Maharashtra Agribusiness Network (MAGNET) Project

GAP Module - Chilli

#GTBharat
SHAPING A VIBRANT INDIA

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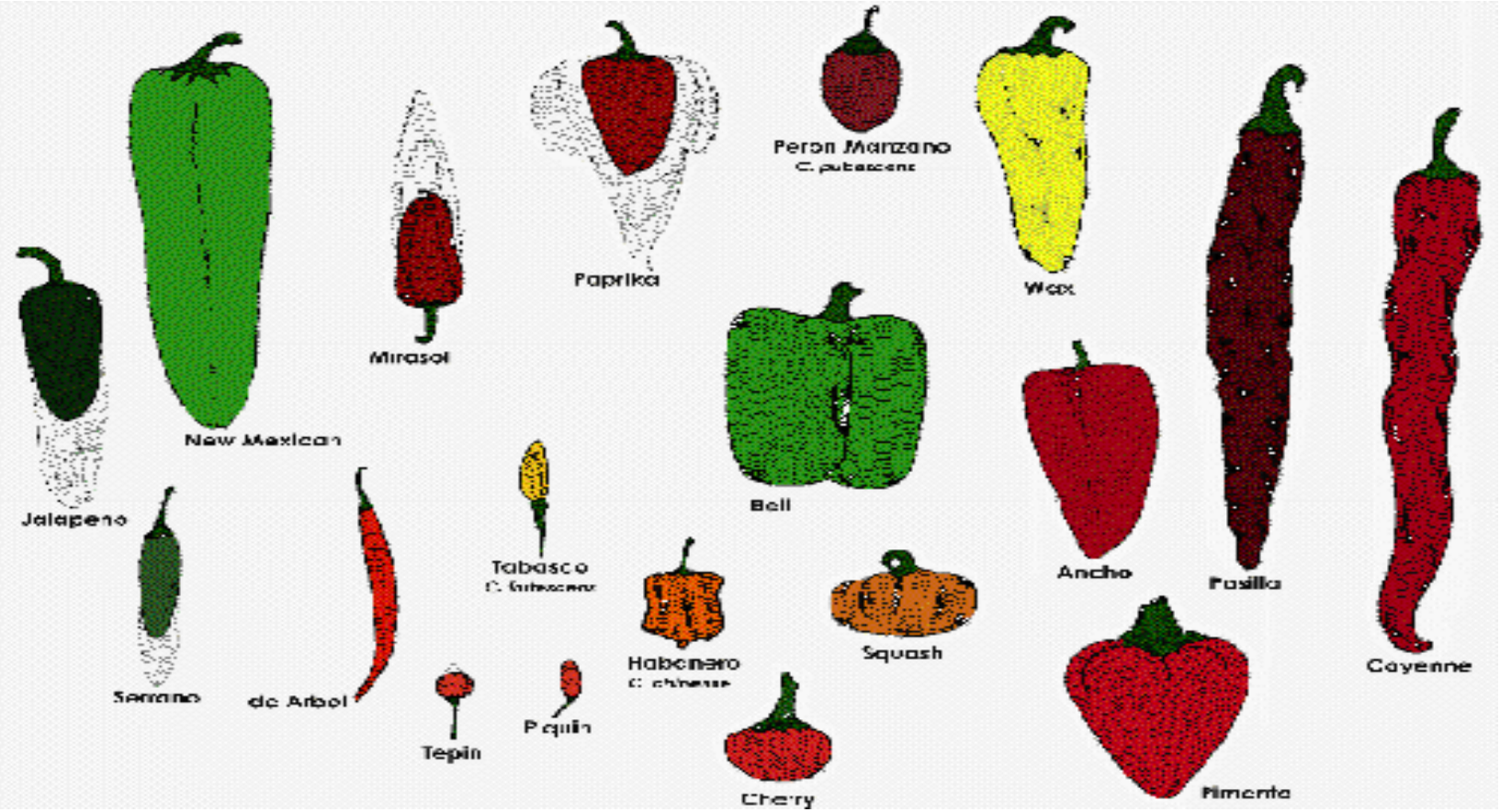
Varieties

Standard Pod Types



Generally, smaller the pod size, higher the pungency.

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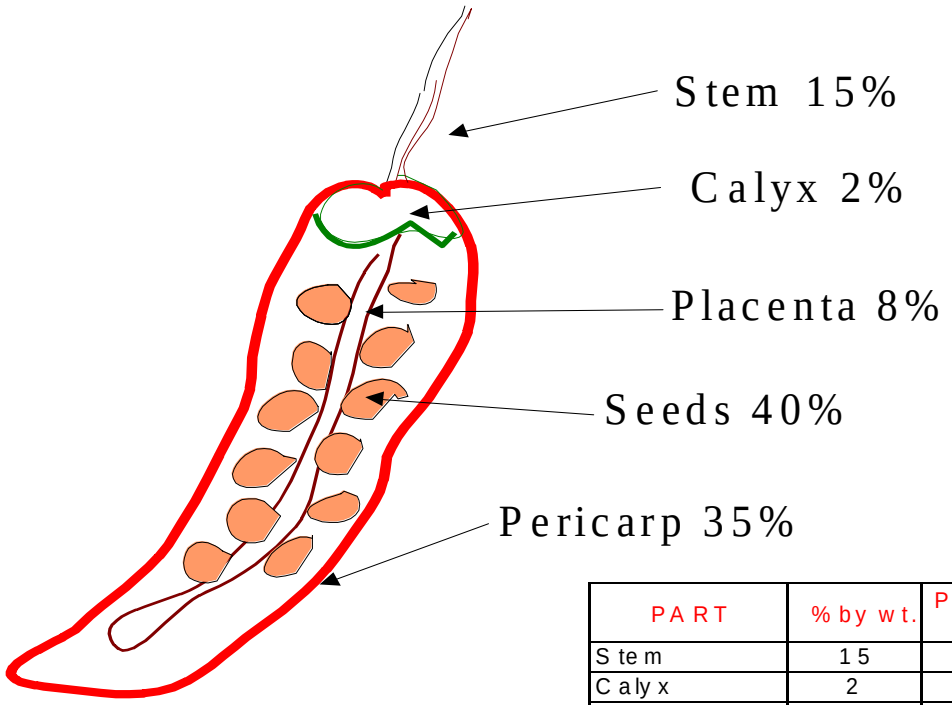
Heat Distribution in Chilli Pod



