Agronomy – Kharif Crops

Maize

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MAIZE

Botanical name: *Zea mays* L.
Chromosome number: 2n = 20

Maize or corn is one of the most important cereal crops in the world agricultural economy both as food for man and feed for animals including poultry. It is also known as "queen of cereals". because of very high yield potential. Over 85% of maize produced in the country is consumed as human food. Green cobs are roasted and consumed by people with great interest. The grains of special variety called the 'pop corn', are characterized by a hard corneous interior structure are converted into the 'popped' form, which is the favourite food for children in urban areas. Several food dishes including *chapaties* are prepared out of maize flours and grains. It is also a good food for poultry, piggery and other animals.

Origin and History

The place of origin of maize is still uncertain. Of the 3 believed ancestors (popcorn, wild maize and teosinte), teosinte is accepted as ancestor of maize now based on cytogenetical and molecular evidences. Maize is believed to have originated in Mexico (Wilkes, 1989), Andean highlands of Peru, Bolivia and Ecuador (Mangelsdorf and Reeves, 1939) and Himalayan region (Anderson, 1945).

The maize plant was unknown in the old world before 5 November, 1492, by the time Columbus arrived in America. The maize was introduced into Spain after the return of Columbus from America, and from Spain it reached to France, Italy and Turkey. The plant was grown in Europe as a garden curiosity. It was introduced into north-west Himalayas of India, probably in early 17th century through silk route.

Geographic Distribution

Maize is the world's leading cereal crop. It is cultivated globally over an area of about 147.26 million ha with a production of 724.6 million tonnes of grain. The major maize producing countries are given in Table 1.

Table 1. Major countries of world producing maize

Country	Area (m ha)	Production (m. tonnes)	Productivity (q/ha)
USA	29.79	299.92	100.65
China	25.47	130.43	51.22
Brazil	12.41	41.81	33.68
Mexico	7.69	21.67	28.19
Argentina	2.33	15.00	64.35
India	7.50	14.10	18.80
Canada	1.07	8.84	82.40
Indonesia	3.36	11.23	33.44
World	147.26	724.59	49.20

Source: FAO Production Year Book, 2004

In India, the crop is cultivated on 7.4 m ha. Among the states, Karnataka, Andhra Pradesh, Uttar Pradesh and Bihar are leading producers of maize (Table 2).

Table 2. Area, production and productivity of maize in important states of India in 2004-05

