

# MAIZE

The miracle crop in which yellow revolution is to be brought is maize. Being Queen of cereals with highest yield potential among cereals, it can play a vital role in ensuring food and nutritional security for India and world as a whole. Major maize growing season is *Kharif*, which accounts for about 85 % of total maize area whereas *Rabi* maize contributes >25 % of annual production with <10 % of total maize growing area in the country.

In Andhra Pradesh, maize can be grown in all the seasons because of the favourable climatic conditions prevailing in the state. The total cultivated area in the state is around 8.8 lakh hectares. Maize is preferred over other crops because of its less water requirement, less pest and disease problems, high demand for its several utilities and export potential.

**Soils:** Maize can be grown on a wide variety of soils ranging from heavy clay to light sandy soils.

**Climate:** Maize can be successfully grown in wide range of agro climatic conditions. Being a warm weather loving crop, it is not grown in areas where the mean daily temperature is less than 19°C. Critical temperature detrimentally affecting the yield is 32°C. It can be successfully grown in areas with annual rainfall of 60 cm, well distributed throughout the growing stages.

**Land preparation:** One deep ploughing to a depth of 20-25 cm immediately after harvest followed

by discing, light ploughing and then leveling is ideal. In heavy soils, 2-3 deep ploughings are needed, whereas in light soils it is not necessary.

**Season:** The most suitable date of sowing in kharif is between mid June to mid July and between mid October to mid November during rabi.

**Selection of cultivar:**

**Long duration Hybrids** (100-120days): DHM 113, 900 M Gold, Bio 9681, Pro-311, 30 B 07, NK-30, NK 6240, SMH 3904 and JKMH 2492

**Medium duration Hybrids** (90-100 days): DHM 111, DHM 117, DHM-119, KH 510, Bio 9637, KH 9541, MCH 2, Kohinoor, Prabhal and JKMH 175

**Short duration Hybrids** (<90 days): DHM 115, Prakash, KH 5991, JKMH 1701, DKC 7074 R, PEH-1, PEH-2, Him 129, VL49, MMH 133

**Sowing:** It is desirable to sow the crop in ridges and furrows method. Seed rate of 20-25 kg/ha at a spacing of 60x20 cm gives 83,333 plants/ha. In areas where intercultivation is done using tractor drawn implements, 75x20 cm spacing can be recommended which gives a population of 66,666 plants/ha. Sowing should be done by dibbling the seed on the southern side of the east-west ridge at 1/3<sup>rd</sup> height from the top so that apart from better irrigation and drainage, optimum amount of sunshine can be received for better crop growth.

Seed treatment with Captan @ 3 g/kg seed should be done to prevent the crop from the attack of seed borne diseases at initial stages.



## Nutrient management

Well rotten compost or FYM @ 10-12 t/ha should be incorporated into the field about 25 days before sowing. A dose of 180-200 kg N, 60 kg  $P_2O_5$  and 50 kg  $K_2O$ /ha is recommended for *Kharif* maize crop. Nitrogen is to be applied in three equal



splits. Entire dose of P, half the dose of K and 1/3<sup>rd</sup> of N should be applied as basal, 5-7 cm deep before sowing while remaining two equal splits of N should be applied as top dressing at 30-35 days and 50-55 days after sowing. Balance 50% of the K should be applied at 50-55 days. In zinc deficient soils, zinc sulphate should be applied @ 50 kg/ha once in 2-3 seasons. Spraying of zinc sulphate



@ 2 g/l of water is recommended, if deficiency symptoms are observed in standing crop.

In case of rabi maize crop, 200-240 kg N, 80 kg  $P_2O_5$  and 80 kg  $K_2O$ /ha are recommended. Nitrogen is to be applied in four equal splits. Entire dose of  $P_2O_5$ , half the dose of  $K_2O$  and 1/4<sup>th</sup> N should be applied as basal while remaining N

should be applied in three equal splits as top dressing at 30-35, 50-55 and 60-65 days after sowing. Remaining 50% of  $K_2O$  should be applied at 60-65 days after sowing.