Whole Chilly – Parts & Heat Distribution

PART	% by wt.	Pungency in SHU	Contribution
Stem	15	3000	450
Calyx	2	3000	60
Placenta	8	120000	9600
Seeds	40	6000	2400
Pericarp	35	50000	17500
	100		30010

The placenta has the highest heat value.

Varieties of Chilli

Variety	Description	ASTA Color Value	Capsacin (pungency)	Grown in	Harvesting Season
Birds Eye Chilli	Blood red, highly pungent	41.7	0.589%	Mizoram, some areas Manipur	Oct – Dec
Byadagi	Red; less/ no pungency	159.9	Negligible	Dharwar, Karnataka	Jan – May
Guntur Sannam - S4	Skin thick; hot and red	32.11	0.23%	Guntur, Warangal, Khammam	Dec – May
Jwala	Highly pungent, light red	33.0	0.40%	Kheda, Mehsana & S. Gujarat	Sep – Dec
Kanthari White	Ivory white, high pungent	2.96	0.50%	Kerala, some parts of TN	round the yr
Kashmir Chilli	Long, Fleshy, deep red	54.1	0.33%	HP, J&K, tropical N. India	Nov – Feb
M. P. GT Sannam	Red & pungent	73.82	0.21.	Indore, Chikli, Elachpur	Jan – Mar
Tomato Chilli	Deep red & less pungent	125.26	0.17%	Warangal, Khammam, E. & W. Godavari Districts, A.P.	Dec – Mar

Varieties

Family: Solanaceae
Genus: *Capsicum.*
Species : *annuum* (most common),
frutescens (Eg.Tabasco),
chinense (Eg. Habanero),
baccatum

Over 100 varieties in the World.
India has the largest number of varieties at 30.

Sannam

- Largest grown variety in India at nearly 75% of Indian Chilli.
- Pungency- 30,000 to 40,000 SHU
- Colour value – 3000 - 3500 CU
- Medium pungency, medium colour.
- Variants: Guntur Sannam, Nalchetti (M.P), GT(Karnataka), Tamil Nadu
- Known as S4 in international Market
- Fruit length 5 to 8 cm
- Grown in almost all parts of India, mainly in A.P, Maharashtra, M.P

GUNTUR SANNAM

Byadagi Kaddi

- Crop Size about 45,000 MT
- Low pungency, high colour, preferred by extractors
- Pungency- 10,000 to 20,000 SHU
- Colour Value – 5000-12000 CU
- Variants: Kaddi, Dubby, Dyavanoor
- Known as KDL or Indian Paprika in international Market
- Fruit length 6 to 12 cm, wrinkled surface
- Grown exclusively in North Karnataka.

BYADAGI (KADDI)

Bird's Eye

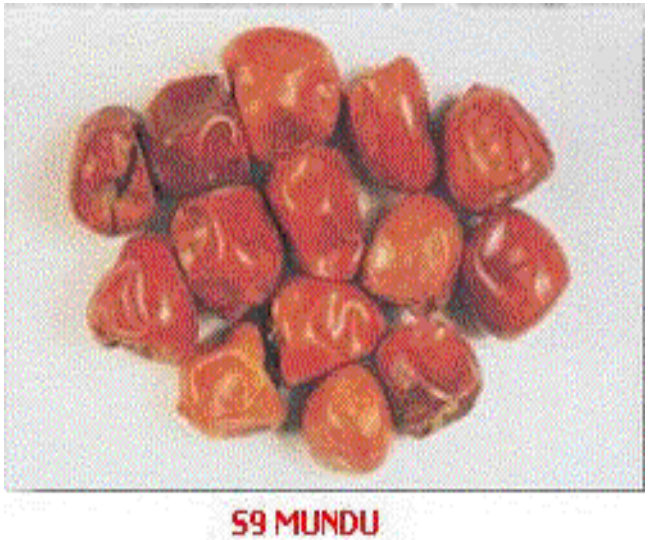
- Crop Size about 5000 MT.
- High pungency, low colour.
- Pungency - 100 – 120,000 SHU
- Color Value – 3000 CU
- Variants: Laata, Dhani, Mizo, etc
- Fruit length 1 to 2 cm, smooth or wrinkled surface
- Grown exclusively in North-eastern States

Bird's Eye

- Crop Size about 20,000 MT
- High pungency, low colour.
- Pungency- 50,000 to 55,000 SHU
- Colour Value – 2000-2500 CU
- Variants: Hindupur, Jwala, Nagpur
- Known as S7
- Fruit length 2 to 6 cm, Orangish Red
- Grown exclusively in Ananthpur, S. Karnataka, Khamgaon and Warangal Dist.

