

Agronomy – Rabi Crops

Tobacco

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TOBACCO

Botanical Name: *Nicotiana* spp

Family: Solanaceae

Chromosome Number: $2n=48$

Tobacco (*Nicotiana* spp.) is an important cash crop. It is raised for its leaves which are used as cured product. It is smoked as pipe, cigar, cigarette or *hookah*, and also used as snuff or chewed as a liquid in various forms. India ranks third in the world tobacco production and second in the flue-cured tobacco exports. It earns about Rs 577 crore by way of excise revenue and Rs 112 crores as foreign exchange. Besides, it also provides an employment to about 56 lakhs of people annually in its cultivation, curing, grading, factories and cottage industries. It also produces nicotine sulphate which is used as an insecticide.

Tobacco seed contains 35-38% nicotine free oil. It is used in making soap and colours. Its cake is used as a cattle feed. Cake contains 3% N, 30-35% crude protein and 20-27% carbohydrates. Some species of tobacco are also utilized as an ornamental plant.



Broadleaf tobacco : Source: <http://en.wikipedia.org/wiki/Tobacco>



Nicotene per cent in various type of tobacco

Type of tobacco	Nicotine %	Type of tobacco	Nicotine %
Flue cured virginia	1.99-4.46	Cigar filler	2.60-3.10
Natu	1.36-4.73	Cigar-wrapper	0.60-6.22
<i>Bidi</i>	7.24	Chewing	4.10-4.57
Burley (mixture)	1.27-4.62	Cheroot	3.25
Lanka	1.67	<i>Hookah</i>	3.00-7.10

Origin and History

Tobacco is though believed to be originated from America, but there are contradictions and ambiguities about its place of origin. It was cultivated by the Red Indians at the time of discovery of America by Christopher Columbus in 1492. He and his men on landing in the little island of Tobago were greatly surprised to find the natives smoking tobacco. In addition

to smoking tobacco, the natives used to grind the leaves into a fine powder, or snuff, and inhaled it through a hollow cane tube called ‘*tobago*’. The name tobacco is derived from the word ‘*tobago*’. Tobacco was taken to Europe by the Spainards in 1559. The French Ambassador in Portugal Jean Nicota saw tobacco in Lisbon and he introduced it in France. The scientific name *Nicotina* and the word nicotine are derived from his name. In India, tobacco was introduced by Portugese during 1605 and was used as *hookah* tobacco and cigarette/pipe tobacco since 1616 and 1711 respectively.

Geographic Distribution

Tobacco is cultivated globally on 3.93 m ha. China, Brazil, India and USA are major producers of tobacco (Table 1).

Table 1. Area, production and productivity in major tobacco growing countries of world (2004)

<i>Country</i>	<i>Area (m ha)</i>	<i>Production (m t)</i>	<i>Productivity (kg/ha)</i>
<i>China</i>	1.352	2.409	1782.3
<i>Brazil</i>	0.462	0.921	1993.0
<i>India</i>	0.438	0.598	1365.3
<i>USA</i>	0.165	0.398	2415.1
<i>Turkey</i>	0.190	0.157	826.3
<i>Malawi</i>	0.151	0.169	457.4
<i>Zimbabwe</i>	0.040	0.062	1558.0
<i>World</i>	3.939	6.442	1635.5

Source: FAO Production Year Book, 2004

The principal tobacco-raising states of India are Andhra Pradesh, Gujarat, Karnataka, Tamil Nadu, Orissa, West Bengal and Uttar Pradesh. The total area in different states (Table 2) and type wise (Table 3) are given.

Table 2. Area and production of tobacco in major growing states of India (2002-03)

<i>State</i>	<i>Area (000' ha)</i>	<i>Production (000' tonnes)</i>
<i>Andhra Pradesh</i>	117.0	168.0
<i>Bihar</i>	14.3	15.9
<i>Gujarat</i>	66.4	114.7
<i>Karnataka</i>	82.0	54.0
<i>Maharashtra</i>	6.0	7.0
<i>Orissa</i>	4.1	2.2
<i>Tamil Nadu</i>	6.2	8.9
<i>Uttar Pradesh</i>	19.6	113.7
<i>West Bengal</i>	7.7	4.2
<i>Others</i>	3.3	3.1
<i>India</i>	326.6	491.7

Source: Directorate of economics and Statistics, Government of India, 2003-04.

Table 3. Area and production of tobacco variety-wise in India (2002-03)

<i>Variety</i>	<i>Area (000' ha)</i>	<i>Production (000' tonnes)</i>
<i>Virginia</i>	180.1	173.2
<i>Natu</i>	22.4	42.7
<i>Bidi</i>	66.3	122.3
<i>Cigar & Cheroot</i>	6.1	11.0
<i>Hookah</i>	17.6	51.2
<i>Chewing</i>	30.0	84.9
<i>Snuff</i>	4.1	6.4
<i>Total</i>	326.6	491.7

Source: Directorate of economics and Statistics, Government of India, 2003-04.

The types of tobacco cultivated in various states of India and its growing tracts are given below.