## Weed management

Atrazine 50 % WP @ 2 kg/ha in case of light soils and 3 kg/ha in case of heavy soils is to be mixed in 500 l of water and sprayed uniformly within 2-3 days after sowing on moist soil for management of weeds. It is desirable to walk backwards so as not to disturb the thin film of herbicide. In intercropping system involving legume crops, pre-emergence application of Pendimethalin 30 % @ 2.5 l/ha in 500 l of water is recommended. Application of herbicide should be followed by intercultivation at 30-35 days. Intercultural operation should be followed by earthing up along with first top dressing of nitrogenous fertilizers.

## Water management

A total of 400-500 mm of water would be enough for *Kharif* maize, if water losses through different sources (run off, leaching, evaporation) are kept to the minimum.

Adequate moisture should be present in the soil at the time of sowing for germination. Care should be taken to avoid waterlogging upto 30 days after sowing. Maize can withstand moisture stress in the early stages. Certain periods during crop growth are more sensitive to soil moisture stress and are called moisture sensitive periods which are flowering, grain filling and dough stages. Inadequate supply of water during these stages will irrevocably reduce yield irrespective of following all other practices at other growth stages. Therefore, irrigation should be scheduled at less frequent intervals in the vegetative phase whereas at frequent intervals in reproductive phase.

450-600 mm water is required in *Rabi* season. Heavy soils may require 5-6 irrigations, whereas light soils need 8 irrigations. Irrigation can be given once in 8 days in sandy loam soils and once in 15 days in heavy soils depending on the weather.

**Insect management:**

**1. Spotted/striped stem borer (*Chilo partellus*):**

It attacks in early crop stage (10-20 days old) especially in kharif season. Caterpillars damage by boring into stem, immature cobs and tassels resulting in shot holes and dead hearts.



**2. Pink stem borer (*Sesamia inferens*):**

In peninsular India, it is more serious during *Rabi* season.

**Management of Stem borers:**

- Ploughing the field soon after harvest, collection and burning of stubbles and removal of infested plants.
- Adjusting the sowing time and maintaining optimum plant density.
- Intercropping with legumes, trap cropping with sorghum and crop rotation with non host crops
- Release of egg parasitoid, *Trichogramma chilonis* @ 8 cards per ha twice i.e. at 12 and 22 days after germination.
- Prophylactic spray of Carbaryl 50 WP @ 3 g/l or Monocrotophos 36SC @ 1.6 ml/l at 10-15 DAG followed by Carbofuran 3G @ 7.5 kg/ha in plant whorls in case of severity.

**3. Aphid (*Rhopalosiphum maidis*):** Aphids attack the plants at the end of mid whorl stage. It is in serious form during drought years. Aphids secrete honey dew on which black sooty mould develops. Both nymphs and adults suck sap from



plants causing yellowing and stunting. Tassel emergence is prevented and pollen shed is reduced when emerging tassels and the leaves surrounding the tassels are covered with aphids.

## Management:

Spraying of Dimethoate 30 EC @ 2 ml/l or Monocrotophos 36 SC @ 1.6 ml/l

**4. Cut worm (*Spodoptera litura*):** Nocturnal larvae defoliate the leaves during night.

a) Poison baiting with Monocrotophos 0.5 litre or Carbaryl 0.5 kg + Jaggery 0.5 kg + Rice bran 5 kg

b) Erection of pheromone traps @ 10/ha

**5. Cob borers:** *C.partellus*, *S.inferens*, *H. armigera* and *S. litura* cut the silk, enter the cob and feed on the milky grains, mostly confined to the last 1-3 rows. They open avenues for infection by ear-rot pathogens.

## Management:

1. Setting up of light traps and pheromone traps in the field can attract the adults of *H.armigera* and *S.litura*.
2. Hand picking and destruction of larvae.
3. Dusting of Folidol 2 % on the silks
4. Spraying of Carbaryl 50 % WP @ 3 g/l or Monocrotophos @ 1.6 ml/l water.

## Disease management

Maize is susceptible to a number of diseases that are responsible for lowering the grain yield considerably.

### 1. Turcicum leaf blight (*Exserohilum turcicum*):

High humidity and low temperature during growing season (18-27 °C) favour disease development. Damage is severe in areas with heavy dew and rainfall. Slightly oval and water soaked small spots appear first on lower leaves, later they grow into elongated spindle shaped necrotic lesions which increase in size and number as the plant develops, till complete burning of foliage is conspicuous.