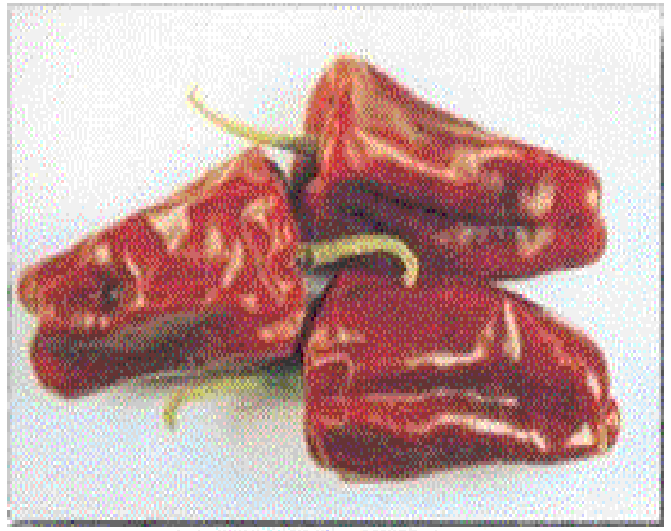
Mundu

- Crop Size about 20,000 MT
- Medium pungency, low colour.
- Pungency- 2000 to 25,000 SHU
- Colour Value – 2500 - 3000 CU
- Known as S9 in international Markets
- Fruit length 2 to 4 cm, round fruits
- Grown exclusively in Southern Tamil Nadu



Tomato Chilly

- Crop Size about 20,000 MT
- Low pungency, high colour.
- Pungency- 10,000 to 15,000 SHU
- Colour Value – 6000-8000 CU
- Variants: Chapata (another Name)
- Fruit length 6 to 8 cm, Squarish
- Grown exclusively in Warangal Dist. of A.P

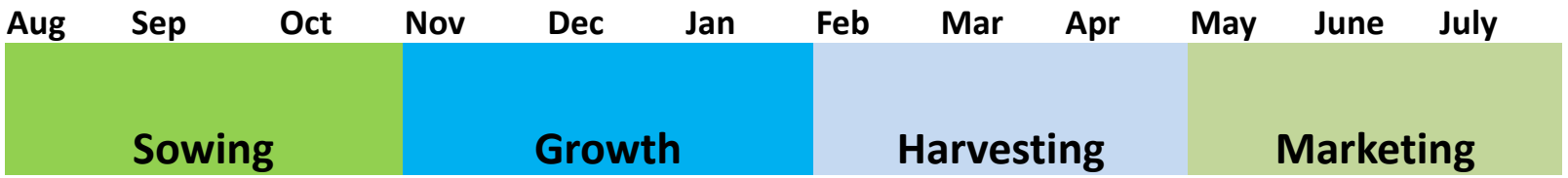


Culture Practices

Best Cultivation Practices

- Warm, humid climate for growth
- Dry weather during maturation
- Wide range of altitudes from sea level to up to 2100 m above MSL
- Can be grown throughout the year under irrigation
- Black soil that retain moisture are suitable for rain fed crops
- Well drained ‘chalka’ soils and sandy loams are good under irrigated conditions
- Mainly grown as a transplantation crop

Harvest Calendar



Climate

- **Suitable Temperature**

  I. Average Monthly temperature 20 - 35 C,

  II. Day Length 9-10 hr light stimulates plant growth to increase productivity by 21-24%

  - Frost is dangerous
  - High night temp improves capsaicin levels;
  - Day temperature 20 - 30 C optimum but >37 C accelerates flower and fruit drop
  - Low night temperature increases parthenocarpic fruit set
  - High day temperature develops abscission zone (flower drop)

- **Spacing**

  Row to Row: 60 cm

- Plant to Plant 45 cm

Nursery Management

Sow the seeds in Pro trays of 98 cavities by using the sterilised cocopeat as a media,

At 10th day after sowing mild spray with Uthane M-45 @ 1g/litre of H O + Ulala 0.3 g/litre of H2O or Saaf @ 1g/litre of H2O + Ulala 0.2 g/litre of H2O

At 15th day after sowing spray with Saaf @ 1g/litre of H O + Ulala 0.2 g/litre of H2O

At 21st day after sowing spray with Uthane M-45 @ 1g/litre of H O + Ulala

At 21st day after sowing spray with Uthane M-45 @ 1g/litre of H O + Ulala 0.3 g/litre of H2O or Saaf @ 1g/litre of H2O + Ulala 0.2 g/litre of H2O.

At 28 days after sowing spray with Saaf @ 1g/litre of H2O+ Ulala 0.2 g/litre of H2O+ 19:19:19 (Soluble) @ 1g/litre H2O.

Hardening of seedlings is must before transplanting. Seedling will be ready for transplanting in 30 Days after sowing.

Transplanting has to be done preferable in evening hours to avoid sun shock & mortality.

Soil & Land Preparation

An ideal soil for growing chilli is a light loamy soil enriched with organic matter & also rich in lime with pH upto 6-7 will be good for cultivating Hot Pepper.

Deep Ploughing & Harrowing (expose the soil to hot sun for 20-30 days in summer season) & keep the soil weed free to reduce soil pathogen as well as to reduce secondary host for sucking pest.