The types of tobacco cultivated in various states of India

<i>State</i>	<i>Type of tobacco grown</i>
<i>Andhra Pradesh</i>	Cigarette (Virginia and natu), <i>bidi</i> , cheroot and burley
<i>Assam</i>	Wrapper, <i>hookah</i> , chewing and cheroot
<i>Karnataka</i>	Virginia, <i>bidi</i> and burley
<i>Gujarat</i>	Virginia, <i>bidi</i> and chewing
<i>Bihar</i>	<i>Hookah</i> and chewing
<i>Tamil Nadu</i>	Cigar, chewing and cheroot
<i>West Bengal</i>	Wrapper, <i>hookah</i> , cigar and chewing
<i>Orissa</i>	Natu, <i>bidi</i> , <i>hookah</i> and chewing
<i>Uttar Pradesh</i>	Virginia, <i>hookah</i> and chewing
<i>Punjab</i>	Chewing

Tobacco Growing Tracts of India

Guntur area of Andhra Pradesh	It is famous for cigarette and natu types. The area consists of Guntur, Krishna, East-West Godavari and Telengana districts of Andhra Pradesh
Charottar area of Gujarat	It is famous for <i>bidi</i> tobacco and is confined to Kaira district
Nipani area	This is <i>bidi</i> tobacco-raising area, which consists of Belgaum, Satara, Kolhapur, Sangli districts
North Bihar and Bengal area	It is mainly famous for <i>hookah</i> , but in limited area chewing and snuff types are also grown. This area consists of Muzaffarpur, Darbhanga, Purnia, Cooch Behar, Jalpaiguri, Behrampur and Dinajpur districts
Uttar Pradesh and Punjab area	This area is famous for <i>hookah</i> and chewing type of tobacco. The area consists of Farrukhabad, Mainpuri, Sitapur, Badaun, Moradabad, Jalandhar and Firozpur districts
South Tamil Nadu area	It includes Coimbatore, where chewing, cheroot, snuff and wrapper types of tobacco are raised

Classification

Indian tobacco was classified by Howards in 1910, who described 20 types in *rustica* and 51 in *tabacum*. The leaves of *rustica* are usually petiolate, whereas in *tabacum*, these are commonly sessile. Morphological characters were used as the basis for classification of these spp. Only 2 species are cultivated extensively in India. The morphological characters of both the species are given below.

***Nicotiana tabacum* (deshi type):** Usually the plants of this species are taller (150-250 cm). The leaves are large but narrow. These are commonly sessile. The colour of flower is reddish, pinkish or white. It is supposed to have derived as an amphidiploid of a cross between *N. sylvestris* and a member of the section *Tomentosae*. It is used extensively for smoking and chewing purposes. It is also used in the manufacture of cigarettes, cigar, cheroot, *bidi* and snuff purposes.

***Nicotiana rustica* (Vilayati and Calcutia):** The plants of this species are stocky, more bushy in nature and shorter in height (90-120 cm). The leaves are large and broad and ovate in shape and always possess a petiole. Flowers occur in clusters and are of dull greenish-yellow colour. It is supposed to have been derived as an amphidiploid from a cross between *N. undulata* and *N. paniculate*. It is used extensively for *hookah*, chewing and snuff purposes. It is limited to Punjab, Uttar Pradesh, Bihar, West Bengal and Assam.

According to utility

- | | |
|---|-----------------------------|
| (i) Cigarette or flue cured tobacco (Virginia and natu) | ii) <i>Bidi</i> tobacco |
| (ii) Cheroot tobacco | iv) Cigar tobacco |
| v) Snuff tobacco | vi) Wrapper tobacco |
| viii) Chewing tobacco | viii) <i>Hookah</i> tobacco |

According to curing to tobacco

- | | |
|-----------------|--------------------------------|
| i) Flue curing | ii) Air curing or shade curing |
| iii) Sun curing | iv) Smoke/fire curing |
| v) Pit curing | |

According to aroma

- (i) Aromatic tobacco and (ii) Non-aromatic tobacco

Botanical Description

Tobacco is a herbaceous annual, grown primarily for its leaves. *N. rustica* is found sometimes to behave like a perennial.

Root system: Tobacco plant generally develops a shallow branched root system. It has tap root from which numerous short lateral roots emerge. The majority of root system is confined to upper 60-90 cm of the soil.

Stem: It has a simple cylindrical stem. The height of the plant and length of the internodes vary in different types. Of the 2 species, *N. rustica* is shorter and more robust and densely growing plant than *N. tabacum*.

Leaves: The size of leaves may vary from 15 cm to 100 cm or even more in length. They may be narrow, long and drawn out like a whip, elliptical or broadly ovate with marked variation even in the same plant. The leaf base may be sessile or petiolate differing in the development of wings having a breadth of 5-6 cm. In general, the texture of leaves of *N. tabacum* is finer

than that of *N. rustica*, which is more or less leathery and tough. The nicotine content of leaves of *N. tabacum* ranges from 0.5 to 5.5%, while in *N. rustica*, it varies from 3.5 to 8.0%.