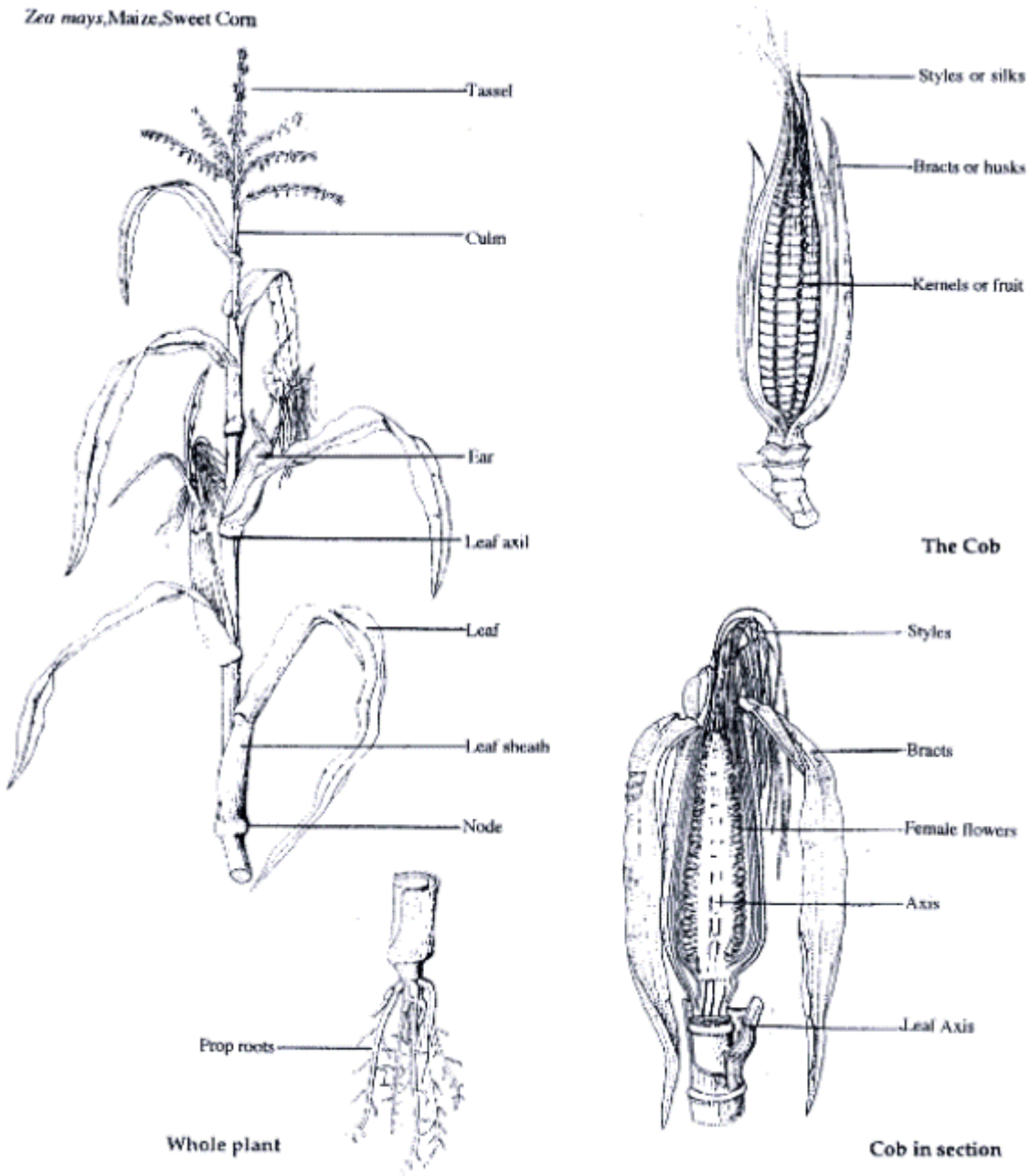
State	Area (000 ha)	Production (000 t)	Productivity (q/ha)
Andhra Pradesh	657.0	2064.0	31.42
Assam	19.2	13.9	7.24
Bihar	614.4	1465.7	14.86
Chattisgarh	96.5	131.7	13.65
Gujarat	459.5	412.5	8.98
Haryana	16.0	40.0	25.00
Himachal Pradesh	324.0	736.0	22.72
Jammu & Kashmir	322.7	492.3	15.26
Jharkhand	191.0	286.0	14.97
Karnataka	850.0	2512.0	29.55
Madhya Pradesh	896.2	1252.6	13.98
Maharashtra	428.0	753.0	17.59
Orissa	65.0	106.0	16.31
Punjab	154.0	422.0	27.40
Rajasthan	1042.4	1262.0	12.11
Tamil Nadu	189.9	294.7	15.52
Uttarakhand	30.0	44.0	14.67
Uttar Pradesh	876.0	1494.0	17.05
West Bengal	46.9	139.6	29.77
India	7430.4	14172.0	19.07

Source: Fertilizer Association of India, 2006

Classification

Maize is an annual C_4 plant classified into 7 groups by Sturtevant (1899) based on the endosperm of kernels.