Apply 25 tonnes of well decomposed FYM/ha fallowed by harrowing to mix in the soil

Prepare ridges & furrows. v) Apply the fertilizer as per the recommendations

Irrigate the field a day prior or before Transplanting,

Ideal time for transplanting is between 3:00 PM to 6:00 PM evening hours & irrigate the field immediately after transplanting for quick & better establishment,

Advisable to adopt technologies like drip irrigation for intensive utilization of water & Mulching for better crop growth & development & also mulching will help to restrict weeds & enhance quality of produce.

Fertilizer Application

- Apply 25t FYM/ha at the time of ploughing
- At the time of final land preparation apply 100:50:50 NPK kg/ha
- 20 DAT again apply 50:25:25 NPK kg/ha as top dressing
- After first picking apply final dose of 50:25:25 NPK kg/ha as top dressing
- Use of bio-fertilizer, Azotobacter or Azospirillum @ 2kg/ha save 25% nitrogen requirement of chilli crop
- For soil application Azospirillum should be mixed with 20 kg of FYM or compost. Top dressing should be done after draining out the water and weeding so that the loss of nutrient is minimum.
- The acidic soils should be treated with liming materials as and when required.
- Addition of organic manures or green manuring should be done at least once in 3-5 years.
- In case of flooded fields slow releasing nitrogenous fertilisers should be used so that loss of nitrogen can be minimised.
- Appropriate plant protection measures and proper tillage practices should be adopted so that plants remain healthy and absorb the applied nutrients from the field.

Growth Regulator

NAA@ 50 ppm, at flowering reduces flower drop & increases fruit setting

Lehosin @ 200 ppm improves fruit quality(fruit dev. & capsaicin);

K-increases capsaicin

MH @ 300 ppm & Ethrel @ 200 ppm suppressed flowering

Use of growth regulators

Flower and fruit drop is a serious problem in chilli and it depends on higher temperature, low soil moisture, shading and light intensity

Planofix (NAA) @ 20-40 ppm (20-40 mg/lit) twice with 15 days interval

2,4,D @ 2-4 ppm at flower bud initiation reduces flower drop and increase fruit set and yield

Application of Ethrel or Ethepon @ 300 ppm through foliar spray increases fruit set and yield.

Application of morphactin at 1ppm before flowering produces stamen less flowers.

Ethrel is applied for uniform maturity of fruits. Ethrel or ethephon is applied @ 500 ppm when the first fruit on the plant begins to turn slightly red. Yield T/ha : 30-35 T (Green); 25-40% of green chilli / red fresh (Dry) Avg. per Fruit weight (g) : Av. Wt. 3.5-4 g, 60-65 seeds/ green chilli & 90-110 seeds/Red Dry No. of fruits per plant : Average 425-450

Bacterial Wilt Remedies (Control Measures)

- Cuproflix 3.0-4.0 g/l & Unilax 2.0 g/l for Damping off,
- Saaf 2.5 g/l for Die Back & Fruit Rot,
- Topas 1.5 ml/l & Beltyon 1.0 g / L for Powdery Mildew,
- Saaf 2.5 g/l, Uthane 2.0 g/l for Cercospora leaf spot,
- Lancergold 2.5 g/l for thrips control,
- Ulala 0.5 g/l for Aphids & White flies control,
- Invade 0.5 g/l, Atabron 3 ml/l for Fruit borer control