(Brightleaf tobacco leaf ready for harvest. When it turns yellow-green the sugar content is at its peak, and it will cure to a deep golden color with mild taste. The leaves are harvested progressively up the stem from the base, as they ripen (Source: <http://en.wikipedia.org/wiki/Tobacco>))

Inflorescence: Tobacco has a terminal raceme panicle, which may be compact to very lax with a short or long peduncle. The inflorescence in main axis always flowers first and the side branches there after from top towards bottom. Flowers of tobacco plant are complete and perfect. The flowers are either pink, yellow, purplish, or white. Calyx is usually tubular, but in few types it is globular and inflated. The flowers bear 5 anthers, which are fused to corolla tube. The pistil is compound and matures into a capsule type fruit.



(Tobacco flower, leaves, and buds: Source: <http://en.wikipedia.org/wiki/Tobacco>))

Capsules: The capsules vary in size, shape and nature of apex, blunt or conical. The shape may be elliptical, void or conical.

Seeds: The seeds are spherical or broadly elliptical with variation in degree of ridging on the seed coat. The colour varies from dark brown to light brown.

Climatic Requirements

Tobacco is a tropical crop but also raised in sub-tropical and temperate regions of the world. Tobacco needs 50-100 cm well distributed rainfall throughout the growing period. Areas having a rainfall more than 125 cm are not fit for tobacco production, whereas a rainfall of less than 75 cm results in production of leathery leaves having very high nicotine content. The leaves remain smaller and possess very poor burning quality. Waterlogging at any stage of growth is very harmful.

The crop needs about 28°C as an optimum temperature for germination. However, it may germinate at temperatures ranging between 15°C and 35°C. The crop can not withstand frost, and starts withering or wilting at a temperature of above 35°C. Temperatures below 13°C are also not suitable. Relative humidity is one of the important factors for yield, quality and curing of leaves. The relative humidity of 85-95% is optimum for the crop. Areas with <50% relative humidity are not suitable.

Varieties

The varieties of tobacco recommended for different purposes and states are given below in Table. 4.

Table 4. Tobacco varieties recommended for different purposes in different states

Type of Tobacco	State	Varieties
Flue Cured Virginia tobacco (FCV Tobacco)	Andhra Pradesh, Karnataka	Harrison special, Chatham, Delerest, Virginia gold, Amerilo 5, Thokku, Desavali, Dakshnarthi, Jayasri, Kanakprabha (HR 62-7). Dhanadani, Special FCV, CTRI special, Godavari special (resistant to TMV), Swarna (resistant to powdery mildew), McNair 12 (tolerant to black shank), K-326 and Tirupati (NLS 4) (tolerant to black shank and nematodes), Bhagya, Dhandayi (HR 62-3), 16/103, G 11/1, Kutsaga E.2, 25/E, FCH-37, Kustaga E1, Kutsaga 51E, CM 12 (KA), Gautgam, Bhavya, Hema, VT 1158
Bidi tobacco	Gujarat, Karnataka, Maharashtra, Andhra Pradesh and Orissa	Keliu 49, Keliu 20, Gandiu 6, Surti 20, Piliu 98, Sajipuria 57, Ramol 43, Anand 2, Anand 3, Anand 23 (tolerant to leaf borer), Anand 119, Anand 145, GT 5 and GTH 2 (tolerant to root-knot nematode), GT 7 (tolerant to drought), NPN 190, PK 5, Mavadu, Kalipat, Gujarat Toba 4, Bhojgund Nipani, Sangli, Javari, PL 5, NPN 1900, Kunkumatari, Minji K-20, Amekeri, NPN 22
Cigar and Cheroot tobacco	Tamil Nadu, West Bengal, Andhra Pradesh,	Oosikappal, Monnakappal, Yeru Maikappal, Bhengi, Mandival Jati, Lanka 27, Krishna (HV-75-10), DR1, Lanka special, Bhavani special (Coimbatore) (PV 69-8), Sendarapatty special (Salem), 1-737 (narrow