1. **Dent corn** (*Zea mays indentata* Sturt): It is popularly known as dent corn because of dent formation on the top of the kernel having yellow or white colour. The depression or dent in the crown of the seed is the result of rapid drying and shrinkage of the soft starch. This is the most common type of maize grown in the USA.
2. **Flint corn** (*Zea mays indurata* Sturt): The endosperm in this type of maize kernel is soft and starchy in the center and completely enclosed by a very hard outer layer. The kernels are round on the top. The colour may be white or yellow. It was discovered by Europeans with early maturity and can germinate in cold and wet soil. It is grown in Europe, Asia, Central America and South America as well as it is principal type of grain corn grown in India.
3. **Pop corn** (*Zea mays averta* Sturt): The size of kernel is small and the endosperm is hard. When they are heated (at 170^oC), the pressure built up within the kernel suddenly results in an explosion and the grain is turned inside out. The grain is used for human consumption and is the basis of pop-corn confections. Its cultivation is mainly confined to the New World.
4. **Flour or Soft corn (***Zea mays amylacea* Sturt): It possesses a soft endosperm. Kernels are soft and of various colours, but white and blue are most common. They are like fruit kernels in shape. It is widely grown in the USA and South Africa.
5. **Sweet corn** (*Zea mays saccharata* Sturt): The sugar (20% on dry basis at green ear stage) and starch make the major component of the endosperm, which results in sweetish taste of the kernels before they attain the maturity. After maturity, the kernels become wrinkled. The cobs are picked up green (with 70% moisture) for canning and table purposes. The crop is mainly grown in Northern half of the USA and Canada. Yellow is predominant grain colour and are rich in Vitamin A and C.
6. **Pod corn** (*Zea mays tunicata* Sturt): Each kernel is enclosed in pod or husk in an ear which is enclosed in husks like other types of corn. It is a primitive type of corn not grown commercially.
7. **Waxy corn** (*Zea mays ceretina* Kulesh): Kernels have waxy appearance. Starch is entirely composed of amylopectin in contrast to common dent corn starch with 78% amylopectin and 22% amylose. Waxy corns are of Chinese origin. The mutations of dent corn have resulted in evolution of waxy corn in USA. The waxy corn hybrids developed in USA with starch similar to tapioca are grown for supplying raw materials for speciality products of the wet milling starch industry for textile and paper sizing and corn oil.



Climate Requirements

Maize is a warm weather crop and grows right from sea level to over 3000 m altitudes. It requires adequate moisture and warmth from sowing to end of flowering. The optimum temperature for germination is 21^{o}C, while for growth it is 32^{o}C. Extremely high temperatures coupled with low humidity are not conducive for pollination. It can not withstand frost at any stage of its life cycle.

The crop prefers the areas receiving an annual rainfall of 50-100 cm. The crop also grows well in areas with annual rainfall of 250 to 400 cm (Assam and West Bengal hills), provided the fields are not flooded.The crop needs more than 50% of its total water requirement in

about 30-35 days after tasseling. Inadequate soil-moisture at the grain filling stage results in poor yield of shrivelled grains.

Soils

The crop is grown on a wide range of soils. However, it prefers well drained fertile soils. The soil should be medium textured with good water-holding capacity. It does not thrive well on heavy clays, especially low lands. It can be grown successfully in soils with pH ranging from 5.5 to 7.5. The alluvial soils of Uttar Pradesh, Bihar and Punjab are suitable for raising good maize crop. The soils with sandy loam to silty loam texture are best for the crop.

Land Preparation

A deep summer ploughing after *rabi* crop followed by light ploughing by country plough and planking is required. For heavy soils, 2-3 ploughing are needed.

In areas of high rainfall during *kharif*, ridge and furrows are made to use furrows for provision of drainage. In *rabi*, spring and summer seasons planting in furrows is preferred over ridge planting. This is done for achieving higher water use efficiency.

Sowing of Seeds

Time of sowing

With the availability of thermo and photo-insensitive varieties, it is now possible to grow this crop throughout the year. Usually 3 crops of maize, viz. *kharif*, *rabi* and spring are grown in the country.

