring less trouble and less care. When the season sets in, take an established and healthy seedling to a tree you like to take graft from, and select an equally healthy branch for scion which must necessarily be of the same age and thickness. Then place the seedling so that it may be easily inclined and adhere to the selected branch of the tree. When a branch is not available close to the ground, the plant-in-pot should be raised by means of a bamboo support or by any other contrivance near to it ; and see if the seedling and scion easily touch each other by a bend. For minimizing labour and trouble, the platform system adapted for grafting answers well. When a large number of grafts from any particular tree is necessary, it is advisable to erect a platform or *Machan* supported by bamboo and wooden poles just beneath the branch that has many offshoots suitable for grafts, and on these *machans* should be spread planks. In order that the branch may not be moved by high winds or storms,

it should be strongly tied with a pole or anything that may serve the purpose.

For taking grafts from lower branches, I have seen in Calcutta and its suburbs, seedlings are put in the ground, but this to some extent objectionable on the score of risking their destruction while removing them after they shall have been united. I am therefore of opinion that the safest way would be to get plants-in-pots.

Let us now proceed with the operation itself. All that is necessary is a sharp knife and a quantity of soft bast, thread, or string. Having these things ready, bring the scion as close to the foot of the stock as possible without injuring it, and mark the points where they exactly touch each other. Then by means of the knife take off the bark with wood slantingly from the sides that face each other of the stock and scion ; the depth of the cut in the middle should not exceed one-third of the diameter of each of them. As for the length, an inch or two will suffice. The portions thus cut out should be firmly held together by the left hand and by the right coiled round with the string very tightly but gently. To prevent heat and moisture passing through, it is necessary to plaster it over with grafting-wax, but the country system is to give a coating of clay. The following two processes among others are easy and had been adopted by the author with success.

I. "Take 27 oz. of common yellow resin, and melt it gradually, so as not to drive off the turpentine. When reduced to the consistency of a syrup add 10 oz. of alcohol. Slake them thoroughly together and pour the mixture at once into a well stoppered bottle."*

II. "Five-eighths of black pitch, one eighth each of the wax of bee, tallow, and resin. Put them together in a glue pot and melt them down over a slow fire."†

Never apply the composition when it is too hot ; in testing its fitness it should be touched by a finger ; should this not cause burning sensation apply without fear of any danger, but be particular that the entire worked part of the graft is thickly covered with it. On several occasions I used only black pitch made thin by boiling in the fire heat which proved successful.

Grafts take a month to two to unite together. When they would appear to have united, the lower part of the scion should be half-cut and allowed to remain a week or two ; if they do not seem to have shrivelled in the least, it should be understood that they are ready to be separated from the tree ; now the stock with scion should be totally separated by another cut, and removed to a sheltered place. An application of the grafting

* Gardeners' Chronicle, April 28, 1860.

† William Paul's Rose Garden.

composition at the base of the scion thus cut will prevent the exudation of the sap.

Another point in grafting should not be overlooked ; it is to select shoots that are to be attached to the seedlings, from the side and lower branches, for they fructify earlier, and more than the perpendicular and upper branches do.

In Murshidabad and Maldah as well, people are fond of big grafts ; the seedlings employed for this purpose are sometimes five or six years old. This evidently requires as much old and thick a branch for scion as the stock itself, and takes a longer period to unite together than usual. Experience has shown that a big tree in a pot cannot receive the amount of food to support itself and the grafted scion ; hence follow the weakness of the tree and delay in uniting. Again it has often been seen that stock and scion do not bear similarity of age or bulk which is an important secret in grafting. Scion or stock that has attained maturity and is hard, can be hardly bent to the desired point, and is liable to be broken by the force applied in bending. Such being the case, the operator is naturally compelled to make the junction wherever they meet together. As I have already mentioned in a previous chapter that grafts are made there a foot or two above the base of a seedling and this is objectionable for more reasons than one, the first and foremost being the difficulty experienced in planting which requires

the join half immersed into the soil, and the propensity of the trees to grow upwards. The arguments advanced by those in favour of the above system, are that the big grafts are stronger and more durable, and that they fruit earlier than the green or half-ripened ones do. The accuracy of the arguments is though partially true, yet considering the time the seedlings take to grow so large, I am equally justified in remarking that the green or half-ripened ones which take less time and require *considerably less trouble and attention, if after being separated from the tree be treated half as much time, will not, I am sure, ignore the advantages which would otherwise have been derived, and at the same time serve the aims and objects that underlie grafting.

Notwithstanding all directions that may be given to the so-called *malis* who are no better than ordinary labourers, they would strictly adhere to the erroneous principles and the empirical methods of their forefathers ; much more they seem to believe that they are experts. Under the circumstances, the reader may well imagine or better feel, if he ever had the misfortune to get such men in his establishment, the difficulties arising from wilful neglect and proneness of habits which stand a barrier in the way of systematic works, and of impressing into their blockheads the successful and advanced methods of modern gardening. To escape the evil outcome of such

circumstances, I would advise the amateur not entirely to depend upon them.

But, however, as far as my experience and observations went, I always attained success with grafts made with stock and scion of the same age which had never been more than a year or two old. Half ripened wood, only a year old, is well suited for the purpose, being neither too hard nor too soft to work upon.

The system of green grafting is accompanied by advantages and disadvantages as well. The solitary advantage that may be derived from it is the short period which a graft would take to unite ; as for the disadvantage, I may mention that a green seedling is likely to undergo a check and to suffer from the effects of the incision ; moreover it requires a careful hand to go on with the operation which but a neat-hand gardener can do with success. The difference arising from those two systems, *viz.* grafting of green plants and half ripened stems, is very little ; the former comes to season a little, say a year or two later. With reference to a communication received by the Agri-Horticultural Society of India on the subject of grafting, the Superintendent of Public Gardens, Allahabad, writes :—"The plant sent was grafted the year before last and you can still see the end of the very thin seedling stock and the complete junction made. With regard to fruitfulness, the trees grafted in this manner have

fruited here. There is no difference whatever in the fruit from those grafted in the ordinary way ; the trees however were a couple of years later in fruiting but they are almost double the size of the other trees of the same age and they more than made up for the lateness in fruiting by the extra quantity of fruit that they gave the first two years in which they did fruit ; they are also of cleaner and stronger growth and in all probability will give heavier crops as they go on. In grafting, two points are to be careful about—1st. to see that the seed is attached to and has not fallen from the seedling to be used as stock ; 2nd. to graft on the semi-hardened wood that is of the last growth of the previous year.”*

About three years before, a few grafts were made on green seedlings in Raesbagh, most of which joined in 3 to 4 weeks’ time, while the thicker ones took a longer time before they were ready. This justifies me in saying that once they are operated up on safely, there was no more fear, and when got down and planted, they established themselves very soon which was apparent from the fact of their making fresh growth with vigour, the percentage of loss from death being at the same time too small or rather nominal.

* Proceedings of the Agri-Horticultural Society of India for August 1887.

GENUINENESS OF GRAFTS.

THE increased love for mangoes and the predilection for mango orchards have given rise to a trade in mango grafts. In the private gardens of nobles and gentlemen, grafts are made to a limited extent, and those even are intended for the owners themselves or for their friends and relatives, outsiders having very limited or no share in the stock. As a matter of course, a trade has sprung up to meet the public demand which is largely supplied by nurserymen and plant-dealers likewise. For the sake of economy, there are many who would like to get grafts from the common plant-dealers, their charge being less than that of the nurserymen. But it must be borne in mind that cheapness leads to adulteration and cheating which low class plant-dealers are well conversant with. A substantial and genuine out-turn should follow cash investment; but in such cases a miserly habit would bring in bad things assuredly. Expense should be no consideration where genuineness of the thing is the object in view. I have often observed in the Calcutta market that these plant-dealers would not hesitate even to give the worst variety that they might happen to have in stock instead of what is actually wanted by the purchaser. To obtain genuine grafts, it would be wise to take from reliable and trustworthy people.

It would not be out of place here to discuss

a point having special reference to the first principles of grafting. Some maintain that the stock and scion should be of the same variety ; to be more explicit, the stock employed for grafting should be of the same variety as the scion itself. But I am at a great loss to find the principle which the opinion is based upon, and I quite differ in this point. In the first place, as has already been said in the previous chapter, there exists a great uncertainty as to the character of the seedlings which might or might not be faithful in inheriting the true merits of their respective parents. Had it not been so, *i. e.*, were the seedling plants to exactly take after their respective mothers, nobody should have great inclination for grafts that entail every year heavy expenses and troubles, and at the same time yield less quantity of fruits than the seedling trees do. I have never observed nor heard of any graft of being improved or degenerated by the employment of seedlings indiscriminately selected. Practice supported by theory has afforded immense proof, since the early days of horticulture, of the fact that the agency of seedlings is simply necessary to support and nourish the graft with the requisite amount of sap ; for some trees and shrubs, that can not always live on their own roots, or if they do at all, are likely to undergo a perceptible change in their true character, apparently from the nature of climate and soil.

It has more than once been asserted that seedlings generally,—mangoes in particular, are apt to ignore their parental character and the reasons ascribed to this phenomenon require less and no further mention than what has been heretofore made. Mr. F. B. Fuller is also of opinion that “if young trees be grown from the seeds of the best Bombay mangoes, the fruit they give will not be nearly as good as that of the parent tree.”* When the seedlings themselves are liable to change, I do not see any necessity for hunting for the seedlings of choice kinds, and it does not matter whether they be of *Fusli*, or Bombay, or any insignificant variety for the purposes of grafting. In this connection, I may mention one fact which I presume will elucidate the point at issue. Some years before, a large and well ripened citron was given me by a relative of mine. The fruit was indeed far superior to the ordinary ones that are available in the market, in its flavour and sweetness, and in its size and substance. I sowed a few of its seeds but four only germinated. For some reason or other two of the seedlings died; of the remaining two, one gave fruits eatable though but inferior; while the other bore fruits in bunches on each branch, but they were so aciduous and bitter in taste that the tree was cut down the

* Agricultural Primer.

fourth year since it fruited first. Referring to the seedlings, Dr. Roxburgh very rightly observes that "there is no depending on the quality of the fruit so raised. The seed of a very superior sort will produce fruit of a bad kind ; and vice versa, hence such an infinite variety."* There are many other authorities that may be quoted here to convince the amateur of the absurdity of the theory. In green-houses as well as out of doors we have many shrubs and trees that seldom or never take root on their own heels but will readily conjoin with others differing altogether in species, without losing sight of the least of their respective origin. We never graft *Aralia vitchii*, *A. elegantissima* or *A. gracilimum* on seedlings or cuttings of themselves ; again *Ipomœa Horsefallæ* is not grafted on a seedling of itself but on a indigenous climber of the jungles ; peaches on indigenous peaches or on plums ; sapota on *khirnee* ; English roses on dog-, Manetti- or Edward-roses ; and it is a wonder that we succeed every day in securing as true grafts as the plants themselves. Hence it is clear and obvious that for grafting purposes no particular kind of seedling is at all necessary but we should prefer indigenous and hardy varieties that would stand the soil and climate of the district. It is a stern fact that the stock has nothing to do with the scion or the graft except for supporting it.