Type of Tobacco	State	Varieties
	Orissa	leaved Oosikappal), 452, Hawana 381, Olor 10, I 462, VV 2, KV 1, Mary gold
<i>Hookah</i>	Assam, West Bengal, Bihar, Uttar Pradesh, Punjab	Snidurkhatua, Kadamdal, Hatikania, Patuakhola, Barapat, Bhengi, Mena Bhengi, Nookhol Snidurkhots, Hingli, DP 401, NP 18, NP 219, NP 220, NP 222, T 23, T 59, Desi Calcuttia (Kalikatiya), Gobhi, Villayati, Chama, Gujarat Culcutti 1, DD 437, Sonar Motihari, GCT-2, HD 67-40, Bitri, Hemti, NPS 219, R 12, Farrukhabad local
Chewing and Snuff	Assam, West Bengal, Bihar, Uttar Pradesh, Punjab, Tamil Nadu, Gujarat, Orissa	Desi Jati, NP 70, Oosikappal, Kalichopadia, Judi, NP 219, NP 220, NP 222, DP 401, Chama, Podali, Gandak Bahar (HP 6-20). Sona (HP 63-3), Prabha (HP 67-5), Pusa Tobacco 76, Vaishali special, Vairam (Pit-cured areas) (HV-67-18), Thangam (HV 67-30) and Maragandham (smoke cured areas))HV 72-13), Bhagyalakshmi and Meenakshi (sun-cured tobacco), I-64, Bhagya Lakshmi (HV 67-10), I-115, S-1, VTK-1, VR 2, VD 1, PV 7, Bhawani special (PV 69-8)
Natu Tobacco or Suncuring cigarette tobacco and toba mixture	Andhra Pradesh	Tokaku, Rayala, Karavithanum, Medarametla, Prabhat (DG 3), Vishwanath, III-435, Natu special, DG4, Kandukennipatti, Peddvithanam, Pyruvithanum, Kammugudam, Rangapuram
Burley Tobacco Burley-aircuring (for mixture in cigarette tobacco)	Andhra Pradesh and some parts of Karnataka	Banket A1 (resistant to TMV), Burley 21, Ky 416, D-1, D-2, Ky 55, Haliam Golden, Ky 21, Ky 58, Momi 2, Burley, Ky 14
Cigar wrapper	West Bengal and Tamil Nadu	Krishna (HV 75-10), Rangpur, Sumatra, Dixie shade, Selection 5, Anand-145 (Chewing-Jarda), Gujrat calcutti-1
Other types	Andhra Pradesh, Gujarat	White Burley, Turkish, Pandharpuri

Latest varieties

Manshi: It is a Jati tobacco variety with a yield of 16-17 q/ha. It is recommended for cultivation in Jati-tobacco (chama type) growing areas of West Bengal.

Hemadri: A FCV tobacco variety identified for traditional black soils in rainfed areas of Andhra Pradesh. It has shown a yield potential of 25 q/ha.

Bhairavi (NG 73): A natu tobacco variety for rainfed areas of Andhra Pradesh.

BSRB 2 (Sweta): A burley variety of tobacco for light soils of Agency area in Andhra Pradesh under monsoon conditions.

Soil and its preparation

Tobacco, in general, needs an open-aerated, well-drained, light textured soil rich in P, K and Fe, but poor in organic matter content. Sodic soils are not suitable for tobacco production, because the plants absorb a lot of chloride ions, resulting in poor burning quality of leaves. A mild acidic soil reaction is always better for production of superior quality leaves. Tobacco finished products and suitable soil types are given in Table 5.

Table 5. Tobacco finished products and suitable soil types

Finished products	Suitable soil types
Bidi	Light or medium loams of old alluvium origin
<i>Binder (cigar)</i>	Heavy soils
<i>Cigarette</i>	Light sandy soils
<i>Filter (cigar)</i>	Light sandy soils
<i>Hookah (chewing and snuff)</i>	Sandy to silt loam alluvial soils
<i>Wrapper (cigar)</i>	Distinctly heavy soils

Nicotiana rustica is grown on heavy and low-lying soils. Contrary to this, *N. tabacum* is grown on light and high lands. Thus a good soil is one that is light sandy in surface, while friable sandy loam in deep layers with good drainage, having acidic reaction (pH 5.0-6.0 preferably), low in inherent fertility with low humus/ organic matter content

As a general rule, heavy and naturally fertile soils are preferred for cigar filler, pipe, *hookah* and chewing type tobacco, while light sandy and somewhat less fertile soils for bright curing thinner and high price leaves of cigarettes, cigar, wrappers and high grade pipe tobacco.

For transplanting tobacco, a clean and well pulverized seed-bed of good tilth is required. Land should be prepared first by deep ploughing with mould board plough followed by 3-4 cross harrowings. Each harrowings should be followed by planking so that the soil is well pulverized and levelled. Care should be taken to see that weeds and stubbles are removed from the field.

Raising tobacco seedlings

Tobacco seeds, being very small, can not be sown directly in the field. Therefore, raising healthy seedlings is an important aspect of tobacco production.

Selection site for nursery bed

The nursery beds should always be made on a raised spot so that these do not get flooded any time. There must be an assured irrigation facility. It is necessary that the beds have sandy structure so that they are open and well aerated for young seedlings. To get healthy seedling, it is advisable to change the place of nursery every year, to avoid occurrence of soil-borne diseases and insect pests. It is always better to prepare raised beds (10-14 cm) on heavy soils for draining out any excess water from the beds.

Preparing the nursery beds

The seeds are sown either on raised (10-15 cm high beds having slopes on all the 4 sides) or flat beds of any convenient length and 120 cm width (preferably 8.0 x 1.25 m) with channels of 30-45 cm width between the beds. The seeds are very small and therefore require very fine tilth. The beds must be free from stubbles, weeds and soil-borne diseases. The beds must be sterilized before sowing the seeds. 10-12 beds are sufficient for 1 ha tobacco transplanting.

Sterilization of nursery beds

The sterilization of beds may be done in the following 2 ways.