As a rainfed *kharif* crop, maize sowings are spread over the months of June and July corresponding with the onset of monsoons. In northern hilly regions, the crop is sown in May. As a irrigated *kharif* crop, it is sown a fortnight or a month before onset of monsoon to avoid water logging damage to seedlings due to heavy rainfall. In north India, this practice helps in taking an early *rabi* crop of *toria* or potato before wheat.

Rabi and spring maize has become popular owing to higher yields. Besides, their sowing periods are flexible and thus can be fitted in any cropping system. *Rabi* maize in Bihar and surrounding states of Indo-Gangetic plains is sown from September to November. In north-western plains zone, sowing should be delayed beyond first fortnight of November, as it leads to poor crop performance due to cold climatic conditions (Table 3).

Table 3. Rabi sowing times in different states

State	Suitable time of sowing
Bihar	10 October – 30 October
Andhra Pradesh	1 November – 15 November
Gujarat	15 October – 1 November
Tamil Nadu	1 October – 15 November
Madhya Pradesh and Karnataka	15 October – 15 November
Eastern Uttar Pradesh, West Bengal, Orissa, Maharashtra	15 October – 10 November

The spring crop is sown during late January to end of February. Baby corn can be planted all the year round, except December and January. Second week of September to first fortnight of February is the best for baby corn cultivation. For sweet corn, June-July (*kharif*) and September-October (*rabi*) are the optimum times of sowing.

Seed Rate and Spacing

In maize, each plant is important for realization of potential yields. During *kharif*, a plant population of 65,000-70,000/ha is recommended for grain production. The seed should be sown at a spacing of 75 cm x 18 cm or 60 cm x 22 cm. A seed rate of 20 kg/ha is required.

In *rabi* season, plants put up moderate growth owing to low temperature. Hence, it requires 30-40% higher population than that of *kharif* season. A plant density of 85,000-1, 00,000 plants is maintained. The plant spacing vary from 50 cm x 20 cm to 60 cm x 18 cm, A seed rate of 25-30 kg/ha is required.

For baby corn, the optimum plant density varies from 1, 25,000 to 1, 43,000/ha with spacing pattern of 40 cm x 40 cm to 40 cm x 35 cm (with 2 plants/hill). In short statured hybrids (as in case of "VL42" with 160 cm height), still higher plant density (1, 75,000/ha) is maintained. Thus, baby corn would require 38-50 kg/ha of seed.

The optimum population for sweet corn varies from 45,000-66,000/ha with spacing of 70 cm x 30 cm or 100 cm x 15 cm. This would require a seed rate of 10-11 kg/ha.

Method of Sowing

Commercially the crop is sown by drilling with seed drill. Under wet soil conditions, the tynes may get choked with soil resulting in blank rows. This method is quick and is suitable for light soils at all moisture levels and in other soils at optimum soil moisture.

For maintaining optimum population and to avoid thinning, seeds are dibbled manually at required spacing. This method requires less seed rate, and is best for costly varieties/hybrids. Dropping the seeds in the furrows opened by plough followed by planking is also one of the common methods of sowing. After germination, the seedlings are thinned out to maintain optimum plant stand.

Hill sowing is the other method adopted for sowing. In this method, the seeds are dropped with the help of corn planter placed at appropriate place and pressed for dropping 3-4 seeds at a place (hill). It also needs relatively less seed.

The optimum depth of sowing is 7-8 cm in *kharif* and 4-5 cm in *rabi*. The optimum planting depth for sweet corns is 3-4 cm, while for super sweet corns it is 2.5 cm. A seedling/hill is optimum for all maize types. However, 2 seedlings/hill are optimum for baby corn.