* Roxburgh's *Flora Indica*,

The relation or rather connection that lies between the stock and the scion is yet a mystery.

Regarding the advantages and genuineness of grafts the Tropical Agriculturist writes :—
“But as seedlings are so slow in coming into bearing, and do not always preserve the quality of the fruit, it would be far more advantageous to have recourse to grafting and budding. The great object of grafting is to preserve and multiply varieties and sub-varieties of fruit trees, the qualities of which cannot be transferred with certainty to their offspring by seeds, and which would be multiplied too slowly or ineffectually by any other mode of propagation, as well as to accelerate and improve the fruiting of the trees.”

MANAGEMENT.

It is idle to suppose that our work ceases with planting, but a responsible gardener would think otherwise, because from this time his labour and anxiety increase. The erroneous idea which leads one to neglect his favourites, serves to advance the cause of failure, notwithstanding all favourable conditions in nature and soil as well. It is often seen that individuals take to gardening either for pleasure or for profit at the first impulse of their mind, and would run fast for some time not hesitating even to expend more than was actually necessary ; but as an inevitable consequence, they

soon fall short of energy and leave things entirely to the mercy of the cattle and goats and the men employed. Be it either for pleasure or for profit, it should always be borne in mind that without constant supervision and care, success cannot be achieved. There are circumstances which might sometimes subdue our desires or bring about fresh causes which are calculated to damp the spirits of an amateur. It is also possible that tiresomeness sometimes causes loss of energy, ultimately resulting in sad failure and heart-rending disappointment. As a precautionary measure, it is of the greatest moment to engage experienced and trustworthy men conversant in the business of an orchard. To employ a so-called *mali* and leave the orchard to his mercy, is to indirectly encourage him in doing what he pleases. A poorly-paid *mali* cannot help seeking other means, though unfair, for the supply of his wants; and among these I may mention from my own experience, neglect of duty and stealing of the grafts by themselves by replacing any available tree of mango, of course, in their respective steads, are the principal ones. This abominable custom is not uncommon in gardening. Again, there is a class of people who directly encourage them by bribes for some choice trees that these selfish men desire to secure for themselves. These ignorant *malis* who are half-fed and insufficiently clothed do not alone deserve our unqualified censure, for

the former ought to share it in the same proportion as those who are bribed by them. Besides those who employ men at rather too low rates which never cover their wants of daily life are morally guilty of forcing starvation upon them and are to a certain extent liable to blame.

Then there are the ravages committed by cattle when trees are not properly protected by means of fencing. In most of the gardens, it is often seen that no proper precaution is taken to save the young plants from the attacks of animals which eat away the new shoots and leaves, from the effects of which sometimes the trees die altogether, whilst the surviving ones are greatly damaged, and take some months ere they could regain their former condition. If hedges all round the orchard be too costly, a fence with wide circumference round each tree at a small expense, would answer the purpose. The lattices of the fence must be so closely intercrossed, that even the head of a goat or sheep may not be thrust in; the least touch of the moisture of a goat's mouth seriously injures plants.

It is a wise and economic plan to utilize the intervening spaces in the orchard by growing some temporary crops for the first few years, until the trees shall have grown to a considerable height. This is not only calculated to be a precaution against the attacks of cows, sheep, and goat but also confers manifold advantages, among

which I may mention the constant stirring of the soil by way of crop cultivation, protection from blasts, and lastly the recovery of a good portion of the costs incurred in forming the orchard. But special attention must be paid to the selection of crops, because there are many crops that would soon exhaust the soil, telling thereby heavily upon the trees,—our favourites. The crops like sugarcane, elephant grass, maize etc, are gross-feeders and would in a single season impoverish the soil and rob it of its valuable ingredients. Besides, their vigorous and tall growth, as also those of jute or flax, form a great barrier to the access of air and light to the trees, the want of which may be well perceived by a scrutinizing observer from the appearance of the trees. The intervening spaces might be profitably utilized by introducing the plantain trees that I found giving satisfactory results in keeping up constant moisture in the soil and protecting the young trees from the scorching midday sun by their wide and long leaves which do not at the same time obstruct free ventilation of air or the access of light. Moreover, the nearness of the plantain bushes is taken advantage of by the mangoes in obtaining potassium which is so very necessary for their woody development which contributes to their fruitfulness. The system which the people of Murshidabad follow is opposed to theory and may be said to be defective, the plantain-trees being so closely

planted to the mango ones that in a short time, the former become big bushes obstructing greatly air and light. As the result of my own experience, I may suggest that plantains should be planted at least 4 feet distant from the trees, and 8 to 10 feet apart in rows. The secret of success in the cultivation of plantains lies in the fact that the bushes should be thinned out by separating the young suckers year after year, so that they may not overcrowd themselves or do not in any way interfere with the growth of the grafts; while on the contrary they will yield a remunerative out-turn sufficient to keep up the orchard in good order.

An orchard should always be clear of weeds and jungles which abundantly grow, especially during the rainy season; and for this purpose the soil should be worked now and then by the plough or the kodali. These weeds and jungles rob the plants of the food and prevent the soil in coming in contact with the atmospheric elements. From an economic point of view, owners of many gardens allow *ulu* (*Anthistiria arundinacea*) to grow in them luxuriantly, and as a result, the trees within a few years become unhealthy and leafless, followed by a decrease in the quantity and degeneration in the quality of the fruits. Now, in many orchards it has often been seen that turmeric (*curcuma longa*) is cultivated year after year under the mango bushes,—a practice, we strongly disapprove on the ground that the

fruits greatly deteriorate in flavour by the turmeric. But the owner, being unable to detect the causes of such deterioration, abandons all hopes of his mangoes, laying more stress on *ulu* grass which grow by themselves and are a better paying crop under the circumstances. The more the trees are kept clear of the weeds and the soil open, the more vigorous will be the growth tending to fruit. Shape, health, and fruitfulness are the chief objects to be aimed at, and in order to attain them, the soil should have always kind and proper treatment.

The branches and shoots of a sickly and stunted tree should be chopped off, so that the contagion may not spread along the living parts of the tree. These may appear to be of minor importance, but it must be remembered that they present a most unsightly appearance and sometimes cause an absolute death to the tree.

As on the one hand watering in proportion to the dryness of the soil is indispensably necessary, so on the other, excess of water that accumulates at the base of the trees during the rainy season should be drained out. True it is that a mango tree would stand on flooded land for some months together, but the water that so logs should never be considered to produce beneficial results.

The bad practice of taking grafts from very young plants,—say four or five years old, should be discouraged by every means, because it not only

weakens but at the same time disfigures them greatly. Moreover, the removal of the lower branches causes the trees to grow erect which, as I have pointed out in a previous chapter, is not at all desirable. Again, the question of shape and figure of a tree is not an unimportant one, for a garden is a resort of pleasure and recreation ; so everything therein should have a pleasing aspect to cheer up even the gloomiest mind. The magnificent topes of mango are really refreshing to the eye and an ornament to the garden itself.

Root-pruning and manuring should also be conducted with judiciousness. Wholesale pruning and manuring without any regard to the varieties under treatment, have different effects on each group ; so they must be regulated according to the order of the season of the fruiting of each.

Some people out of fancy allow their plants to bear fruits before they shall have arrived at maturity. This most assuredly exhausts the trees. It is advisable that trees under five years should be disbudded. It is not uncommon that grafts come into blossom the second or third year, but a sensible grower ought to be careful in this respect.

Great inconvenience is felt owing to the inaccuracy of the names of trees, and sometimes it so happens that the owner himself cannot single out the particular tree he wants. This is partly due to want of care for the names, and partly to

the conservative idea of keeping them secret, and as a matter of course, he himself forgets the true names, or the man in charge of the orchard dies with the names. It is, we presume, for these reasons only, that we often meet with the same tree differently named in another district or even in another garden in the same district. But it would be of great benefit to the owner himself and his family as well, should he make out a ground plan of his garden on a small scale and mark the spots where the trees are planted, with letters or figures, and record the names against the letters or figures as the case may be, in a small note-book ; a glance at the pages of the note-book would give a correct idea even to an outsider as to the situation of each tree. This is neither expensive nor troublesome, and once done, it is done for ever.

PESTS AND DISEASES.

The mangoes, fruits and trees alike, are subject to numerous diseases which I shall attempt to deal with in this chapter.

The sombre appearance of the tree bespeaks its healthfulness which can only be preserved by supplying it with the necessary amount of nourishing food and proper treatment. Weakness, poverty of soil, and want of manure and water are the sources of all diseases. A tree in vigorous growth

and sound condition is less liable to any disease than a poor and dwindled one. Leaflessness and awkwardly curled leaves are the first symptoms of a disease ; but it requires patience and judgment to diagnose the true cause and to detect the part affected. When any particular branch or shoot is affected, it may be decided that the disease is confined to that particular branch or shoot, whilst an entire tree presenting similar appearance easily leads one to conclude that either the trunk or the roots must have been affected by insects or grubs. The root-disease, which works at ease and with much rapidity into the entire tree, should be eradicated with as little delay as possible. The earlier are the measures taken, the less would be the trouble and risk.