By rabbing: It is the process of burning of trashes, weeds or any organic refuse on the soil surface. For rabbing, 15-20 cm thick layer of paddy straw, leaves or weeds are uniformly spread over the soil surface and burnt.

By chemical treatment: This treatment is done after application of organic manure in soil. Formaline solution of 2.0% concentration in water or formaldehyde takes care of damping off. Sometimes Bordeaux mixture, chloropicrin, methyl bromide and calcium cyanamide are also used as fumigants or herbicides (calcium cyanamide is used as herbicide).

Seed and Sowing

Seed rate

A seed rate of 2-3 kg/ha is optimum for all types of tobacco. Under hot weather conditions, a high seed rate of 4-5 kg is recommended.

Seed selection and seed treatment

The seed should be of high purity and germination for economic and healthy seedlings production. The seeds should be poured in a bucket containing water and the floating ones should be removed. Sometimes to protect the seedlings from seed-borne diseases, the seed is treated with 2.5% of formaline solution or 0.5% solution of dithane M 45 before sowing in nursery. Pre-sowing seed soaking in 50 ppm solution of gibberellic acid (G3) for 48 hours increases and hastens the seed germination.

Nursery

The sowing time of seed in nursery depends on area and type of tobacco as given below.

Sowing time of seeds in nursery for various types of tobacco in various states

State	Sowing time	Type of tobacco
Andhra Pradesh	August-September July-October	<i>Bidi</i> (Nipani area), cigarette, cheroot, chewing and cigar types
Bihar	August-September	<i>Hookah</i> and chewing
Gujarat	May-June	<i>Bidi</i> , cheroot, snuff, chewing, wrapper
Karnataka	April-May	<i>Bidi</i> , wrapper, chewing, snuff, cheroot
Tamil Nadu	April-May	Snuff, cheroot, chewing, wrapper
Uttar Pradesh	June-July	Chewing

Uttar Pradesh	September	Chewing
Uttar Pradesh	December	<i>Hookah</i>

Method of sowing the seed in nursery: Usually treated or water-soaked seeds are broadcast on the surface of the beds and mixed in the soil up to a depth of 1.5 to 2.0 cm with the help of a rake. Before sowing, the seeds are mixed with ash or fine sand in 1:15 or 1:20 ratio for their proper or uniform distribution on the beds. Sometimes the seeds are sown in shallow furrows prepared at 5.0 cm distance from each other. Later the seeds are covered with leaf mould and sand mixture and are pressed.

Care of seedlings in nursery:

The following points needs attention in nursery.

- To minimize damage to the seedlings from scorching sun or beating rains, it is necessary to shade the nursery by a thatch prepared out of grass or sugarcane leaves. The thatch should be removed soon after the seeds have emerged and seedlings have 2 leaves.
- In order to keep the beds moist they should be irrigated by watering cane every evening. There should not be water accumulation at any spot of the bed. Later the beds are flooded with controlled flow of water.
- Seedlings must be thinned out 10-15 days after sowing in order to protect them from damping off.
- Resetting of 3-4 week old seedlings at a distance of 5 x 5 cm in new beds may be done for hardening of the seedlings.
- A spray of dithane M 78 @ 11-12 litres of 0.03% solution for every 40 m² area prevents spread of fungal diseases.
- For control of insect-pests, a spraying of carbaryl 50 WP (Sevin 50 g in 22 liters of water) is useful.
- Transplanting age of seedlings is 7-9 weeks for *tabacum* and 5-6 weeks for *rustica*. Transplanting of younger seedlings causes a higher percentage of gaps while aged or woody seedlings result in a poor growth of plants.
- Irrigation of the bed should be stopped about 10-15 days before transplanting so that they may become drought-resistant and may resist the setback. However, in the evening of the preceding day of pulling the seedlings, the beds must be watered copiously to facilitate the pulling of the seedlings without injury to the root system.

Manure and Fertilizers

In tobacco crop, the economic returns are largely dependent on the right combination of yield and quality rather than the yield alone. The quality in tobacco, particularly in the smoking types, depends on the balance of the nutrients in the leaf. Heavy application of N increases the yield, but has an adverse effect on the quality. With greater of N supply, the carbohydrate-nitrogen (C:N) ratio gets reduced. On the other hand, better quality in chewing, *bidi* and *hookah* tobaccos is generally associated with higher yields that may be obtained with heavy dose of N together with other nutrients. In flue cured tobaccos for cigarette and cigar better quality leaves are obtained from partially N starved plants. Therefore, nutrient requirements of different tobaccos are different.

Phosphorus requirement of tobacco is comparatively low. Potash is an important element, particularly for smoking tobacco. Potash also improves the physical qualities of the leaf like elasticity and low prominence of veins.