Varieties

The maize improvement programme got a boost with the establishment of All India Coordinated Maize Improvement programme in 1957. A large number of double cross hybrids and composites were developed and released from then onwards. However, since 1980's, single cross hybrids development is given more emphasis. Trishulata (three way hybrid) and Paras (first single cross hybrid) were thus released in 1991 and 1995, respectively. With increasing emphasis on *rabi* maize cultivation, cold tolerant cultivars (Pratap and Pratap-1) were evolved in Punjab in 1983 and the same were adopted in Haryana too. The state wise recommended composites/ hybrids are given in Table 4.

Speciality corn (pop corn, sweet corn, baby corn), high oil, waxy and amylo maize and quality protein maize [QPM (with *02* gene and hard endosperm)] development has been emphasized since 1970's. These efforts have results in release of Shaktiman 1 (2001) and

Shaktiman 2 (2002) QPM hybrids; Amber popcorn (1981), VL Amber popcorn (1981) and Pearl popcorn (1995). The sweet corn composites developed include Madhuri (1990) and Priya (2002). Though no exclusive baby corn types were evolved, early maturing hybrids developed (Prakash, Vivek 4, Vivek 5, Pusa 1 and Pusa 2) have been found suitable for this purpose.

Table 4. Recommended hybrids and composites of maize for different states

State	Hybrids	Composites
Uttar Pradesh	Hi-starch, Ganga-4, Ganga 7, Ganga 9, DHM 103*, Him-129, JH 3459, Vivek Hybrid 5, Shaktiman 1*, Buland, Pusas early Hybrid-5, DHM 15	Tarun, Type 41, Navin, Sonari (Shweta), Kanchan, Dhawal*, Parbhat, Pusa composite 1, Pusa Composite 2, Azad Uttam, Mahi Kanchan, Megha, Gaurav, Composite Azad, Sharadmani, Narmada Moti, Pragati
Uttarakhand	VL 54, Him-128	Proteina, Shakti, VL Makka 16, VL Amber pop corn, VL 41, Vivek Sankul Makka 11, VL Makka 88
Jammu & Kashmir	Him-123, Him-128	C1, C2, C3, C6, C15. Mansar, Nishant, Trikuta, C8, C14
Himachal Pradesh		Early Composite, Parvati, Girija
Punjab	Sangam, Paras, Sheetal*, JH 3459, Buland, Pusa early hybrid-5	Rattan, Makki Safed 1, Ageti 76, Narmada Moti, Partap*, Partap 1*, Arun, Dhawal*, Parbat, Pusa Composite 1, Pusa Composite 2, Mahi Kanchan, Kesri, Megha, Punjab Sathi 1, Pearl popcorn, Gaurav, Taruna
Haryana	HHM-1, HHM-2, JH 3459, Buland, Pusa Early Hybrid 5	Arun, Parbhat, Pusa Composite 1, Mahi Kanchan, Megha, Gaurav, Narmada Moti, Tarun
Bihar	Hi-starch, Ganga 4, Ganga 9, DHM 103*, Rajendra Makka 1*, Rajendra Makka 2, Shaktiman-1*, Shaktiman 2*, DHM15	Lakshmi*, Suwan, Hemant, Tarun, Dhawal*, Pusa Composite 1, Pusa Composite 2, Megha, Devki, Pragati
Jharkhand		Birsa Makai, Pragati
Karnataka	DMH-1, Pusa Early Hybrid 1, Pusa Early Hybrid 3, DMH 2, DHM 15	Protina, Renuka, Dhawal*, Prabhat, Pusa Composite 1, Pusa Composite 2, Prabha, Amar, NAC 6004, NAC 6002, Narmada Moti
Assam	DHM 103*, DHM 109, DHM 15	Pragati
Maharashtra	Pusa Early Hybrid 3, DHM 15	Hunius, Manjari, Dhawal, Pusa Composite 1, Pusa Composite 2, Mahi Kanchan, Panchganga, Amar, Narmada Moti
Andhra Pradesh	DHM 109, Pusa Early Hybrid 3, DHM 15	Amber popcorn, Dhawal*, Prabhat, Pusa Composite 1, Pusa Composite 2, Madhuri (sweet corn), Mahi Kanchan, Amar, Narmada Moti
Tamil Nadu	DHM 109, Pusa Early Hybrid	Dhawal*, Parbhat, Pusa Composite 1, Pusa