In the year 1888, a number of mango trees had been attacked by grubs in the gardens of the Cossipur Horticultural Institution with which I was then connected. After an active search the affected part of each tree was detected. A small hole about the size of the head of a nail led to my investigation. With a sharp and pointed knife, I split open the affected parts, and followed the longitudinal, sometimes horizontal bores that the grubs had made into the branches, by opening the bark and wood until they were detected at last. From the very appearance of the grubs it was remarkable that they could have endured and outlived the hot iron rod which was thrust into their

respective holes, and that how long had it taken them to work up so long an aperture through the wood. The bores that were made longitudinally were convenient for the purposes of my operation, but those worked horizontally, could not be splintered without causing injury to the tree. Persistently striving to remedy the evil, I made bores a little wider by means of a carpenter's tool, so as to enter into them the rose of a syringe; then a strong and lukewarm solution of tobacco mixed with soap-suds was applied over and over again, until the grub came out dead, or as in some cases half dead. The application was repeated for a few days more, because it was feared lest the eggs, which the grubs might have deposited within, should come into life and continue the ravages commenced by their predecessors. When it appeared that the eggs had perished, each hole was plastered over with bees' wax.

The trees that appear to have been attacked at the roots should be specially dealt with, and as an important measure, the base of such trees should be carefully dug to a considerable distance and depth, taking sufficient care not to hurt the roots; and if necessary, a certain quantity of earth should be removed from around the stem, so that the roots might come in contact with air and the sun. In the meantime endeavours should be made to detect the affected parts and to remedy the disease

by cleansing and washing the portion with soap or a weak solution of sulphate of copper. When it will appear that the disease has been properly remedied, the roots should be covered over with fresh soil intermixed with some limy manure, such as bone-dust, weak lime, or ashes. The root-disease is to be apprehended in the extreme, as it spreads its influences all over the tree, running through trunk, branch, and leaf, resulting in the affectation of the fruits and seeds at last.

The mango-beetle which was long described by Fabricus as *Cryptorinchus mangiferæ*, commonly known as weevil, feeds in its larvæ state upon the pulp of the fruit, and when fully developed and grown with jaws sufficiently strong, penetrates into the seed and devours the kernel. The beetle not only damages the fruit but also by affecting the seed produces unhealthy and sickly plants, which again spread the disease by the production of such diseased fruits. With a view to save the future generations of the mango, it is of absolute necessity that all such infested fruits should be entirely smashed or burnt, or it would take shelter in some corner or crevice until it finds a home for future depredations.

Another class of insects known as 'bugs,' belonging to the genus *lassus*, is most mischievous to the mango crops. According to the learned botanist, Mr. Gollan, Superintendent, Saharanpur Botanical gardens these insects are most "des-

tructive to the mango blossoms, appearing in millions upon the flowers" and "they appear to subsist on the juices of the leaves and flowers, and particularly upon the pollens, etc. But Mr. Frederic Moore of Penge is of opinion that "they are no pollen-eating insects, but live entirely upon the juices of the leaves and young shoots of the tree." However, taking it for granted that they do not live upon the juices of the mango blossoms, we have still every reason to fear the ravages that are likely to be caused to the leaves and then to the fruits and seeds. The numerous galls that are met with upon the leaves are said to be the work of these pests that are known by the name of *Dipterous* and *Hymenopterous*. But there is a conflict of opinion as to the genus to which they respectively belong, for Mr. Cotes, late of the Entomological Section of the Indian Museum, Calcutta, maintains that the *Dipterous* belongs to the *Syrphides*, a family of *Dipterous* insect, while Mr. Moore is of opinion that it may probably belong to the *Cecidomyia*.

It is a two-winged fly, in shape an elongated cone and has eight bands of strong, dark hooks. The grub is eyeless and its hooked jaws serve the purposes of legs. The committee which was appointed sometime ago to investigate into the subject, and a report of which was read at the general meeting of the Microscopical Society and published in the Journal of the Agri-Horticultural Society

of India, is of opinion that this beetle did not appear to them to be a pest of the mango, so far as the uninjured fruits were concerned. But as far as my observations go I can say without any hesitation that this insect was found in many cases in the mangoes of Lower Bengal, particularly of Jaynagore, a village in the Baruipur subdivision, 24-Pergunnahs, which I had occasion to visit during two or three mango seasons. The fruits to all appearance seemed as good as any, while in some a very minute spot or bore was visible ; and when these fruits were cut, the grub inside flew away and the pulp was found completely damaged. These flies have become so numerous that it would take some time ere their extinction could be effected, and their depredations are so extensive that I did not find even a solitary fruit that escaped their ravages. Their work is not confined to any particular part of the fruit, for they, as I have said, begin their operations first with the substance and then go into the kernel. Unless these infested fruits are completely destroyed, the germs that the grubs leave within in the shape of blackish globules spread themselves rapidly. The network of tunnels which contain the excreta and eggs of the insects in such abundance that the substances are seldom eatable, is not uncommon even in the green fruits. The extent to which these grubs work is not to be won-

dered at, for their activity and energy enable them to work and spoil a good many fruits in a season, leaving one after the other. It has been also observed that fruits had traces of their depredations while no worm was to be seen. It may be thus concluded that they leave one fruit as soon as they have finished it for a fresh one and subsequently, that is, when the season is over and unless they die, they take shelter into the adjacent jungles or heaps of rubbish that may lie within a short distance. They appear again in company with an immense number of cohorts next season with renewed vigour for fresh attacks. Curious and sincere observers ought, therefore, to be always mindful of watching their movements with particular care and attention and to check any further spread of these destructive pests.

In many cases, no trace of attacks could be found from the mere appearance of the fruit by which one is sometimes deluded; it is also curious to note that notwithstanding the absence of any spot or sign on the skin, they should have penetrated the fruits; but the inference that is drawn from the fact, is that either the queen lays its eggs into the ovary of the blossoms which most probably envelope them, or that they in their larval state enter the fruits, working inward until their mission is performed and with the development of the fruits, the holes on the skin disappear.

In Murshedabad and other places I have seen many a mango tree having knots on branches and trunks, varying in size from a small play-ball to a large basket. These knots appear to be like the heads of the negroes splintered all over the surface. Such knotty trees are very common at Murshedabad ; I caused some of the knots to be removed from a tree and cut open, and examined them by means of a powerful glass. It appeared to me to be like the skin diseases of animals, caused by ring worms. This knot-disease is peculiar to the mango trees only, because I have never seen any other tree than mango, being attacked by it. It is also to be noted that it is a contagious one and spreads from one branch to the other, and from one tree to another close by it. From what I observed I am of opinion that the density of the trees themselves and want of sufficient air and solar heat in the orchards is the cause from which their worms spring up. Trees or branches thus attacked should be heavily amputated and the knots burnt by fire at once, and in cases where such amputation or shortning is not possible make the branches clean of them and then wash the place with tepid soap water. This wash may be repeated for a day or two more and afterwards apply a thick coat of tar over it.

Exudation of gum is one of the diseases to which mango trees are subject, the young and healthy trees in particular, being much more liable to the

virulence of the disease. I have often marked that vigorous young trees are often attacked by the disease, and the reason assigned is the excess of richness in the soil. Whether it is due to the outburst of superfluous sap or to the attacks of some insects, is yet to be determined. But some of the plants that were so attacked, were examined by me and I have no hesitation in saying from what I observed that the track through which the gum was oozing out was exactly of the same nature as it were worked by some insects. It was however possible that there were insects within either before or after the first flow began. Yet it remains to be observed whether insects precede flow, or flow precedes insects. Whatever it might be, it is certain that a continuous flow of resinous liquid weakens a tree, followed by the shedding of the leaves, and worse than that by the death of the tree at last. As a remedy I should recommend the reader to cleanse the affected part with a fine bladed-knife and to wash it with lukewarm water intermixed with soap suds. Sprinkling of finely powdered sulphur on the affected part proved a success with Rai Setab Chand Nahar Bahadur of Azimgunge, who writes as follows :—

“I cannot but thank you heartily for your recommendation to use sulphur to the mango grafts, as indeed it has saved my grafts. Certainly I made a mistake by not taking any steps earlier, otherwise I could have saved many

valuable grafts which have perished owing to ignorance.”*

In a conversation which I had recently with him at his place, as well as with his worthy son Babu Manilal Nahar, I was informed that repeated application of soap suds only gave most beneficial results. The latter took me to their garden on the other side of the river and showed me the plants that had been so attacked and were thus at the point of death, and when I saw them they appeared as good and healthy as anything. It was due, he said, to the application of soap-water only.

There are several other insects that feed on the leaves and fruits, but it is difficult to enumerate them with their descriptions and other particulars in a little work like this. I therefore refer my inquisitive readers to the valuable ‘Contribution to the study of the mango weevils’ by Mr. W. J. Simmnos, which appeared in the Agri-Horticultural Society’s journal.† As a remedy calculated to prevent in some degree, at least, the insects from their dreadful attacks, I should suggest that burning of heaps of decayed leaves and stubble at the windward side of the orchards when the trees are in bloom is likely to produce beneficial results. Rai Setab Chand Nahar Bahadur is also of the same opinion, and he told me distinctly that on one occasion he

* Journal of the Agri-Horticultural Society of India, No. April-June 1892.

† Vol. VIII., Part II., (new series).

had one of his mango bushes treated in the same way, *i.e.* he had the soil underneath the tree strewn over with weeds and fire set to them. Of course, the fire was not allowed to conflagrate. The next year after the operation, that particular barren tree yielded fruits in great abundance, and since then it has been fruiting well. Mr. W. J. Simmons in his most learned paper as mentioned heretofore prescribes the use of salt manures as an effectual remedy against the attacks of insects. "I am told," he says, "that manuring a mango tree with salts prevents the fruits from being attacked." "I am" he further says, "also told that boring a hole right through the trunk, and across it, and then driving a *plug of wood* into the hole, diffuses the upward flow of the sap and throws it into the branches more effectively than would otherwise be the case ; and that the tree is so invigorated by the operation as to enable it to live down the larva of the weevil." Further more he observes that "in the case of insect-pests, kerosine emulsions have proved efficacious." I have also heard many say that the 'plugging system,' as suggested by Mr. Simmons, has the effect on barren trees in inducing them to bear fruits. This I have not experimented and cannot therefore vouch for its truth. Should the reader try this experiment and succeed in inducing barren fruit trees to bear, he would render an invaluable service to the cause of horticulture.