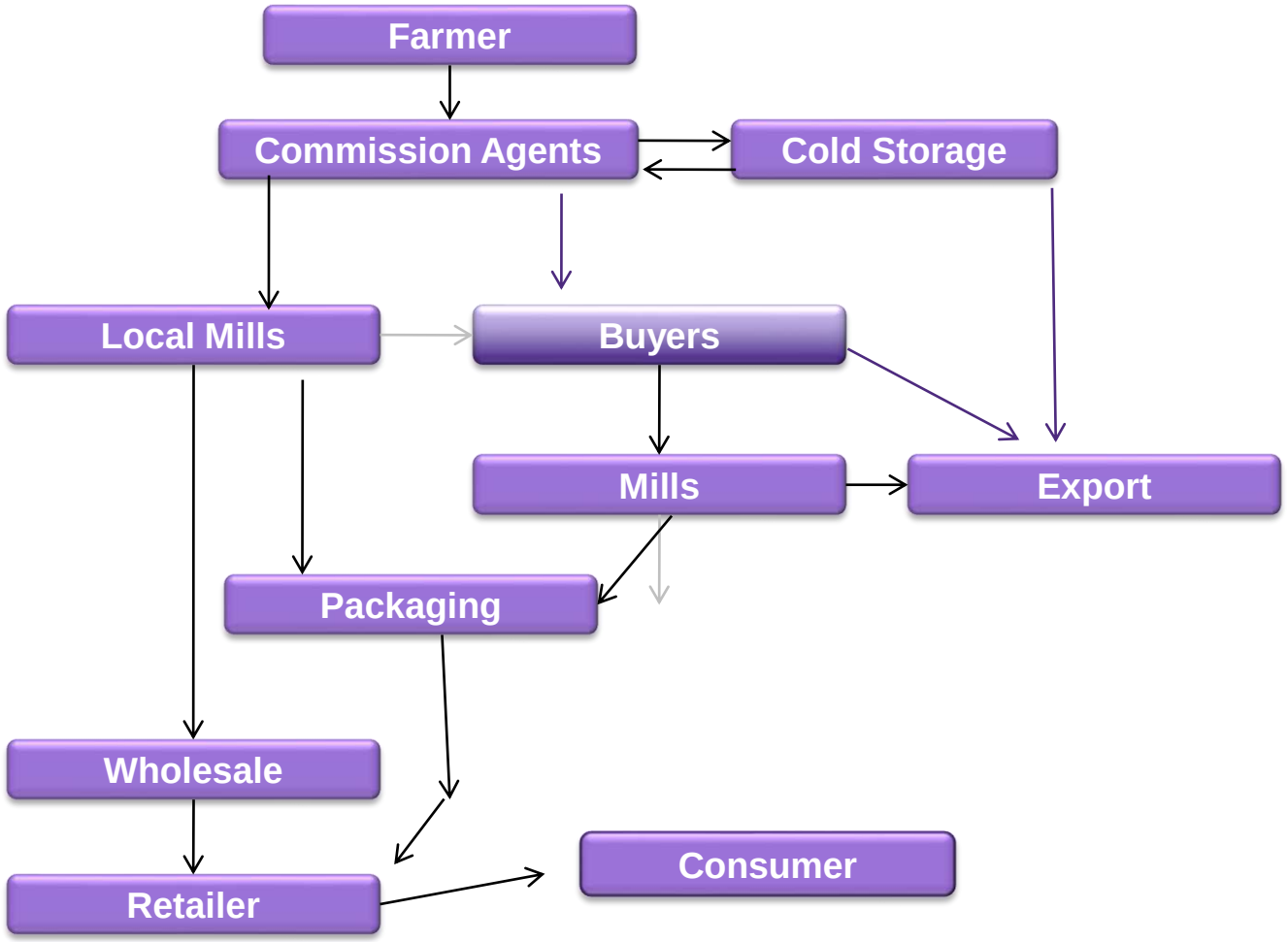
Leaf Curl Virus (LCV) Remedies

- Apply phorate between lines during nursery 10% @ 10 kg/ha
- While transplanting-dip seedling tips in mixture of monochrotophos (36% @ 15 ml + Mancozeb 25 g + S 25 g in 10 L water; After transplanting Spray - Mix. of monochrotophos @15 ml + Wettable S (805) 25 g + 25 g COC in 10 L water;
- Second spray 10 days after 1st : Mixture monochrotophos -15 ml + S 25g + ziram -20 g in 10 l water
- Follow the same spray at an interval of 10-15 days till flowering
- When irrigation facility is not available - dusting with methyl parathion s/be done ;
- On flowering spray - mix. of mathion (50%) 20 ml/mono 15 ml + S (80%) 25g + ziram 2 g in 10 L water at 10 days interval;
- If picking is to be done then 1stpick & then apply the sprays;
- Towards the end of Oct. Chilli is often infested by PM: CM - Dusting with S (300 mesh) @20 kg/ha; Never pick the fruits for 6 days from spraying

Backward Integration

Conventional Value Chain

Chilli Value Chain in India



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Current market scenario

- **Major Brands**:
  - MDH
  - Aashirvaad (ITC)
  - Everest
  - MTR
  - Catch

Company/ Brand	Variety	Cost	
Catch	Kashmiri Mirch Masala	400	Rs/ kg
Catch	Red Chilli Powder	290	Rs/ kg
MTR	Lal Mirch Powder	160	Rs/ kg
Everest	Kashmiri Lal	500	Rs/ kg
Everest	Tikhalal	300	Rs/ kg
MDH	Deggi Mirch	400	Rs/ kg
MDH	Kashmiri Mirch	400	Rs/ kg
MDH	Lal Mirch Powder	300	Rs/ kg
Aashirvaad	Lal Mirch Powder	250	Rs/ kg

- **Challenges/ Strategy**:
  - Identifying the right mix for the consumer requirements
  - Catering to local tastes
  - Maintaining consistent quality
  - Ensuring availability of product