State	**Hybrids**	**Composites**
	3, DHM 15	Composite 2, Mahi Kanchan, Narmada Moti
Rajasthan	Ranjit, DHM-109, Him-129, Pusa Early Hybrid 1, Pusa Early Hybrid 2, Vivek Hybrid 4, Pratap Hybrid 1	Bassi selection, Rattan, Shakti, Moti, Arun, Dhawal*, Parbhat, Pusa Composite 1, Pusa Composite 2, Mahi Kanchan, Megha, Mahi Dhawal, Amar, Aravali Makka 1*, Narmada Moti
Gujarat	DHM 109, Him-129, Pusa Early Hybrid 1, Pusa Early Hybrid-2, Vivek Hybrid 4	Farm Sameri, Gujarat Makai 1, Pusa Composite 2, Mahi Kanchan, Megha, Gujarat Makai 2, Amar, Gujarat Makai 4, Gujarat Makai 3*, Narmada Moti, Gujarat Makai 6
Madhya Pradesh	Ganga 1, Ganga 4, Deccan 101, DHM-103*, DHM 109, Him-129, Pusa Early Hybrid 1, Pusa Early Hybrid 2, Vivek Hybrid 4, DHM 15	Narmada Moti, Jawahar Makka 216*, Chandan Makka 2, Shakti, Chandan Makka 1, Chandan Makka 3, Chand Safed Makka-2, Pusa Composite 1, Mahi Kanchan, Amar, Megha, Jawahar Makka 8, Jawahar Makka 12, Jawahar Makka 216
West Bengal	DHM 103*, Rajendra Makka 22, DHM 15	Megha, Pragati
Orissa	Rajendra Makka 2, DHM 15	Dhawal*, Megha, Pragati
Sikkin		NLD white
All India	Ganga safed 2, Ganga 5, DHM-103, DHM-1*, Ganga-11, DHM 105*, Trishulata*, Parkash, Deccan 107	Vijay, Ageti 76, Navjot, D 765, Diara 3, MCU 508, Kiran, Surya, Shakti 1*, Madhuri (sweet corn)
Peninsular	Deccan, Deccan 101, DHM-103*, VL 42, Pusa Early Hybrid 2, Vivek Hybrid 9, Rangit	Amber, Jawahar, Sona, Harsha, Varun, Priya (sweet corn)*
Himalayan region	Ganga 9, VL 42, DHM 109, Him-129, Vivek Hybrid 9	Amber, Kisan, Mansar, VL 88, Pratap Makka 4
Northern plains	Ganga 1, Ganga 101, Ganga 3	Jawahar, Kisan, Sona, Vikram

* *Rabi*

Maize composites/hybrids released by private companies for cultivation between 1997-2003 are:

3058 (Y1402K), JKMH 2492, PRO 303, MMH 69, KH 951, SSF 9374, PRO 311, MMH 113, PAC 701, PAC 705, Bioseed 9681, 32A09, PRO 312, PRO 316, PAC 738, PAC 776, JH 3189, Bio 9637*, JM-12*, Co BC1, JH 3459, Makka 3, JKMH 175, Kohinoor hybrid, HKH 1082*, HKH 1071*, Seedtec 740, DK 701, PRO 339

*State release

Manures and Fertilizers

Manure and fertilizers both play an important role in maize cultivation. The maize is an exhaustive crop and prefers light soil types for its cultivation, which may further aggravates the nutrient deficiency. Nutrient requirement and its mode of application is, however, governed by a number of factors viz., soil type, variety, planting season, preceding crop, method and time of fertilizer application. For example, maize grown after potato needs relatively less fertilizers and so is the case of crop grown after any legumes. Irrigated crop needs higher doses of nutrients than rainfed ones.