In the low and moist districts of Nadia, Jessore, Dacca, Dinajpur, Mymensing, and in the southern parts of the 24 Pergunnahs, as also in Assam, different kinds of weevils invariably infest the mango fruits. The bores are in many cases not visible to the eye from the outward appearance of the fruit. In many fruits, it has often been observed when cut or sliced, that blackish thread-like substances abound within. These threads are no other than fibres, but blackishness was surely due to some root disease which cannot be avoided unless roots are properly treated. I did not know if it had any effect upon the stones or seeds, but the taste of the fruit was dull and indifferent.

In the year 1895, some of the young mango plants had been attacked by pests known by the name of *Pylotropidius didymus* belonging to the Acrididæ family, the specimens of which were sent to the Deputy Superintendent, Indian Museum, Calcutta, by Pundit Gokul Das, Superintendent of Forests, Merwar State, Jodhpur, who says, "They have appeared at Jodhpore in a mango and jaman plantation of one year old. They were perceived only a week ago when they began to eat the leaves and bark of mango plants. They have not touched the jaman plants. During the day-time they remain attached to the dry branches of a shrub locally called Siniya or Sangtra (probably one of the *Leguminosæ*) and damage mango plants at night. I am also sending parts of a mango

plant, the bark and leaves of which have been eaten by it. I have burnt the dry shrubs, but in doing this, plants are damaged." In order to remedy the evil the Pundit very wisely burnt weeds in the plantation which proved to be of great effect. He says "about two acres of the plantation were burnt by me, and the ashes sprinkled all over the mango plants. Strange to say, no more damage has been done by the insects. They are still to be found here and there, and the ashes sprinkled over the plants have been washed away by hand-watering, but the plants have not been damaged as yet."*

In summing up this chapter, I am inclined to believe that from the circumstances under which mangoes of Bengal are attacked by various insects, the excess of moisture at the roots, as also in the atmosphere, is the primary source of all pests and diseases. Previous observations have clearly proved to what extent Bengal mangoes are subject to be infested by weevils, whose sphere of ravages is more confined to Lower Bengal and Assam than to any other Province of India. Apart from the natural dampness of the soil and atmosphere, with which they are always charged, even in the driest months of May and June, cloudy and rainy days in the blossoming stage, have the most fatal effects on the mango-crop, for then, and then only it is,

that these pests find the weather most congenial for carrying out their destructive depredations. Mango-growers should do well to burn sulphur, tobacco, tar or cowdung cakes or weeds and jungles in their respective plantations from time to time, especially from the blossoming to the fruiting period. Expensive and troublesome though it may seem, yet considering the amount of the great loss many of us suffer every year, it would be more remunerative and pleasant when a good crop is harvested.

With a view to conduct a systematic investigation into the causes and nature of the diseases, I may in this connection be permitted to suggest that a conference be organised exclusively for this purpose which should comprise representatives from local governments and administrations, agricultural and horticultural societies, land-holders' associations and other such bodies, private individuals also taking part in it. The work of such a conference should be fully recorded and published from time to time in the leading journals until the final sitting of the conference. And to make a prolonged investigation and to improve the cultivation of this favourite fruit, a Mango Society may be formed as was suggested some time ago by Dr. Bonavia, and a journal issued periodically dealing exclusively and entirely with the mango. These I am sure will materially help the cause of mango-growing which has long been treated empirically

from generation to generation without any perceptible change for the better.

CAUSES OF FAILURE.

PAINFUL disappointment, which we sometimes feel by the failure of crops, may be overcome greatly by human intelligence and efforts in the treatment of orchards. Truly speaking, India has very little of systematic orcharding, which, if not stimulated, is likely to degenerate our fruits in the near future. Our orchards are laid out and trees planted, generally very haphazardly, and as an inevitable consequence, there arises innumerable difficulties in the way of keeping them up. Selection of soil and situation, convenience of irrigation and labour, and advantages of personal supervision are of paramount importance for the consideration of an initiative.

Before proceeding further, let us see how the causes might be classified. I have already alluded to the means of success, and it now remains for me to point out the measures, the adoption of which is likely to be preventive of failure.

Success and failure partly depend upon natural causes and partly upon human endeavours. Among the natural causes of failure, fogs, excessive dew, clouds and rains, and diseases are the foremost. These natural obstacles are difficult

to surmount, though I have yet reasons to believe that it is not entirely beyond the control of human intelligence to escape from them. Where our endeavours fail in overcoming the difficulties presented by nature, we must direct our attention to such measures as are calculated to act beneficially, or in other words, selection of the locality should be so wisely made that these natural obstacles can hardly interfere with our orchards. Again, marshy land where water logs during the greater part of the year, is one of the most unhealthy places for mangoes. A bog is also a source of various kinds of diseases which so often visit the orchards of Lower Bengal.

It is seldom seen that the mango orchards are systematically treated and the reason is self-evident. We know many instances in which amateurs on the impulse of the moment lay out orchards without taking into consideration the various difficulties in the way of gardening. Some select a site in the most inconvenient locality where no irrigation is possible, or at least with the means he has at his disposal. While others will go in search of a plot of land for a garden at so great a distance that he will not be in a position to supervise it even once in a fortnight. There are many gardens left entirely to the mercy of the *malis*, who would invariably loiter

without taking the least care for the garden for which they are paid.

As a matter of course, orchards should be properly supervised, and all works timely done. Manuring, watering, weeding, ploughing and pruning are also of great importance, and should be performed exactly when they are required to be done. The season and operations help each other,—the one without the other will be of very little or no avail.

Though we may do without manuring, watering, or pruning, yet weeding and ploughing are indispensibly necessary. The entire surface of the orchard should be clear of weeds, and the soil often stirred; a neglect of these is sure to degenerate the trees themselves. When they have once run wild, it would be too late then to adopt means for reinstating them. In gardening, no work should be left in arrears. The more it is cared for, the more are our efforts turned to good account.

Beware of the *malies* who are generally the most mischievous of pests or enemies of an Indian garden. They not only neglect their duties but would not even scruple to rob and sell the choicest grafts, replacing them by any ordinary seedling or graft of mango of course, that may be available. The fruit they will eat, carry it home, and sell it mercilessly, keeping the surplus, as it were, for their masters. The amateur who cannot devote some time in supervising the works of his garden per-

sonally should not undertake them at all, and should he still persist, it would be nothing but wilful and premeditated squandering of money and thus setting a discouraging example to others.

HARVEST.

AS the period of ripening of the fruits is not the same everywhere and with all the varieties, it is not possible to determine any fixed time for harvesting. In general, mangoes ripen during the rains, commencing from July, and lasting up to the end of October. Again, there are varieties fruiting all the year round and are called in vernacular *Baromasia*. In the Flower Shows at Calcutta, ripe mangoes though forced, are exhibited every year in February, and we have known that they are sent down from Guzrat and other places in the Bombay Presidency. They generally form the centre of attraction in the fruit section of the exhibition, but they are invariably found to be most acid in taste and fibrous in the extreme. The only reason for their being so much admired by the spectators is their being grown out of season when the mango trees in Bengal only come into blossoms.

The qualities in taste and flavour greatly depend on the time of harvesting. Too early or in their green condition the fruits must not be

collected, as we often see done by many. It is not difficult to distinguish a ripe fruit from a green or immature or unripe one. Whatever may be the variety be, it must change in colour when ripe, and when they arrive at such a stage, they should be harvested and taken into a room which should be dark, but not damp. The exposure to light after they have been harvested has the tendency of producing toughness in the fruits, losing at the same time much of the juice contained therein. The sap or juice, when the fruits are on the tree, remains active and is utilized by the fruits in making up the last stage of its development. As fruits are liable to the baneful effects of dampness, one must be particularly careful in keeping them in a dark but well-ventilated room.

As fruits begin to ripen, they should be individually collected by means of a netted-bag attached to a long pole. This prevents the fruits from falling upon the ground. A fall on the ground deteriorates the quality of the fruit. This is a very simple and inexpensive contrivance for collecting fruits in India ; and I have no hesitation in recommending this rural apparatus for the purpose. The rayyats generally collect fruits from the trees in the afternoon, and they require two things for the purpose, namely one pole as described above, and a basket or a gunny-bag to keep them in. Before plucking, they inspect the fruits individually and break only

those that appear to have ripened. This is best done by holding the lower end of the pole by hand, each mango being inspected, the fruit that has ripened or is expected to ripen in a day or two is carefully secured in the netted-bag on the pole, which being pulled, the fruit falls in. He now proceeds to a second, then to the third and so on until the bag is filled up. It is then brought down and the fruits are taken out and put into the basket or gunny-bag that hangs at his back ; thus the fruits escape from falling upon the hard surface of ground. As they are much injured by such fall, it is not at all advisable to collect them by shaking the branches or shoots.

Fruits fresh from trees are not so palatable as those properly cured or treated in '*jag*' as it is called, for it has often been observed that fresh fruits, having the sap yet flowing in them, are neither suitable to taste nor agreeable to the stomach, but become most delicious and pleasant after they have undergone careful curing. Though the process of curing is very simple yet it requires some attention and care, without which well ripened and well seasoned fruits can hardly be obtained. For curing purposes, select such a room or shade as is free from dampness and has access to ventilation. In case the house appears to be damp, it should be planked at least two feet above ground or a platform made of bamboo or such materials ; on such platform or on a dry floor spread out the

leaves of *Sheora* (*Trophis aspera*) or *Debdaru* (*Guateria longifolia*) or lichi, and arrange the fruits in layers, never placing one above the other or touching one another. Then, examine the collection twice or thrice every day so that they may not be over-ripe. In order to ascertain their perfection, they must not be pressed hard by the fingers, for this is a practice of a very rude character and should only be continued by the unprofessionals; a sensible man will hardly spoil his fruit by such an awkward practice in examining them. As said before each fruit should be examined and handled, so that each may have the chance of being turned over. When allowed to remain as they have been kept, they are most likely to rot at the lowerside, or ripen imperfectly; the reason, which is not far to seek, is that the entire juice, accumulating at the bottom is not within reach of the other parts of the fruit. Again, in order to obtain fruits ripened to perfection, a necessary amount of light and heat in the shade should be secured. The amateur should take heed in removing immediately any damaged or rotten fruit that might happen to be in the collection; for this contagion is likely to spread among others of the lot, spoiling them to his utter disappointment. In the process of curing, each fruit is to be the object of special care and attention, which if properly bestowed, are amply repaid by its flavorful juice and agreeable substance at the very smell of which the mouth waters.