- Sanitation
- Clean cultivation - plough down of infected crop debris
- Spraying with Mancozeb @ 2.5 g/l at 8-10 days interval
- Growing resistant cultivars- DHM 1, DHM 105, Trishulata

### 2. Maydis leaf blight (*Helminthosporium maydis*):

Disease is favoured by high relative humidity and warm temperature of about 20-30 °C during the cropping period. It is prevalent



in hot humid areas. Initially, the lesions on leaf are small and diamond shaped. The lesions may coalesce producing complete burning of large area of leaves.

- Ploughing down of crop debris may reduce early infection
- Spraying Mancozeb or Zineb @ 2.5 g/l

### 3. Rust (*Puccinia sorghi*):

Moderate cool temperature (16-25 °C) and high relative humidity favour rust development and spread. It is most conspicuous when plants approach tasseling. Circular to elongate cinnamon



brown powdery erumpent pustules appear on both leaf surfaces.

- Spraying of Mancozeb @ 2.5 g/l as soon as pustules appear and repeat at 10 days interval till flowering

### 4. Banded leaf and sheath blight (*Rhizoctonia solani*):

Disease appears at pre-flowering stage in 40-50 days old plants but can also occur on younger plants. (in which case severe blight is accompanied by death of apical growing point).



- Spraying of Propiconazole @ 1 g/l or Carbendazim 1 g/l or Rhizolex 50 WP @ 1 g/l
- Stripping off the lower infected leaves touching the soil along with their sheaths
- Clean cultivation and destruction of crop debris

### 5. Bacterial stalk rot (*Erwinia carotovora f. sp. zea*):

Disease occurs where high temperatures (32-35 °C) are coupled with high humidity during pre-flowering stage and later plants lodge/topple down. Ears also rot, fail to develop further and hang down from plants.

- Avoid waterlogging
- Provide proper drainage
- Avoid sewage water for irrigation
- Planting on ridges than on flat soil
- Soil drenching with bleaching powder containing 33 % Chlorine @ 10 kg/ha at pre flowering stage

### 6. Pythium stalk rot (*Pythium aphanidermatum*):

Maximum disease development occurs within temperature range of 30-35 °C and relative humidity of 80-100 %. Disease is associated with excess rain, poor drainage and high temperature.

- Avoid waterlogging, provide good field drainage
- Remove previous crop debris
- Seed treatment with Metalaxyl 4 g/kg or Captan 3 g/kg
- Soil drenching with Captan 1.5 g/l or Metalaxyl 2 g/l or COC 3 g/l when crop is 5-7 weeks old

### 7. Charcoal rot (*Macrophomina phaseolina*):

Dry weather, high temperature (37 °C) and water stress at the time of silking favour disease development. Imbalanced fertilizer application and high plant density influence disease prevalence and severity. Prevalent in *Rabi* when temperatures are high during post flowering period. Disease generally appear early after flowering when plants approach maturity.

- Sanitation
- Removal of previous crop debris
- Deep ploughing
- Crop rotation
- Avoid water stress at flowering time

### 8. Late wilt (*Cephalosporium maydis*):

Appears only after flowering stage. Plant wilt basipetally (top to bottom) giving a dull green appearance of leaves which dry up later. Lower internodes are discolored, turn reddish brown and soft which dries later and become hollow.

- Seed from infected area not to be sown
- Avoid moisture stress at flowering stage
- Balanced potash application reduces disease incidence
- Rotation with other crops

**9. Downy mildews:** Two types are common in India. Prevalent in warm and humid regions.

**A. Sorghum downy mildew (*Pernosclerospora sorghi*):** Half leaf symptom is the typical symptom at the base of a leaf having sharp margin between diseased and non-diseased tissue and later entire leaf becomes chlorotic. These stripes turn reddish brown, become necrotic later in the season and may shred. Infected leaves are narrow and erect. Downy growth on both leaf surfaces because of conidia formation. Cobs fail to form and tassel may be replaced by vegetative proliferation dubbed 'crazy top". Plants infected at an early stage of downy mildew often appear stunted and may die prematurely and may be more susceptible to other diseases.