The crop should be supplied with organic manure (FYM or compost) @ 10-15 tonnes/ha before sowing to ensures good tilth and improve the water-holding capacity.

The recommended dose of N varies with duration of the variety and its season of cultivation. For full season hybrids, 100-200 kg N/ha; for medium maturity, 80-100 kg N/ha; for early maturity, 60-80 kg N/ha; and for extra early maturity, 40-60 kg N/ha is required. *Rabi* maize and baby corn require higher dose of N (180 kg/ha) than *kharif* crop and grain crop respectively owing to their higher population.

Besides N, 40-60 kg P_2O_5/ha is necessary for realization of higher yields. The response to K fertilization is rare in India. However, in intensive cropping systems and low temperature regions of Himachal Pradesh and Jammu & Kashmir, K fertilization @ 30-40 kg K_2O/ha is necessary. In sandy soils and freshly levelled field the crop exhibits Zn deficiency. It is also noticed in the soils of north Indian states. Deficient plants show a broad band of bleached tissues on each side of the midrib, beginning from the base of the leaves. In severe cases, the apical leaves become white, a symptom called ‘white bud of maize’. Therefore, it is advisable to apply 15-20 kg/ha zinc sulphate along with basal application of fertilizers. The deficiency of zinc in plants at later stages of growth, however, may be corrected by foliar application of zinc sulphate ($ZnSO_4$) dissolved in water with half the quantity of lime (0.5% $ZnSO_4$ + 0.25% hydrated lime).

One fourth of the total quantity of nitrogen and entire quantity of phosphorus, potash and zinc (wherever required) should be applied at the time of sowing. The rest of N should be applied by side dressing 10-12 cm away from the base of the plant to avoid plant injury. Half of the total N should be applied at knee high stage (20-30 days after germination) and rest one fourth of the nitrogen should be applied after the emergence of flag-leaf, but before the emergence of tassels. Soon after side dressing, the fertilizer on the soil surface should be covered to minimize losses.

Water Management

Maize as *rabi* and *zaid* season crop is grown under irrigated conditions only. However, protective irrigations are necessary under periods of moisture stress, when grown during *kharif* under rainfed conditions. In *kharif*, 2-3 irrigations are required after sowing, whereas, spring crop requires 8-10 irrigations. A good crop of maize requires about 480-600 mm of water during its life cycle. A vigorously growing maize plant needs about 2-3 litres of water/day during peak growing period or on an average its consumptive use of water varies from 2.5 to 4.3 mm/day. The growth stages of the crop affect the water requirement to a greater extent. It is observed that a good crop of maize needs a rainfall or irrigation of about 1.0-1.2 m/ha during the growth period.

The 5 critical growth phases for irrigation are seedling stage (6-leaf stage), knee high stage, tasseling, 50% silking and dough stages. Moisture stress at early growth stages results in delayed tasseling and silking. Stress at later stage of growth causes drastic reduction in yield.

Kharif maize sown before monsoon should be given a pre-sowing irrigation besides irrigation at 6-leaf stage. The other irrigations may be adjusted as per rainfall distribution. It must be ensured that the crop should not suffer from moisture stress at flowering and grain filling stages.

Irrigated crop of maize besides pre-sowing irrigation should be irrigated at all 5 critical stages. However, if only 3-4 irrigations are available, then irrigation at tasseling and 6-leaf stages may be avoided. At times of cold or frost, irrigation is provided to minimize the damage to crop.

In baby corn, 15-20 days after sowing, knee high stage and pre-flowering are the critical stages of irrigation. Stress at any of these stages may result in barrenness and reduced size of baby corn.

In sweet corn, tasseling and silking stages are critical for irrigation. The moisture stress at tasseling stage reduces seed set, and in extreme cases barren ears are also formed.