In this connection, it will not be out of place here to give a short direction as to the best manner of curing mangoes. As in the animal, so in the vegetable kingdom, there is heat in every living object, and fruits are not an exception. It is therefore good to allow the fruits, as soon as they are gathered a good soaking in cold water for at least an hour, so that the heat within them, may be absorbed by the surrounding water. This not only makes them cool but renders them agreeable to the stomach also. After washing and cleansing them well in water, wipe away the moisture by means of a soft and fresh cloth and spread out as directed.

For the spoon or table uses, fibreless mangoes are best preferred, while those who are partial to suck the juice, like fruits with fibres which are replete with the juice, bringing in a current in the mouth of the eater. Though the latter are considered most repugnant to the taste of a polished and refined eater, in reality, they are superior, so far as the quantity of the juice is concerned, to the fibreless fruits of our civilized days. The Marchioness of Dufferin has very graphically described the Indian system of Mango-eating,* and we could not but burst into laughter, when going through that portion of her interesting work.

* Our Viceregal Life in India, by Marchioness of Dufferin and Ava.

MARKET.

THE demand for mango has been, of late years, steadily increasing among all classes of the people. The increase in the demand is due to two causes ; firstly, the decline in the class of mango-orchardists, who have mostly given up the occupation and, as a consequence, the quantity of the outturn from want of proper care has fallen short considerably ; secondly, the existing orchards are not sufficient for meeting the demand of the constant increasing population. Hence it follows that the annual yield cannot keep pace with the needs of the population. However, to keep the market well supplied with mango there should be an extensive cultivation of the fruit, which stands first in the estimation of the people of this country. It not only forms a delicious food of the opulent and grandees, but, those, who have ever lived in the mofussil, must have studied the wretched condition of the poor rayyats, who, during the greater part of the season, live almost on the mango. Moreover, during scarcity they can well live upon them—and them alone,—for some time together with their large number of dependants. But the mangoes which they use are generally of inferior quality. The middle class of people also consume a reasonable portion of it, whereas big and wealthy classes and the Europeans use only the selected and choice kinds. It is not un-

frequently seen that the *Fuzli* sells at from Rs. 12 to Rs. 25 per 100, while the *Langra*, the *Maldah*, the *Bombay*, the *Choonakhali*, are sold from Rs. 4 to Rs. 12 per 100, and worst and insignificant kinds sell from 12 ans. to Rs. $1/8$ per 100. There is no fixed price for any particular kind of mangoes, for it is subject to fluctuations according to the quantity of supply in the market.

For purposes of profit, it is a wise plan to plant such varieties as come late into bearing, they fetch much more than the early kinds; but for the keeping up of a succession of fruits during the whole season from the beginning to the end, all the three groups must have reasonable area of land, so that the market may have constant supply from the orchard without cessation. In the months of June, July, and August, our markets and road-sides are crowded with mango-dealers heaping up tens of thousand of mangoes in their full display. The chief mango markets of Calcutta are Barrabazar and the river-side, besides many other markets in the city. This efflux of mango from all directions of the country presents a grand exhibition of mangoes for some time in Calcutta. In this season hawkers,—the hawkers of miscellaneous articles in other seasons,—will sell mangoes only, and they are so large in number that one would see in every street a hundred mango-hawkers within a short time passing through with a basket of mango over their respective heads. In the

morning, scores of boats loaded with mangoes, border the riverside, and the wholesale-dealers thronging there for settling the price or in taking delivery of their merchandise,—the mangoes. The carts over-loaded with them, passing through the streets from one market to another or to some town or village market in the interior of a district. The railway waggons are not exempted, for the Companies make special arrangements for carrying them from remote districts to Calcutta. In Rajhat, which also forms a centre of mango, where in like manner mangoes come from the most interior parts of the district. The mangoes of this place are also noted for merit. In Khagra and Bhagawangolah in the Murshidabad district mango marts are also held during the season ; moreover a good many dealers visit Maldah, Murshidabad, Durbhangha and other centres of mango for the sole purpose of making large purchases of mango which they invariably send down for the supply of the Calcutta market.

Though no statistics could now be obtained of the mango trade, yet at a rough estimate, one would find that from 10 to 20 lacs of Rupees are annually laid out in India, Murshidabad alone contributing a lac, if not more. About the middle of July last when I visited Durbhangha I had the occasion to witness what a large quantity of mangoes are daily despatched from the town of Durbhangha alone. The platform of the railway station be-

comes almost impassable owing to the out-going parcels—large baskets filled by hundreds with mangoes—awaiting the arrival of the train. Roughly speaking, we think, Durbhanga with its neighbouring villages annually exports mangoes worth 20 to 30 thousand rupees. Considering the vast amount of business that is transacted with mangoes, our attention ought to be directed in its further development. As a practical means for the furtherance of this object, it occurs to me that systematic organizations in the shape of “limited companies” might be started to carry on a trade in the remotest parts of the country, as also with Europe, where each mango of intrinsic merit sells from 6 to 12d. Such companies, as I believe, are most likely to flourish in a short time, leaving a reasonable margin for damages and freight. Before setting about recklessly in the affair on a large scale, I would suggest that an experimental beginning might be made. The only difficulty that lies in the way of its success is the arrival of the fruits at their destination without being perished or damaged in large numbers, and as a precautionary measure, the greatest care should be taken in packing them. For the present, some enterprising gentlemen would do well to form themselves into a body with a small capital to start with, on a very small scale, enlarging it gradually as success is achieved in their safe arrival and the market is established there. In the meantime, orchards

may be formed in different parts of the country, especially in Bombay presidency, where such trees should be planted the fruits of which are known to be able to stand the long and precarious journey across the Atlantic.

The export of Indian fruits to Europe is not an impossibility when it has been observed that Australia sends out her fruits annually to India with so much success. Whatever might be the expenses of cultivation, freight, and other charges, I am confident, they would be amply recovered together with a reasonable margin for profit. In the shops of England each mango sells at 4s. as Dr. Bonavia says in his article on "Oranges and Lemons of India."* A few years hence the learned Doctor directed his attention to the important question of mango trade, and opened communications with the Government of the N. W. P., requesting them to take up such measures as were feasible in giving a stimulus to the cause, but unfortunately the latter declined to interfere with it on the ground that the people were already taking an active interest in the matter,† and, as a consequence, his valuable suggestions fell to the ground. Were it not India, the suggestion would certainly have taken a definite and practical shape in the way of a regular mango-trade by this time at the hands

* Journal of the Agri-Horticultural Society of India, Vol. VIII., part II.

† Journal of the Society of Arts, July, 1888.

of private enterprisers. I have just clearly shown the difficulties that stand in the way of the proposed trade and also the measures to surmount them. I will now urge upon my countrymen to take up this particular branch of business as an experimental speculation, the success of which will no doubt open up the gates of a new industry.

Besides foreign trade, what other benefits might be achieved by such an organization? The internal trade will improve, the method of cultivation will be developed, and many novelties appear. Unless any article comes under the category of business, it is almost superfluous to expect any improvement in it, and so long as it remains exclusively in the hands of the illiterate rayats, who are not inclined to do anything opposed to the systems followed by their predecessors, it is not at all possible that any material advantage would accrue, even in a century I may say. In the hard times of the present day, when every article is so dear, labour so expensive, no stone should be left unturned in search of new industries, no matter if failure even ensues. These ideas can hardly enter the dull heads of our famished or half-starved rayats; it is therefore necessary that our educated countrymen should take these matters into their serious consideration.

Why a good many choice varieties of fruits and grafts of mangoes are not available in the market is not far to seek. Excepting a few kinds of choice ones, the public have not the advantage of other

varieties that abound in the orchards in every part of the country. The popular tendency of the people of keeping the choice kinds strictly reserved for their own, is a great obstacle for the distribution of choice and rare kinds. I have also heard at Murshedabad many say that in the former days, an owner of a mango orchard would scarcely part with a single fruit, when giving to any outsider, without destroying the stone by means of a hot iron rod !

PACKING.

IN order to carry on a trade with other countries successfully, the primitive system of packing should be abandoned. It is neither wonderful nor impracticable to send out our surplus mangoes to other countries with as much success as the Australians export their fruits to India or Europe, or the Peshwaris bring in fresh fruits, such as grape and strawberry to Calcutta every year during the cold season, and which form the rich dish of the Europeans and natives alike. In order to test the standing power of mango, the author tried several methods of packing, and he is delighted to be able to say that out of many, he succeeded in two in keeping them well for more than 15 days together, and in one instance, more than 20 days. The processes were as follow—

(a) In every case, first pick out such fruits as have not been injured in the least, and examine each fruit individually. Then heaping them up for a few hours to sweat, spread out for an hour, so that the heat within may subside by the time. After which washing in clean water, wipe them by means of a fresh cloth and allow them to remain in the house for some time, in order that they may dry. Now spread out paper in a tin box and give a layer of sawdust, over which place the fruits one by one until a layer is complete, when give another layer of sawdust and so on until the box is filled up to the rim. The last layer must be of sawdust and at least 3 inches thick. Done this, cover up the lid air-tight, and keep it in a dry but cool place.

(b) Following the preliminary process up to drying the washed mangoes in the air, entirely wrap up each fruit by means of newspapers or printed papers and arrange them in a tin case previously matted with dry hay by alternate layers, finishing the top with a thick layer of that material only. As soon as it is done, seal the tin case hermetically, and put it in a wooden case, so that it may not be disturbed during handling or transit. Of these two processes, the latter gave most successful results. In the former case, it was detected that the sawdust was not as dry as it ought to have been, and it was perhaps for that reason that some of the fruits were found rotten, but when the rest were

taken away and kept again similarly, they again lasted about a week.