Safety Concerns

Aflatoxin Content

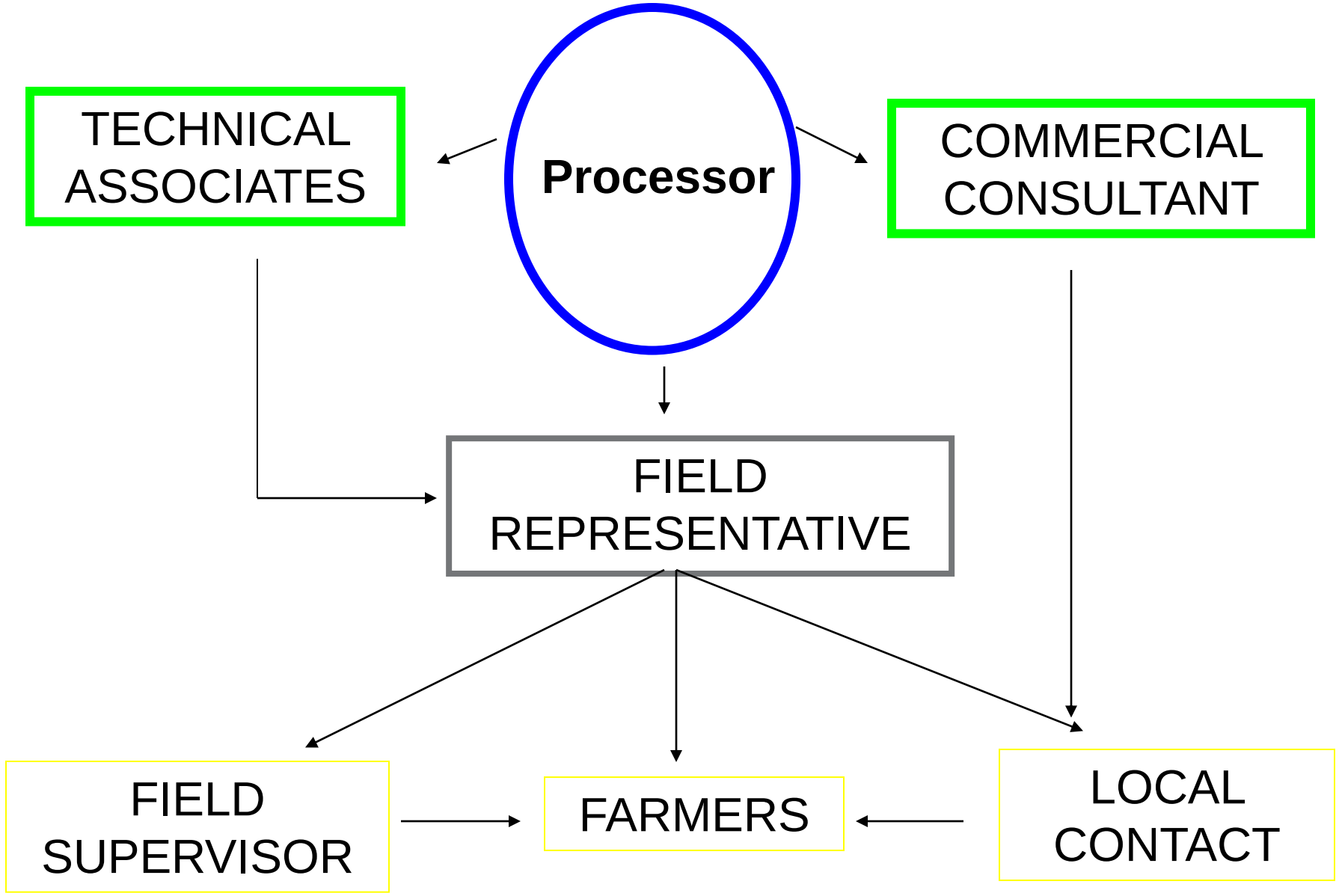
- produced by mold (*Aspergillus Flavus)*
- moisture and storage conditions are important causes
- measured in parts per billion (ppb)

Pesticide Residue

- cause is agricultural practices
- measured in mg/kg or ppm

Colour Dyes (adulterants)

- Sudan I – IV, Rhodamine, Para Red, etc



Qualified agriculturists along with local partners co-ordinate all field activities

Integrated Pest Management

Pesticide Residue Control

1. Pesticide Residue is controlled by restricting application of pesticides in the field.

2. Pheromone traps and other observation methods help understand intensity of pest incidence and decide the right pesticide application.

3. When pesticides are to be applied, the right pesticide is chosen by our technical field staff based on the MRL's allowed under EU regulations.

4. Pesticides are rarely repeated.

5. 40 day pesticide holiday before harvesting is strictly observed.

6. Detailed logbook captures information regarding what, how much and when applied of the pesticide.

7. Lab gives feedback to field staff regarding residues found in the chilies cultivated by them. Helps to fine tune practices.

Field Measures to control pests

Castor as a border crop against caterpillars

Field Measures to control pests

Marigold is a preferred crop for Ball Worm.

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Field Measures to control pests

Maize as a border crop to stop pest advancement. For Aphids that attack chillies, Maize is the preferred crop.

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Field Measures to control pests

Bird perches invite birds who eats away flying insects and caterpillars.

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Field Measures to control pests

Pheromone traps attracts and collects insects which are counted to evaluate the severity of pest attack

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Chilli Crop

Chilli in India

Andhra Pradesh is the largest producer of chilli in India.

Ripe Chilli Pods

Ready for Harvest

Harvesting and Quality Management

Grading at Farm Level

Macro / micro contamination issues

Traditional field drying of chilli pods

- Done on the bare fields / streets.
- No hygiene control
- Aflatoxin and contamination issues

Packing Chilli – The Man in the Bag Method

- Cold stores charge per bag.
- The more you can get in the bag, the better

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Cleaning Harvested Chili in the field

Removes diseased and damaged pods.

Infested/Damaged Pods

- Damaged and infected pods are separated immediately to prevent mould growth.
- Clean, good pods go for drying.

Sun-drying chilli pods on clean tarps

- Faster drying
- Better hygiene
- Reduces Aflatoxin development

Drying/Grading Facility

- Clean and well operated facility with perimeter walls also prevent intrusion by animals, poultry and people who may otherwise walk over and contaminate the lot.

Grading and Cleaning of Chilli

- Trained workers, aprons, hair-nets, sanitised hands/ tarps/ utensils.
- Improved hygiene, lower micro, prevents contamination.

Fumigation Prior to Storage

- After lab approves for moisture, aflatoxin, pesticides, colour, pungency and other physical parameters, the lots are packed into 25 kg bags and fumigated.

Chilli Cold Storage

- Dedicated cold stores ensures that Chilli lots does not get mixed up regular products of other farmers.
- Cold store prevents aflatoxin development during storage and also help preserve colour over long periods.