In addition to inorganic fertilizers, application of organic matter in the form of well rotten FYM or compost is also recommended @ 7-8 tonnes/ha for heavy soils and 10-12 tonnes/ha for light soils to improve the physical condition of the soil. It may be applied 1 month in advance and ploughed in the soil. In Gujarat, green manuring with sunnhemp or castor cake was recommended for *bidi* tobacco grown in light soils. Phosphorus should be supplied through single superphosphate and potash through potassium sulphate. Through these fertilizers, sulphur requirement of tobacco is also fulfilled. Potash should never be supplied through potassium chloride. The leaf quality decreases due to chloride as thickness of leaf increases. Humus containing soils are best for cigar tobacco. Calcium decreases the thickness of leaves, and increases crop yield. Due to magnesium deficiency, a special type of chlorosis is developed in leaves which is known as Sand drown. Due to boron deficiency, lower leaves may become thick. The recommended doses of fertilizers for different types of tobacco are given in Table 6.

Table 6. Fertilizer doses for different types of tobacco

Type of tobacco (State/ soil)	N-P ₂ O ₅ -K ₂ O (kg/ha)
<i>FCV tobacco in light soils:</i>	
North AP	70-60-60
South AP	40-60-60
Karnataka	40-80-80
<i>Black soils</i>	40-0-0
<i>Bidi tobacco</i>	
Gujarat	160-0-0
Karnataka	125-60-40
Pikka (Orissa)	80-40-40
<i>Burley</i>	100-50-50
<i>Natu: Rainfed</i>	80-50-50
<i>Irrigated</i>	300-50-50
<i>Lanka</i>	300-50-50
<i>Cigar & Cheroot</i>	100-50-100
<i>Cheroot</i>	112-50-50
<i>Hookah</i>	112-56-50

Transplanting

The field for tobacco transplanting should be well prepared. Seedlings of 15 cm height with 5-7 leaves are good for cigarette tobacco, but *bidi* tobacco requires smaller seedlings. Transplanting should be done in the late afternoon to avoid the heat of the sun.

Optimum time of planting and spacing vary with the type of tobacco. Transplanting is usually done in October-November in case of winter crop, while at the end of March or in the beginning of April for the second or summer crop. Immediately after transplanting, light irrigation should be given for establishment of seedlings. Seedlings not established well should be replaced with fresh seedlings within a week of transplanting.

FCV and natu in black soils, and FCV in light soils in A.P. are planted at 80 x 80 cm and 100 x 60 cm respectively. In Tamil Nadu, cigar and cheroot tobacco are spaced at 75 x 50 cm, where as chewing tobacco at 75 x 75 cm. In Bihar, chewing tobacco is planted at 90 x 60 cm. *Bidi* tobacco in Gujarat and Karnataka is planted at 75 x 75 cm and 105 x 45 cm respectively. In West Bengal, *tabacum* is planted in wider spacing of 90 x 90 cm than *rustica* (60 x 45 cm). The *hookah* tobacco (*rustica*) in U.P. is grown at 45 x 45 cm, while the *tabacum* at 50 x 45 cm.

Water management

Water management of tobacco crop depends upon the type of tobacco and the region where it is raised. In order to raise a successful crop on light soils, it is necessary that watering be done timely through light irrigation. Too much irrigation causes leaching of the nutrients from the soil and produces slick leaf with dirty colour. Insufficient irrigation, on the other hand, restricts crop growth, and the curing of leaf becomes difficult. Tobacco can not tolerate waterlogging at any stage of growth, and also can not withstand drought.

In northern light soils of Andhra Pradesh, altogether 6-7 irrigations are required by flue-cured tobacco, starting 3 weeks after transplanting, at 18 mm each for first 2 irrigations, 25 mm each for next 2 irrigations and 37 mm at topping stage and 25 mm each for the last 2 irrigations.

In case of the flue-cured tobacco, water quality is important. The quality of tobacco leaf gets adversely affected if crop is irrigated with water having a chloride content in excess of 50 ppm. Excess chlorides in tobacco inhibit the leaf burn; reduce leaf storage quality, leads to 2-faced leaf, which ultimately results in low pricing index.

The flue-cured Virginia tobacco grown on black cotton soils is rarely irrigated, whereas the one grown on light soils is given 5-7 irrigations. The cigar, cheroot and chewing tobacco in Tamil Nadu and chewing tobacco in Bihar are normally irrigated and about 15-18 irrigations are applied. The *bidi* tobacco in Karnataka, Maharashtra and the *hookah* and chewing tobaccos of West Bengal are raised as rainfed, but under drought 1 or 2 irrigations are desirable under drought conditions. The *hookah* and chewing tobacco raised in Uttar Pradesh are irrigated and generally 12-15 irrigations are applied.

Weed control

About 20 days after transplanting, when the plants get established, their young rootlets require very fine and pulverized sub-surface soil for their rapid growth and further expansion. Besides, inter-cultivation also helps in mulching, removal of weeds and proper aeration etc.

The crop is very often infested by '*Orobanche*', a total root parasite. This weed is found to infest the field at the topping stage or at the later stage of crop growth. *Orobanche* is found to be attached with the tobacco roots. It is advisable to collect them and destroy as soon as they are seen in the field. For chemical control of *Orobanche*, a pre-planting application of EPTC @ 6.0 kg/ha (1 month before planting) followed by post-planting application of 2, 4-D and

0.1% allyl alcohol have been recommended. Combination of herbicides like diphenamide, fluchloralin, oxyfluorfen, trifluralin prove effective in suppressing the weed growth in the crop.