DIFFERENT USES OF THE FRUIT.

BESIDES their use as ripe-fruits, mangoes are employed in very many other ways. In their green condition, they are used by the natives in meals. The fruits are cut into pieces and boiled in water, some spices being given to it, and taken with relish. The watery juice thus prepared, forms a soothing drink during the hot months of April, May, and June. It is also said, it keeps the body cool, and counteracts the scorching heat of the sun. In the United-Provinces where heat in that season is severe, pulp of boiled mango rubbed on the skin, effects much in resisting the fiery blasts called *Loo*.

An agreeable syrup is also prepared with the boiled pulp intermixed with refined sugar and a nominal quantity of salt. Little rosewater, a piece of ice and a little of *keera** will add to the excellence of the consistency.

Roasted fruits are considered and prescribed by physicians as being an effective remedy in heat appoplexy.

Amchurs are made from green mangoes cut into pieces and sun-dried, to which mustard oil,

* Water distilled from the flower of *Kia* (*Pandanus odoratissimus*).

chillis and salt are added, and kept up for a month or so, so as to allow them to absorb the ingredient as much as possible. They are used afterwards as such or added to the curries. The sweet-acid taste is really refreshing.

Another preparation of mango with various ingredients forms a thick consistency called *kasundi*. It is much liked by the people.

Many other kinds of *tarts*, *jellies*, *chutnees* and *pickles* are made and exported to Europe every year.

Jam is prepared from ripe mangoes squeezed, and the thick consistency is made free from fibers and impurities that might happen to be in it, by seiving it through a fine cloth and laid out in the sun on *tattees* or plates. When the water dries off, it is cut into reasonable sizes and brought to market for sale. The thickness of these 'breads' if I may call so, varies from very fine to about quarter of an inch, according to the pleasure of the makers, and this is done by giving repeated layers over them, when they have been partially dried. It is one of the high attainments of an accomplished Hindu lady to make different preparations from mangoes to perfection, as well as other domestic works, such as needlework of the old days, cooking &c, and it is really a satisfaction that almost all the Hindu homes are proud of having such illustrious ladies. The girls are also taught in these things until they leave their father's home after marriage.

In times of scarcity, mango forms a healthful food to the people, though for a short time. The kernels of the fruits are boiled and eaten,* also made into *chapatis* or breads by the poor people during famines. In Durbhungha, I have seen this year—the memorable year of great and widespread famine,—boys, girls, and adults traversing the streets and markets with baskets on their heads or waistes to gather seeds of mangoes for the purpose.

The extract of the bark of the tree in its various forms, is a valuable remedy for dysentry and diarrhœa and is considered antiscorbutic.†

From the bark and leaves a yellow dye is obtained which is not in much request.

A LIST OF MURSHEDABAD MANGOES.

Ali Buksh;—a rare mango; named after the owner of the garden in which it grew, but that garden is now attached to the estate of H. H. the Nawab Bahadur of Murshidabad. Fruit round; weighs from half to a pound; sub-acid in taste, and very favourite to the Nawabs; an intermediate variety; ripens in July and August, and sells from Rs. 5 to 10 per 100.

Atai;—a rare kind; flesh very sweet and tender.

* Roxburgh's *Flora Indica*.

† Watt's *Dictionary of the Economic Products of India*.

Beera;—the only tree is in the collection of one Sitla Bibee of Ichchagunge, Murshedabad, and is now owned by Nawab Khakr Mirza Bahadur *alias* Buddhun Sahib. Fruit exceedingly good ; sells at Rs. 16 per 100.

Bijnour Safeda;—skin whitish green, flesh pink ; medium sized ; a delicious variety.

Chini sukker;—skin of light magenta colour ; substance pink ; sweet, juicy and fibreless ; aroma like sandalwood.

Char-ki-champa;—fibrous but juicy ; smells like *champa* flower ; very rare (in the collection of Rai S. C. Nahar Bahadur of Azimgunge).

Do-anti or the two-seeded ;—a peculiar variety, each fruit having two stones, one as usual and the other in the so called tumor ; not of any special merit (in the collection of Rai S. C. Nahar Bahadur).

Dauddbhog;—parentage not traceable. The original tree is in the garden of Sidi Darab Ali Khan Bahadur. Fruits cylindrical, scarcely exceeding 8 oz. in weight ; yellowish, and very delicious ; ripens in August, and sells at Rs. 8 to Rs. 10 per 100.

Doodia;—has several varieties closely allied to one another ; substance whitish, and fibrous, but very sweet and replete with juice. The best of the *Doodias* is in the garden of Miah Ambar, which is now owned by H. H. The Second Prince (Majla Sahib) ; an early variety.

Gul-sukri;—cone-shaped ; skin apple-coloured ; pulp very sweet, having the fragrance of rose ; fibreless ; stone very thin.

Kohitoor;—the pride of Murshedabad. It found its way into the garden of H.H. Nawab Hossein Ali Mirza Bahadur, the Second Prince. There is an anecdote in this connection *vis.* that on one occasion, a *Unani* physician, Hakim Aga Muhamed, had sent a present of some choice mangoes to the Prince, who, after using them, found one to be the best in the lot. The Prince, who is known to be the first mango-tester in Murshedabad, offered Rs. 2000 for the parent tree, since then it has been in his possession. By some it is maintained that *Kohitoor* is a sport from *Kálápáhár*, but there is a great departure between the two. It is oval in shape and weighs sometimes 18 or 20 oz. Of all the indigenous mangoes of Murshedabad, there are about 25 varieties of the first class, and of these, *Kohitoor* ranks the foremost place and is very rare.

Kálápáhár;—how and by whom this splendid mango was introduced is not known. The parent tree is yet to be found in the garden of the late Sidi Darab Ali Khan Bahadur. It is supposed to be a variety from Mirzapasand. There is a *Kálápáhár* in the Maldah group which greatly differs from the *Kálápáhár* of Murshedabad, the leaves of which

are narrow and shining; stems blackish. Fruit weighs nearly a pound; skin very thin, substance very sweet, juicy and fibreless. Stone, thin and small. No change of colour on the fruit is visible even when the fruit is fully ripe; flavour exquisitely delicious.

Kharmuza;—there are very few trees of this variety in Murshedabad. It has the merits of a first rate mango; moreover it is agreeably flavoured like musk-melon. The original tree is at Chunakhali (Murshedabad); its crop is sold annually from Rs. 250 to 300, and in the market it sells at Rs. 5 per 100. Fruit weighs 12 oz. each.

Khysapath;—originally came from Maldah, but has become so much acclimatised and changed in the soil and climate of Murshedabad that it may be now fairly called a distinct variety; shape long and nosy; well grown fruit weighs a pound each; bears much similarity to the *Amritbhôg*, and keeps a long time, hence suitable for transport to distant countries; ripens in July.

Khanam-pasand;—the time of its introduction is not traceable; strictly confined in Fouzbag, a garden attached to the Nizamat State.

Mejidi;—sweet and juicy but fibrous; keeps a long time and suitable for transport to distant countries (in the collection of Rai S. C. Nahar

Misrikund;—the author is exceedingly partial to it; shape oval and flat; stone very thin; fibreless, sweet and most delicious; flavour exquisitely agreeable; weighs 3 to 4 oz.

Nazuk-badan;—very delicate and can hardly stand much handling, hence it is named *Nazuk-badan* which means shy-faced; so susceptible to the touch that it would not bear the least toss of the finger; shape long; colour yellowish; weighs from 8 to 12 oz.

Nazim-pasand;—growth of the tree is upright and straight; it was much favourite with the late Nawab Humayun Jah, at one time Nawab-Nazim of Bengal, Behar and Orissa, the grandfather of H. H. the present Nawab Bahadur of Murshedabad. It makes excellent *polao*. Well grown fruit 8 to 10 oz.; shape round, colour yellowish; ripens between June and July. It is said that in former days, there used to be held private mango competitions in the Nawab Durbar, where it always held the foremost place. Amongst others there are two well grown and fruitful trees of this in *Raesbagh*.

Phaykalbayan;—a delicious variety; weighs about 8 oz; colour allied to vermillion red.

Pirgachia;—fruit large, skin green; fibreless and sweet; weighs about 32 oz.

Raja-pasand;—fruits very large; stone thin; substance pink red; a "ver"

kind. (In the collection Rai S. C. Nahar Bahadur).

Sarda ;—small fruited but profuse bearer; skin and flesh yellowish ; sweet, juicy and cool ; a very desirable variety indeed. The only tree is in the collection of Raja Ranjit Sing Bahadur of Nashipur, Murshedabad.

Sarvati ;—large, juicy and fibreless ; flavour exceedingly nice, and cooling to the taste. The parent tree is still in the garden of Lohigunge Mohanta.

Talabi ;—one of the late varieties ; skin yellow, flesh rich yellow ; sweet and juicy and a very suitable dessert for the table ; of peculiar aromatic flavour. Original tree is owned by Nawab Jain-ud-din Khan of Murshedabad.

Tota ;—there are two kinds of it, the difference between the two being in size, one is large and the other small ; the best of the kinds is in Harigungebagh, formerly belonged to Her Highness Nawab Raesunnisa Begum Sahiba. Size long ; weighs about 16 oz ; of light sulphur colour when ripens ; skin very thin ; fibreless ; stone small ; very early, ripening in June.

In order that the amateur may have an idea of the varieties Murshedabad alone possesses an exhaustive list which is given below :—

A

- 1 Amritabhôg.
- 2 Anupan.
- 3 Absara.
- 4 Ali-pasand.
- 5 Ata-pasand.
- 6 Afinghi.
- 7 Amir-pasand.
- 8 Asmantara.
- 9 Amrud.
- 10 Anardana.
- 11 Angna-bahar.

B

- 12 Badshah-pasand.
- 13 Baromesia.
- 14 Batasa.
- 15 Batavi.
- 16 Buxoo-pasand.
- 17 Brindabani.
- 18 Begum-pasand.
- 19 Bemli.
- 20 Bell.
- 21 Bhowani-chowras.

C

- 22 Chapti.
- 23 Charukhasa.
- 24 Choosni.
- 25 Champa (Choonakhali).
- 26 Chini-champa.