Excess water or water logging is equally or even more harmful. The crop is highly sensitive to excess water (waterlogging) and hence efficient drainage is equally important as irrigation. It is observed that water logging for more than 3-4 days may result in a yield reduction to the extent of 50% or even complete crop failure, depending upon severity of water logging. To avoid water logging, sowing on ridges is desirable especially in *kharif*.

Weed Control

Weeds emerge with the germination of maize seeds and grow along with plants till the early growth period. This causes a severe crop weed competition to maize plants. The losses caused by weeds are more at seedling stage (3-6 weeks after sowing) than later stages.

The crop is found to be infested with both grassy and broad-leaved weeds. The important weeds are *Elusine indica* (thingri), *Cyperus spefies* (motha), *Cynodon dactylon* (doob), *Dactyloctenum aegyptium (makra), Echinochloa colonum (sawan), Pharagmites (safed murge ka phool), Cleome viscose (hulhul), Phyllanthus niruri (hazardana), Solanum nigrum (makoi), Portulaca oleracea (naunia), Commelina bengalensis (kankoa).*

Two hoeings 15 and 30 days after sowing are necessary to control weeds. Mechanical hoeings should not be done after knee-high stage, as it may lead to leaf damage. In *Kandi* area of sub-montane Himalayan regions, ploughing between the rows of crop of 1m height is practiced. It not only helps in uprooting weeds, but also serves the earthing up purpose besides conserving rain water.

The herbicide usage is common for weed control in maize. Pre-emergence application (within 2 days after sowing) of atrazine or simazine @ 1 kg/ha or alachlor @ 2 kg/ha has been found effective in weed control.

Cropping Systems

Crops like soybean, blackgram, greengram, cowpea are raised mixed with maize. These legume crops are grown in space between 2 rows of maize. In Bihar mixed cropping of groundnut with maize is quite profitable. In certain areas maize is intercropped with pigeonpea. In *rabi* maize, intercropping of pea, rajmash, lentil, potato, onion, methi etc. is done in different parts of the country. In irrigated areas of north India, barley, wheat, *toria*, potato, blackgram, berseem, sugarcane, lucerne, oats are raised after maize.

Some of the most important crop rotations are given below.

Maize-wheat or gram or pea	Maize-wheat-cowpea
Maize-potato-onion/ wheat/ tobaco	Maize-berseem or oat
Maize-lucerne-maize-potato-sugarcane	Maize-*toria*-wheat
Maize-wheat-muingbean or blackgram	Maize-potato-maize
Maize-wheat-cotton-berseem,	Maize-oat-napier grass
Maize-senji-sugarcane-cotton	Maize-wheat-sorghum-sugarcane
Maize-wheat-sugarcane	

Harvesting and Threshing

Maize is harvested when husk is turned yellow and grains are hard enough with about 30% moisture. There is no need to wait for stalks and leaves to dry, because they remain green in most of the hybrids and composites.

The husk is removed from the cobs, and cobs are dried in sun for 7-8 days. Thereafter grains are removed either by beating the cobs by stick or with the help of maize sheller.

Yield

Well managed crop gives 5-6 tonnes grain/ha in case of hybrids and 4.5-5 tonnes in case of composites under irrigated conditions. In case of rainfed crop, yield levels are about 2.0-2.5 tonnes/ha for hybrids and 1.5-2.0 tonnes/ha for composites.

The yield attributes (range) and mean quality characteristics of grain are as below.

Attribute	Value
Cobs/plant	1-1.5
1,000 grain weight (g)	200-250
Protein (%)	11.1
Fat (%)	3.6
Fibre (%)	2.7
Carbohydrate (%)	66.2

Corn plants showing ears: Source: http://en.wikipedia.org/wiki/Maize

Corn male flower, a.k.a. corn tassel

Source: http://en.wikipedia.org/wiki/Maize

Corn female flower, a.k.a. corn silk

Source: http://en.wikipedia.org/wiki/Maize

Cultivars of maize: Source: http://en.wikipedia.org/wiki/Maize