Application of glyphosate at 1.5 kg a.i./ha along with ammonium sulphate at 10 g/litre of spray solution, 3 weeks prior to tobacco sowing suppressed weeds including nut sedge in tobacco nursery. Glyphosate at 1.25 kg /ha in combination with ‘ASPA’ – an adjuvant was equally effective in weed suppression.

Cropping Systems

Tobacco is generally not grown as mixed crop. In Bihar, chewing tobacco is, however, intercropped with onion, garlic or radish in *rabi* season and maize in summer season.

It is a common practice with the tobacco farmers to raise tobacco as a monocrop year after year in the same field without following any crop rotation, which leads to soil sickness, builds up pests and diseases. Therefore, it is advisable to grow tobacco in rotation. The most common rotations in various parts of the country are as follows:

Bihar	Maize-tobacco, Sunnhemp (green manuring)-potato-tobacco
Gujarat	Tobacco-pearlmillet
Tamil Nadu	Onion-tobacco, tobacco-chilli, tobacco-redgram, tobacco-sorghum/pearlmillet/ <i>ragi</i>
Uttar Pradesh	Potato-tobacco (summer crop), wheat-tobacco (summer crop), maize-tobacco (winter crop)
West Bengal	Paddy (aus)-tobacco (motihari)

Mulching

In case of flue-cured tobacco, mulching with 3.6 t/ha of paddy straw after inter culture may help in preserving moisture and keeping down weeds, but care must be taken to protect the crop from termites.

Topping

This is a process of removal of flower heads either alone or with few upper leaves from the plants. The main object of topping is to improve the size, body, texture and quality of leaves. The height of topping and number of leaves at which topping is to be done vary with the type of tobacco. The number of leaf left on the plant is as under:

<i>Type of tobacco</i>	<i>Number of leaves left</i>
Hookah, <i>chewing and bidi</i>	10-14
<i>Cigar filler and cheroot</i>	12-14
<i>Wrapper (cigar)</i>	12-12
<i>Burley-black soils</i>	12-24
<i>Burley-black soils</i>	14-16
<i>Cigarette-flue cured</i>	8-9

Topping may divert the energy and nutrients absorbed by the plants are diverted to the leaves rather than flower heads. Thus it helps in the full development of top leaves, which otherwise remain relatively shorter. It increases the leaf size, thickness and dry weight of the leaves to the extent of 84, 24 and 48% respectively. The effect of topping is more pronounced in younger leaves than older ones.

Topping of inflorescence is called as topping high, and topping of inflorescence with 2-3 upper leaves is called as topping low.

Desuckering

Following topping, the dormant buds become active and they put forth branches technically known as “suckers”. To get full benefit of topping, the suckers are to be removed periodically. The process of removal of these suckers commences after 7 days of topping and 2-3 successive desuckering are necessary. The manual desuckering is a time-consuming, laborious and expensive process. Therefore, use of chemicals may be practiced. Desuckering is not required in wrapper type of tobacco.

Use of coconut oil to the top 6 axils soon after topping suppresses the emergence of suckers in the flue cured Virginia tobacco. In case of cheroot tobacco of Tamil Nadu, application of 2% naphthalene acetic acid (NAA) in triethenolamine to the topped position suppresses all suckers. Use of 2% MH or IBA is also recommended for an effective de-suckering.

The main object of topping and desuckering is to divert energy and nutrients of the plant from flower head to leaves.

Piercing: Just after topping, piercing of main stem with the help of 20-25 cm needle increases the yield of tobacco leaves.

Harvesting

Timely harvesting helps in production of better quality leaves. Out of two methods of harvesting viz. priming and stalk cut method, the leaves in the former method get sufficient time to attain optimum size till they mature and thus helps in increasing more desirable grades of leaves. The stalk of leaves should be separated from the harvest.

Immature leaves are gummy and of poor combustibility, while over matured leaves become scrappy and lack elasticity. Thus such leaves lead to high percentage of the low grade leaves. Braised and wilted leaves produce unsatisfactory cures of poor quality. The green leaves should be handled carefully. These should not be exposed to sun in the field for a longer

period nor allowed to wilt badly by exposure for longer periods in stringing sheds. Cigarette and wrapper type of tobaccos are harvested through priming method. In stalk cut method, plants are harvested near the ground surface. Cigar, cheroot, *bidi*, *hookah* and chewing types are harvested through stalk cut method. In priming method, only ripe red leaves of tobacco are picked from plants.

Time of harvesting

Generally cigar and cheroot tobaccos are ready for harvest 20-25 days after topping, as is indicated by yellowing of tip and margins, slight puckering and brittleness of the leaf. The high yields of excellent leaves are obtained from the crop harvested 3 weeks after topping than the crop harvested earlier or later.

Curing of tobacco leaves

Tobacco leaves are cured after harvest. Curing is a process by which harvested tobacco leaf is made ready for the market. Curing is done in order to impart the required colour, texture and aroma to the final product. It is essentially a drying process whereby most of the moisture of the leaf is removed.