D

- 27 Daudbhôg.

E

- 28 Emam Bux.
- 29 Elairhdana.
- 30 Enait-pasand.
- 31 Ferdous-pasand.

G

- 32 Gulkund.
- 33 Gourjit.
- 34 Golapjamun.
- 35 Gorla.
- 36 Gairamardan.
- 37 Golabi.
- 38 Gungaprosad.

H

- 39 Hiralal Bombay.
- 40 Hossein Bux.
- 41 Haujeh-kusr (Raesbagh).
- 42 Halua-doldol.

K

- 43 Kakatua.
- 44 Katgulia.
- 45 Kalooa.
- 46 Kakchia.
- 47 Karanja.
- 48 Karkaria.
- 49 Kalmegha.
- 50 Kudrak-khasa.
- 51 Kanchan-khasa.
- 52 Khaja.
- 53 Khanum-pasand.

L

- 54 Larooa.

M

- 55 Meah-pasand.
- 56 Motia.
- 57 Martaban.
- 58 Majlis-rowson.
- 59 Moh-sahib.
- 60 Molamjam.
- 61 Mohunbhôg.
- 62 Miti.
- 63 Mali-pasand.
- 64 Modhubilas.
- 65 Madrasi.
- 66 Mayla.
- 67 Maniakhasa.
- 68 Maulsari.
- 69 Mirza-pasand.

N

- 70 Naonehal.
- 71 Nawabi-pasand.

- 72 Patbatia.
- 73 Pearaphuli.
- 74 Pimprakul.
- 75 Papayr.
- 76 Pata.

R		
77 Rani-pasand.	91 Saptalu.	
78 Rahupeti.	92 Shower's Bombay.	
79 Ramtanu-khasa.	93 Shah-dowla.	
80 Raes-pasand (Raesbagh).	94 Sultan-pasand.	
81 Ratan-kewa.	95 Shahtut.	
82 Ramgati-khasa.	96 Swasia.	
S		
83 Sravania.	97 Soraiya.	
84 Sipia.	T	
85 Siradar.	98 Tia kata.	
86 Saga.	99 Tota-mukhi.	
87 Sadek-pasand.	100 Tund-khasa.	
88 Sinduria.	101 Turbuza.	
89 Sarenga.	102 Taru-pasand.	
90 Subja.	U	
	103 Umda-khasa.	

Mr. Soban Ali Khan, a Zaminder of Hajipur has been pleased to furnish me with the following list of mangoes which are indigenous to that district.

Antochat ;—a very large variety, sometimes grows as big as 32 oz ; ripens in July. Shape round, skin thin, flesh yellowish, and stone small ; introduced by Hardwan Choubay of Hajipur.

Bhadaya Munshiwala ;—a late variety lasting till the middle of October ; fruit round ; skin thick, flesh whitish and sweet ; stone small ; weighs 12 oz.

Dadh mungoo ;—about 12 oz. in weight ; ripens in July ; skin yellow, flesh white, very sweet and juicy ; very prolific, bearing in bunches.

Gal Sing ;—a late variety, giving fruits till the middle of October, though they are not larger

than 8 oz. in weight ; shape long, skin thin ; in other respects do not differ much from a *Sukul-ka-Bhadiya*.

Golab-khash ;—a very delicious variety giving out the fragrance of rose ; size elongated, skin thin, yellow. Named by Moulvie Sadik Ali Khan of Durbhungha.

Kálápáhár ;—shape cylindrical ; flesh pale yellow ; sweet but with little sourness ; stone small ; ripens about the end of August ; weighs 32 oz.

Kathambi Sobhan Ali Khan ;—a second early variety, ripening in July ; skin entirely red ; flesh hard, and red ; stone small ; very sweet and most delicious ; weighs 24 oz ; named after the famous mango amateur Mr. Sobhan Ali Khan Sahib of Hajipur.

Kartika Jaffer Shah ;—long but flat ; skin thin ; flesh red ; very juicy and of agreeable flavour ; a late variety coming into season in October. Named after Mir Jaffer Shah of Badhanpur, Muzaffurpur ; weighs 24 oz.

Laldarma ;—24 oz. in weight ; an early variety ; skin red ; substance extremely sweet ; flavour highly agreeable ; originally came from Durbhungha.

Langra ;—means lame or crooked ; a very fine variety and one of the first rate kinds, green, and thin ; very sweet, fibreless, good flavour. Stone small. Named /

the parent tree is crooked.* (For further particulars see page 41).

Lat-kampi;—ripens in July ; weighs 8 oz. ; skin and flesh yellow ; very sweet, and a desirable variety ; stone small.

Maharaji-ladua ;—about 24 oz. in weight, shape round ; skin yellow, flesh white, very sweet and juicy. It is said to have been named by H. H. The Maharaja of Durbhunga.

Maharaj-pasand ;—ripens in July ; weighs 4 oz. ; shape round, colour pink ; substance light yellow, stone small ; very rich in flavour like camphor. Being very favourite to him, has been probably named after H. H. The Maharaja of Durbhunga.

Madkupia ;—form cylindrical ; flesh very sweet ; stone small ; named by Panditji of Hajipur.

Mithua ;—early variety ; fruit small ; very sweet and of excellent flavour ; stone small ; very prolific ; named by Reza Mirza Hossein Khan, of Dandreanagar, Hajipur.

Mahbub Kelwa ;—shape elongated, colour of the skin partly red and partly yellow ; juicy and sweet with very little of sourness ; very delicious ; weighs about 8oz. ; an early variety.

* Babu Hari Mohun Bannerji of Durbhunga remarks "the original tree, which is famous by this name still there a very old and majestic tree. The fruits of which sell separately for hundreds of rupees a year. The *Durbhungha-Malda* is generally known in Calcutta by the name of *Laingra*, but it is not other an intermixture of both."

Rahim-pasand;—elongated in shape; skin thin; very sweet and juicy; named after Rahim Buksh Khan of Modhaul, Hajipur; an early variety; weighs 8 oz.

Rarhi;—long and flat; flesh pale white, and sweet; weighs 8oz.; available till September.

Shah Joginag;—long but crooked; juicy; stone small.

Sridâhan;—flat; colour of the skin and pulp light orange; extremely sweet, and of a very agreeable flavour; ripens in July; introduced by Shaik Mukhdum Buksh of Jarhnah; weighs 8oz.; a desirable variety.

Sinduria Bhogwan Singh;—colour of the skin partly yellow; very sweet and juicy; stone small; named after its rich red colour, and its introducer Bhogwan Singh of Deghi, Hajipur; about 16 oz. in weight.

Sukul-ka-Bhadiya;—comparatively long; skin thick; flesh of orange colour; fibrous but replete with fine sweet juice; stone small; weighs about 16 oz.; a late variety, ripening in September—October.

Sokhta;—long and slender; flesh red, stiff; an early variety, of ordinary size; introduced by Shaik Ashgar Ali of Hajipur.

JAYNAGAR* MANGOES.

My friend Babu Raman Chundra Dutt, a Graduate of the Saidapet Agricultural College, Madras, and an inhabitant of Mazilpur, within the municipal area of Jaynagar, 24 Pergunnas, has favoured me with the following list of the mangoes of that place.

Dhumo;—very large and round; moderately sweet.

Dhurrumpur, a village in the 24 Pergunnas, is the place of its origin, hence it was so named.

Gopal-dhoba;—Gopal was a *dhobi* or washerman in Baruipur Sub-Division, 24-Pergunnas, in whose house it first occurred, thus it was so named. It is green even when ripe; size oval; very sweet, and one of the best. It bears so much similarity to the *Fuzli* that the former is supposed by many to be a sport from the latter.

Kodalay;—named after its original place Kodalay, a village close to Harinavi, in Baruipur Sub-Division.

Nim-Chowdhury;—one of the best, occurred first in the house of one Nimai Chowdhry in Maida, village of about 15 miles south of Calcutta; oval; free from fibres; when ripe of visible on the green skin. Very flavoured.

* within 30 miles south of

Paddojola ;—original place Poddajola, in Baruipur Sub-Division ; shape round ; skin yellow when ripe ; sweet and good.

MYSORE MANGOES. *

Amina ;—(in the collection of Rai S. C. Nahar Bahadur of Azimgunge).

Badami ;—description not available.

Chitoor ;—long size, flesh white. A desirable variety.

Chitkai ;

Golkeri

Finimati or Fini mavu

Karikai

Manj mavu

Peachkai

Sukkuri or Simavu

} description not available.

MADRAS MANGOES.

The following list has been compiled exclusively from the collection of Rai S. C. Nahar Bahadur of Azimgunge—

Chitore ;—probably the same as *chittoor* of Mysore.

Dilpasand ;—description not available.

Ithada ;—medium

but not entirely

* Gazetteer of Mysore
the Amina

<i>Gova</i>	} description not available because perhaps have not yet fructed there.
<i>Hathuda</i>	
<i>Malgova</i>	
<i>Office pasand</i>	

Othada mavu ;—not a desirable kind.

Peter ;—not a good variety, but bears in profusion ; a handsome-looking variety.

Pootoo ;—cone-shaped ; skin green, and thick ; flavour not agreeable.

Rapesberry ;—tastes like raapsberry ; medium sized ; a tolerable mango.

Walaja-pasand ;—description not available.

GOA MANGOES. *

Costa.

Dijoao.

Fernandina.

Fredrico.

Timer or Timerata.

BOMBAY MANGOES.

The following list has also been compiled from the collection of Rai S. C. Nahar Bahadur

l, almost round ;
ring any descrip-

Amirgola ;—of ordinary size, round ; one of the best.

Black Alphenso.

Cowasji Patel.

Himsagar ;—of ordinary size ; pulp crimson red ; sweet, and cool. Free from fibres, and of fine flavour ; free-bearer and an early variety.

Long Bottle.

Majgaon ;—a big mango ; skin green, flesh light sulphur yellow ; moderately sweet.

Peary ;—a delicious variety ; more juicy than the *Alphonso*.

Salem-pasand ;—moderate sized ; a good variety.

THE MANGOES OF MISCELLANEOUS PLACES.