Post Harvest Management

Special Considerations

- Pungency or hotness of chillies is due to capsaicinoids (capsaicin is the main one)
- Pungency depends on type, cultivar, genetics, environmental factors, maturity of the chillies
- Chillies stored under a range of temperatures and still of marketable quality maintain their capsaicin concentrations

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Maturity Indices

- **Harvesting of Chillies:** Chillies are harvested depending upon the purpose for which used - either as fully mature green coloured for use as vegetable or when colour changes from green to red for use as Dry Chillies.

- **Mature-Green Chilli**: Fruit size, firmness, color
- **Coloured Chilli**: Minimum 50% coloration to achieve complete colour development

Maturation and Ripening

Maturation and ripening stages of Anaheim Chiles

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Quality Indices

The whole dried chillies must be:

- Intact (slight superficial damage is not considered as a defect).
- Sound (fit for consumption and no rotting or deterioration).
- Clean (practically free of any visible foreign matter).
- Sufficiently developed with attached peduncle.
- Typical shape and colour characteristic of chilli types.
- Free from living pests whatever their stage of development.
- Free from pest damage, absence of dead insects and/ or mites, their debris or excreta)

- Free from blemishes, patches of discolouration or spread stains in pronounced contrast with the rest of the produce affecting in aggregate not more than 5 percent of the surface of the produce.
- Free from mould filaments visible to the naked eye.
- Free of abnormal external moisture.
- Free of foreign smell and/or taste.

The condition of the whole dried chilli peppers must be such as to enable them:

- To withstand transportation and handling;
- To arrive in satisfactory condition at the place of destination.

Optimum Temperature & Relative Humidity

- Should be cooled as soon as possible to reduce water loss.
- Storage at above 7.5°C causes water loss, shrivel, color change and decay.
- Storage at 7-10°C is considered the best for maximum shelf-life (3-5 weeks).
- Chillies can be stored at 5°C for at least 2 weeks without visible signs of chilling injury.
- Storage at 5°C reduces water loss and shrivel, but after 2-3 weeks, chilling injury is mostly detected as discoloration of the seeds.
- **Optimum Relative Humidity**
- More than 95% (less than 100%)
- The firmness of chilli peppers is directly related to water loss during storage.

Effect of Temperature (Chilling Injury)

Physiological Disorders

- ***Blossom end rot.*** This disorder occurs as a slight discoloration or a severe dark sunken lesion at or near the blossom end; it is caused by temporary insufficiencies of calcium due to water stress and may occur under high temperature conditions when the peppers are rapidly growing.

- ***Chilling injury.*** Symptoms of chilling injury include surface pitting, water-soaked areas, decay (especially *Alternaria*), and discoloration of the seed cavity.

Diseases

- Common decay causing organisms are *Botrytis*, *Alternaria*, and soft rots of fungal and bacterial origin.
- ***Botrytis or Grey mold.*** A common decay-causing organism on chili peppers; field sanitation and prevention of wounds on the fruit help reduce its incidence. Botrytis will grow well at the recommended storage temperatures. Hot water dips of peppers can effectively control botrytis rot (55°C) water for 4 minutes) without causing fruit injury.
- ***Bacterial Soft Rot.*** Soft rotting areas can be caused by several bacteria which attack damaged tissue; soft rots can also be common on washed or hydro-cooled chillies where water sanitation was deficient.

Botrytis Decay

Botrytis decay on stored Jalapeño chiles

Decay development on stem end of Jalapeño chile

Bacterial Decay

Bacterial decay on damaged areas of Jalapeño chile

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Other Common Postharvest Defects

- **Mechanical damage** (crushing, stem punctures, scrapes, etc.) and any physical injury, not only detracts from the visual quality of the chillies but also cause increased weight loss and decay.