- Eradication of collateral hosts
- Rouging of infected maize plants
- Metalaxyl seed treatment/foliar spray

### Harvesting:

Harvesting should be done when the crop attains physiological maturity i.e., 7-8 weeks after flowering or when the grain moisture is 25-30 %. Physiological maturity can be known by -

- Yellowing of most leaves which start drying. Cob husks turn brown and papery.
- Cobs begin to droop on stalk
- Black layer formation at the tip of kernels.

In the absence of irrigation facilities and failure of rains, maize can be harvested at any stage of its growth. At pre-flowering stage for fodder, flowering stage for baby corn and milky to early dough stage for green ears. Stalks/stover can also be used for silage making or feed in cattle.

**Processing:** Harvested cobs should be dehusked and sun dried for about 4-5 days till the grain moisture decreases to 12-15 %. Sorting of

diseased cobs and off-type cobs (different colour & texture) should be done. Shelling can be done manually or by power/tractor operated sheller. Processing is done using 10.5 x 6.4 mm sieve for all maize types. Shelled grain is dried for 2-3 days till moisture falls to 8-10 % and then stored in polythene lined gunny bags/cloth bags and kept on wooden pallets in dry ventilated store with proper labeling.

## **NO -TILL MAIZE**

In Rice-pulse system adopted by the farmers especially in Godavari, Krishna and Guntur districts, pulses productivity has decreased due to the incidence of yellow mosaic virus. Instead of pulses, irrigated dry crops like sunflower and maize were recommended but farmers are not willing to take up because lot of time and labour are required to make the soil suitable for sowing. Hence, Zero tillage (No till) technology has come into practice which not only has short term benefits like saving of 25-30 % of energy for field preparation, advancement in sowings by 20-25 days but also long term benefits like improvement in the organic carbon content of the soil, checking soil erosion etc.

Due to higher productivity, profitability and assured alternative *Rabi* crop after rice, acreage of maize has shown an increasing trend and rice-maize emerged as a potential cropping system. No-till maize in rice fallows demonstrated a potential benefit of saving on cost of production ranging from Rs.3,800-5,500/ha.

**Season:** After harvest of *Kharif* rice, from November which may extend up to December in coastal districts

**Sowing:** Depending on the soil type, one last irrigation should be given to the standing paddy crop so that sufficient moisture would be available for the germination of subsequent maize crop. If

there is no sufficient moisture in the soil at the time of sowing, one light irrigation has to be given. Row to row spacing of 60 cm can be maintained using a rope and seeds should be dibbled with a gap of 20 cm at a depth of 13 . Zero till drill machine can also be utilized for dibbling the seed. Plant population should be 83,333 plants/ha.

**Weed management:** Since there is no preparatory tillage, weeds become a serious problem. An effective strategy for weed management in no-till system is the pre-emergence application of Paraquat 24% @ 2.5 l/ha to arrest regrowth of paddy stubbles followed by Atrazine @ 2.5 kg/ha in 500 l water. Combination of Paraquat and Atrazine (1.25 l + 1.25 kg/ha in 500 l of water) was also found to give effective weed control.

**Nutrient management:** Placement method of fertilizer application is recommended. Fertilizers dose is similar to that of *Rabi* maize i.e, 200-240; 80; 80 N, P<sub>2</sub>O<sub>5</sub> & K<sub>2</sub>O kg/ha.

**Water management:** Maize can neither tolerate drought nor waterlogging. Optimum moisture should be present at the time of sowing. The critical stage for moisture is from flowering to grain hardening. In order to realize higher yields, irrigation should be given at 30, 45, 60, 80 and 90 days depending on the soil type.

**Insects & Diseases:** In the coastal areas of Andhra Pradesh, incidence of cob borers like *Sesamia inferens*, *Spodoptera spp*, *Helicoverpa spp* and hairy caterpillars cutting the silk were noticed in no-till maize. Banded leaf and sheath blight was also more prevalent, may be due to previous rice crop, high humidity, dense planting etc.

**Yield:** Yield obtained in no-till planting is similar to that of *Rabi* sown crop or sometimes high also.