Rai S. C. Nahar Bahadur, has also kindly furnished me with the names of the following mangoes which he collected from different parts of India for his garden at Jiagunge, Murshedabad, *Seo-Hind or Gopal-larooa* ;—round ; of apple colour ; weighs more than two pounds. Sold generally at 12 per 100.

Sundali or Chandani ;—of ordinary size and has the smell of sandal-wood ; a variety ; fibreless and not very juicy.

Nursing-bottle

Gooria ;—medium sized ; yellow, sweet, juicy, and fibreless.

Malabar Bombay ;—a first rate variety over 9 inches long, cylindrical in form ; skin thick, but sweet and juicy ; flesh of light sulphur colour.

Jet Bombay ;—from Khusrubagh of Allahabad ; one of the earlist of the Bombay group.

Besides the names given above there are numerous varieties available in the Calcutta and other markets and may be found in the Catalogues of the Nurserymen. I have therefore omitted them from this.



THE END.

A List of Durbhunga Mangoes
kindly furnished by Babu Hari Mohun Bannerji of Durbhunga.

No. of Class.	No. of Variety.	Name.	Description.	Local market value per 100.	Early, late or intermediate & when ripens.	History of particular varieties.	Remarks.
1.		Malda.					
	1.	Subza }	Cylindrical in shape, weighing 12 to 16 oz. Very sweet and delicious with good flavour, perfectly fibreless; colour of the skin yellow when ripe and that of the substance rosy white; does not get spoiled for some days, even after being ripe; stone very thin.	Rs. 4 to 5.	Intermediate July & Aug.	One ~~one~~ of the Durbhunga mangoes were originally brought into these parts from Malda by the ancestors of the Maharaja of Durbhunga more than 100 years ago. At present it is abundant there, having now widely scattered itself throughout the district.	Idah mangoes at 12 annas to 1 rupee it is made both east and west, but the
	2.	Safeda }					
	3.	Bherowa or Chapra ...	More long than round, weighing as above; sweet and delicious, but of no special flavour. The substance fibreless but a little watery, and very thin.	Rs. 2/8 to 3/8.	Do. (little earlier than the above two.		

SUPPLEMENTARY LIST.

MALDA MANGOES.*

Amrita-bhōg } almost similar to the *Misri-*
Amrita Pal } *kund*. Price varies from Rs. 3
Amrita-monda } to 6 per 100.

Aswina ;—shape like that of the *Fuzli* ; weighs from 2 to 2-pounds-and-a-half ; substance sweet and good ; a late variety, ripening in October. From Rs 25 to 50 per 100.

Baromasia ;—bears twice in a year, the first crop being harvested in June and the second in November. From Rs 5 to 10 per 100.

Batasa ;—round and flat ; bulk 8 oz ; substance sweet, flavorful and agreeable ; an early variety, ripening in June. From Re 1 to Rs. 2 per 100.

Belua ;—round ; weighs from 8 to 12 oz ; very tasteful, and has the fragrance of the *Bael* (*Ægle marmelos*) fruit. An early variety, ripening in June. From Rs 2 to 4 per 100.

Bhaduria (long) ;—very large, cylindrical ; weighs 2 pounds ; sweet, and full of substance but without flavour : ripens in July-August. From Rs 5 to 10 per 100.

Bhaduria (round) ;—large, round ; weighs about 2 pounds. Skin thick ; without flavour but sweet, and full of substance : ripens in July—August. From Rs 5 to 10 per 100.

Bonkhaja ;—round, nosy ; from a pound to two in weight ; vermilion-coloured ; of moderate taste but of very handsome appearance ; ripening period, beginning of July. From Rs 3 to 5 per 100.

Brindabani ;—oval ; weighs 8 oz ; sweet, delicious and of good flavour : ripens in June. From Rs 5 to 10 per 100.

Chakla ;—round ; weighs from 2 to 3 pounds ; ripens in July-August. From Rs 15 to 25 per 100.

Champa-daghi ;—little better than the ordinary ones ; ripens in July. From Rs 4 to 6 per 100.

Chhuttra ;—weighs 8 oz ; an ordinary variety. From Rs 3 to 5 per 100.

Without a pound in weight ; sweet,

and sweeter still when ripe. From Rs 3 to 5 per 100.

Barika ;—large, elongated ; weighs sometimes 2 pounds ; substance sweet, but wanting in flavour ; ripens in July-August ; sells at from Rs 5 to 8 per 100.

Dilsaj ;—large, oval ; weight varies from 2 to 3 pounds ; fibrous, and not entirely sweet, having the touch of little sourness ; rind thick ; bears profusely ; ripens in July-August. From Rs 5 to 10 per 100.

Durga-bhóg ;—in all respects,—size, shape, and taste, resembles the celebrated *Fuzli*, except that the former is of vermilion colour while the latter deep green when ripe ; lasts till the middle of August, sometimes up to the middle of September and in that case would fetch Rs 50 per 100, but ordinarily sells from Rs. 10 to 25 per 100. One of the rare kinds.

Fuzli ;—first occurred in the house of a Mahomedan widow named Fuzleh, in the village of Nimasara in Maldah. Largest mango in cultivation ; shape long but flat ; weighing from a pound to four ; entirely free from fibres, and of a delicious substance, but without flavour. Begins to ripen .

Golab-bash ;—larger than the ordinary ones .
 elongated ; weighs about 8 oz ; very delicious,
 and scents like rose ; ripens in June. From
 Rs 5 to 10 per 100.

Gopal-bhóg ;—small, oval ; weighs from 8 to 10 oz ;
 of very excellent flavour and taste ; ripens in
 June. From Rs 3 to 5 per 100.

Gopinath-bhóg ;—very similar to the above ; ripens
 in June ; from Rs 2 to 4 per 100.

Ilsapeti ;—long and flat ; weighs from 8 oz to
 1 pound ; fibreless ; an ordinary variety. From
 Rs 2 to 4 per 100.

Falibandha (large) ;—size large, shape round ;
 curved at the lower end ; weighs about 1
 pound ; skin thick, but very refreshing, sweet
 and of good flavour. Intermediate variety
 ripening in July-August. Rs 5 to 10 per 100.
 Does not last long on the tree.

Falibandha (small) ;—smaller than the foregoing
 one ; shape long ; weighs about 12 oz ; little
 better than an ordinary variety ; not entirely
 free from fibres. Rs 3 to 5 per 100. Ripens
 in July-August.

Bhóg ;—oval ; weighs 8 oz ; of good
 taste ; ripens in July ; from Rs 3

of ordinary merit ; ripens in July-August. From Rs 10 to 20 per 100.

Kancha-mitia ;—in size and merit similar to the above ; ripens in June-July. From Rs 2 to 4 per 100.

Kurpura-dagi ;—weighs from 12 to 20 oz ; flesh sweet ; of good flavour having slight fragrance of camphor ; ripens in July ; from Rs 25 to 50 per 100.

Khysapati (large) ;—round, weighs from 8 to 16 oz ; rind thin ; fibreless ; ripens between June and July. From Rs 4 to 6 per 100.

Khysapati (small) ;—appears to be a variety of the last named, being similar in all respects but little smaller.

Kua-paharia ;—size ordinary, shape long ; weighs about 8 oz ; skin thin ; ordinary sweet, and without any flavour, but fibreless ; ripens in July-August. Rs 3 to 8 per 100.

Kumrajali ;—very large and round ; weighs from 2 to 6 pounds ; not entirely fibreless. A second class mango ; ripens in July. From Rs 15 to 25 per 100.

Laljan-banka ;—elongated ; weighs from 8 oz to a pound ; flesh coloured ; and handsome-looking ; ripens in July. From Rs 1 to 2 per 100.

Madhua ;—oval ; 8 oz ;
and taste

Misri-bhóg ;—oval ; weighs from 8 to 12 oz ; very sweet and of good flavour ; ripens in July. From Rs 10 to 15 per 100.

Misrikund ;—round ; weighs from 8 to 16 oz. ; flavour good and of excellent taste ; ripens in June ; from Rs 3 to 5 per 100.

Mohun-bhóg ;—round and bulky ; weighs from a pound to two ; entirely free from fibres : insipid when eaten fresh from tree, but sweet and delicious when the skin becomes soft ; ripens in July-August. From Rs. 5 to 10 per 100.

Nur-Fuzli ;—in almost every respect similar to the *Fuzli*, and probably a variety of the same : from Rs 15 to 20 per 100.

Nakua-daghi ;—weighs about a pound ; ripens in September. From Rs 10 to 20 per 100.

Phoolia ;—oval ; weighs about a pound ; ripens in July-August. From Rs 5 to 10 per 100.

Pólla ;—long and small ; from 8 to 12 oz in weight ; yellow-coloured ; fibreless and sweet ; ripens in June. From 8 ans to Re 1 per 100.

Raj-bhóg ;—round ; 8 oz in weight : good and taste-ful : ripens in July. From Rs. 3 to 4 per 100.

very large, weighing from 2 lbs. to
handsome-looking, and a
From Rs 50

Sarat-bhōg ;—in size and shape similar to the above but in taste superior, and very much allied to the *Fuzli* ; ripens in September-October. The only tree is in the compound of the Ramnagar Cutchery of the Chanchal-Raj.

Sauna ;—shape little elongated ; cochineal coloured ; moderately sweet but very refreshing ; ripens in July-August. From Rs. 5 to 10 per 100. Somewhat rare.

Sinduria ;—means vermilion which is the colour of its substance even when unripe ; deep red when ripe, not of any merit but early, ripening in June. From Re 1 to Rs 2 per 100.

Situ-bhōg ;—long and flat ; similar to the above. From Rs. 10 to 20 per 100.

Subja ;—elongated, large and cylindrical ; weighs from 8 to 12 oz. Tasteful and flavourous ; ripening about the end of July. Rs 5 to 10 per 100.

Tehfaringa ;—cylindrical ; weighs from 8 to 12 oz ; sweet even in its green state, and sweeter and flavoured when well ripened ; ripens in July. From Rs 5 to 8 per 100. A rare variety.

Tisiphool ;—in size, shape and bulk very similar to the *Subja* ; ordinary sweet ; ripens : in July. From Rs 4 to 8 per 100.