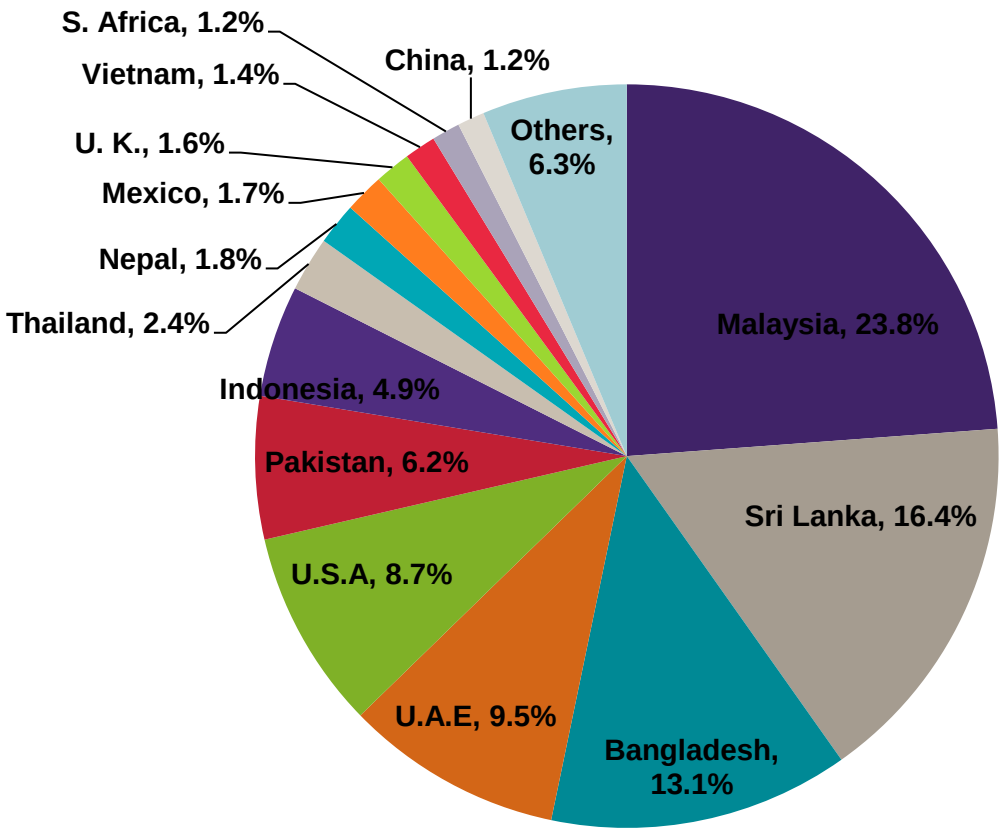
Processing and Exports

Indian Spices Industry

- India is largest producer and consumers of spices
- India grows 5.4 million tons of spices from 2.95 million hectares
- India exports 10-11% of its production, viz., 575000 tons of spices valued at Rs 9,783 cr. (US$ 2.04 billion)
- India is largest producer of Chilli (1.3 Mn MT), Turmeric (0.8 Mn MT), Coriander (0.6 million tons), Cumin (0.22 Mn MT) and Mint products and Second largest producer of Pepper
- World trade is approximately 1.0 million tons of which India contributes 0.575 Mn MT (which is 59% of the volume)
- 109 spices/ spice products are exported to 160 countries
- 1500 registered exporters with Spices Board
- 350 manufacturer exporters, of which 100 (7%) contributes to 80% of exports

Exports Scenario

Chillies - Country-wise Exports share



- **Biggest Buyers of Indian chilli**
  - Malaysia (23.8%)
  - Sri Lanka (16.4%)
  - Bangladesh (13.1%)

- India also imports small quantities of chillies, an average of 1,000 tonnes per year.

Global Scenario – Top Consumers & Producers

Top 10 consumers
(last 5 yr avg.)

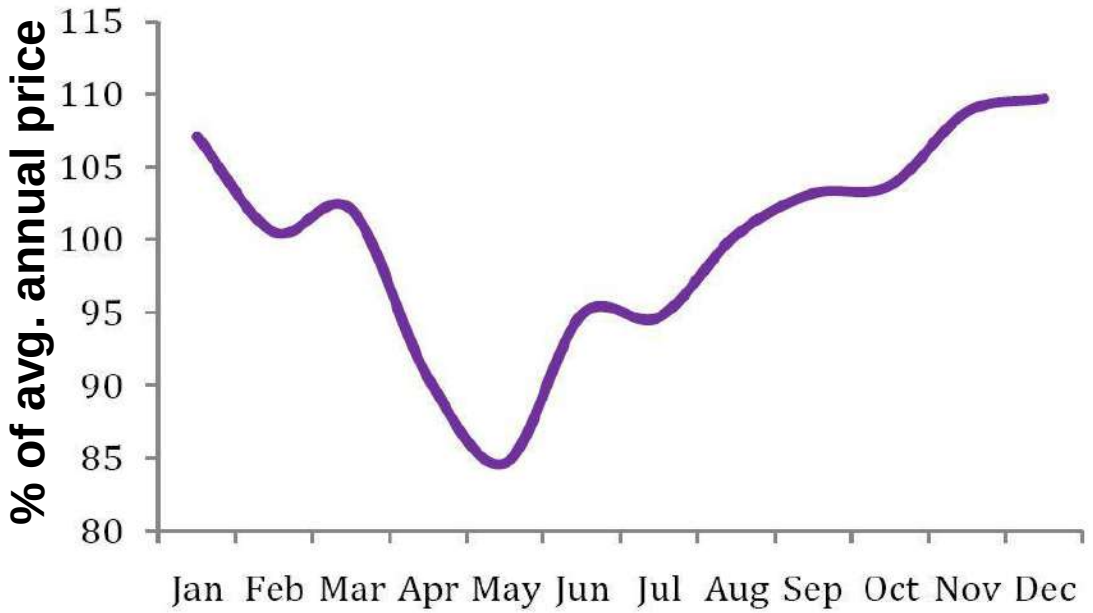
1.	India	37.5%
2.	Thailand	7.4%
3.	Pakistan	5.7%
4.	Bangladesh	4.65%
5.	China	4.55%
6.	Ethiopia	4.05%
7.	Myanmar	4%
8.	Vietnam	3.9%
9.	USA	3.65%
10.	Ghana	3.2%

Top 10 producers
(last 5 yr avg.)

1.	India	44%
2.	China	9%
3.	Pakistan	6%
4.	Thailand	6%
5.	Peru	5%
6.	Ethiopia	4%
7.	Myanmar	4%
8.	Vietnam	3.9%
9.	Bangladesh	4%
10.	Ghana	3%

Indian Chilli – Domestic Price Movements

- **Factors affecting the prices**:
- Arrivals in the market
- Historical Price movement
- Climatic Conditions
- Shifting towards alternative crops



- January to May prices correct due to peak arrival season
- June onwards prices start moving upward on export demand and arrivals season also come to an end
- After June prices take small corrections when sowing for next crop starts
- Good domestic demand keep the prices up

Food and Consumer Safety

Roasting and Blending

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Steam Sterilization

- Dry Chilli (Whole chilli/ kibbled chilli/ Powder)
- Upcoming market trend

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Packing Line

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Thank You