Temperature, relative humidity and air supply are the main factors affecting curing process. These are responsible for fixation of colour, yellowing of leaves and better quality of cured leaves. These factors vary from method to method of curing. Thus selection of suitable curing method from the following must be adopted with reference to quality of the finished products.

Name of the finished product	Method of curing
High quality cigarette	Flue curing
Inferior quality cigarette	Rack curing
Cigar, cheroot, chewing, snuff and <i>bidi</i> tobacco	Rack curing
Very low grade cigarette, <i>bidi</i>	Ground or sun curing
Chewing, <i>hookah</i> and snuff tobacco	Ground or sun curing
Chewing and <i>hookah</i>	Pit curing
<i>Bidi</i> , snuff, chewing and <i>hookah</i> tobacco	Fire curing

Rapid drying improves quality as compared to slower drying by old methods. In slower drying, the leaf gets discoloured. The cured leaves should be bulked by piling them in heaps for improving flavour and aroma. Also the amount of moisture in the cured leaves must be regulated for better quality of cigar tobacco, which is called as reconditioning.

Different methods of curing are adopted for different types of tobacco, depending on its quality requirements and its use. There are 4 common methods of curing.

Flue curing

The flue-cured tobacco is raised with low level of nitrogen and harvested by priming method. The harvested leaves are strung on sticks which are then stacked into a flue-curing barn. The

barn is artificially heated. The green leaves should be loaded in the upper half of the barn and the lighter ones in the lower half. The curing process consists of 3 stages namely (i) yellowing, (ii) fixing the colour and (iii) drying.

Yellowing: During yellowing, leaf is kept at a low temperature (32-35°C) and high humidity for about 30-40 hours till it attains a bright lemon yellow colour.

Fixing colour: After yellowing, the temperature is raised gradually and humidity of barn is lowered by opening the ventilators. Great care is required in raising the temperature during this stage. It is raised by not more than 1-2°F every hour. The rapid rise in temperature, when the leaf is still wet, results in a bluish-black discolouration called 'scalding'. It takes about 16-24 hours.

Drying: This is the last stage in flue curing process, which may last from 28-42 hours. The ventilators are closed and temperature is again gradually raised to 71-71°C to dry the veins and midribs of leaves. This completes the process. Now ventilators are opened to cool down the barn. The leaves are left in barn overnight for absorbing moisture and to come to normal condition for handling and storage.

Air curing

Two types of tobacco, the Lanka tobacco in Andhra Pradesh and wrapper tobacco in West Bengal are air cured. Wrapper tobacco is harvested by priming method slightly at green maturity. The leaves are divided into groups according to their size and are strung on a string secured on a bamboo stick. These sticks are taken to barn with closed side and roof. The leaves are cured under atmospheric temperature. Relative humidity of 70-80% is maintained by sprinkling water inside the barn. The entire process is over in about 5-6 weeks.

Lanka tobacco leaves in Andhra Pradesh are strung on ropes in a shade for 8-10 weeks. During this period, the leaves turn yellowish brown. After this process, the leaves are placed in a pit for 24 hours and then transferred to the second pit for 48 hours and then back to the first pit for 24-48 hours. Fermentation of the leaf occurs during pit curing. After curing, the leaves attain a dark brown colour and fruity smell.



Fire curing

This method is adopted in case of chewing tobaccos. The leaves are harvested in such a way that a small portion of stem remains attached to the leaves. The leaves are wilted for a few hours in the field, then tied into bundles and hung in a smoke hut. They are smoked for about 12 hours by burning dried leaves of trees locally available. After the smoke treatment, the leaf is fermented in bulks for 3-4 days. The fermented leaves are given treatment with salt water or with jaggery.

Sun curing

A number of tobaccos are sun-cured. There are several modifications in sun-curing method. I) curing whole plants on racks as in cigar and chewing tobaccos. After initial wilting in the field, the plants are strung on bamboo poles and cured in sun. The entire process takes about 15-20 days, ii) Curing leaves with pieces of stems on racks as in natu tobacco. In this curing, racks are not exposed to the direct sun. Therefore, it takes longer period (6-8 weeks) and iii) Curing whole plant on the ground as in *bidi* and *hookah* tobacco. In this curing, leaves are allowed to dry in sun on the ground and are turned over twice a day. This process continues for about a week and then heaps are made which are opened the next day and reheaped. This process of heaping, opening of heaps, spreading and reheaping continues for about 10-15 days. By the end of this period, the leaves become completely cured.

Table 7. Yield of different types of tobacco

Type of tobacco	Tobacco growing area	Yield of cured leaves in q/ha
Cigarette	In Tamil Nadu	7.5-9.5
Bidi		6.5-9.0
Chewing type		16.0
Deshi	In Bihar, Uttar Pradesh and West Bengal	
Hookah		8.0
Vilayati		7.5-8.5
		12.0-16.0

Additional Reading material:

<http://en.wikipedia.org/wiki/Tobacco>

<http://www.indiantobacco.com/index.php>

http://www.victoryseeds.com/tobacco/backer_cultivation.html

