

Cucurbits

- Cucurbits form an important and a big group of vegetable crops cultivated extensively in the sub-tropical and tropical countries.
- This group consists of a wide range of vegetables, either used as salad, or for cooking, or for pickling or as dessert fruits or candied or preserved.
- Cucurbits have been used in many traditional medicines of India. Different parts of the plant are used to relieve diabetes, hypertension, as a stomachic, laxative, antibilious, emetic, antihelmintic agent, for the treatment of cough, respiratory diseases, skin diseases, wounds, ulcer, gout and rheumatism.
- The bitter flavour of bitter melon is due to the alkaloid momordicine produced in fruits and leaves.

Characteristic features of cucurbits

- Viny growth habit (except summer squash)
- Annuals (except pointed gourd, ivy gourd, *kakrol* and chayote)
- Frost-sensitive
- Monoecious (except pointed gourd, ivy gourd and *kakrol*)
- Cross-pollinated
- Propagated by seed (except pointed gourd, ivy gourd and *kakrol*)
- Multi seeded fruit (except chayote*)
- Mainly fruit *i.e.*, ‘pepo’ is the edible part (exceptions: chayote all plant parts edible, pumpkin besides immature and mature fruit, flower is also edible)
- Mostly old world origin (except squashes, pumpkin and chayote)

****(viviparous : single seed /fruit & the seed germinates inside the fruit)***

List of cultivated cucurbits

S.No.	Common Name	Hindi Name	Botanical Sp.	Chromosome number(2n)
1.	Bitter gourd	<i>Karela</i>	<i>Mormordica charantia</i> L.	22
2.	Spine gourd	<i>Kakrol</i>	<i>Momordica dioica</i> Roxb.	28
3.	Sweet gourd of Assam	<i>Kheksa</i>	<i>Momordica cochinchinensis</i> Spreng	22
4.	Bottle Gourd	<i>Louki</i>	<i>Lagenaria siceraria</i> (Mol.) Standl.	22
5.	Cucumber	<i>Khira</i>	<i>Cucumis sativus</i> L.	14
6.	Indian squash	<i>Tinda</i>	<i>Praecitrullus fistulosus</i> Pang.	24
7.	Musk melon	<i>Kharbuza</i>	<i>Cucumis melo</i> L.	24
8.	Snap melon	<i>Phoot</i>	<i>Cucumis melo</i> var. <i>momordica</i>	24
9.	Long or serpent melon	<i>Kakri</i>	<i>Cucumis melo</i> var. <i>utilissimus</i>	24
10.	Pumpkin	<i>Sitaphal/ kasiphal</i>	<i>Cucurbita moschata</i> Duch ex Poir.	40
11.	Squash or pumpkin or winter	<i>Kaddu</i>	<i>Cucurbita maxima</i> Duch	40

14.	Sponge gourd	<i>Ghia tori</i>	<i>Luffa cylindrica</i> Roem (syn. <i>L. aegyptiaca</i>)	26
15.	Snake gourd	<i>Chinchinda</i>	<i>Tricosanthes cucumerina</i> (syn. <i>T. anguina</i> L.)	24
16.	Pointed gourd	<i>Parwal</i>	<i>Trichosanthes dioica</i> Roxb.	24
17.	Water melon	<i>Tarbuz</i>	<i>Citrullus lanatus</i> (Thunb.) (syn. <i>C. vulgaris</i> Schrad)	22
18.	Wax or ash gourd	<i>Petha</i>	<i>Benincasa hispida</i> (Thunb.) Cogn.	24
19.	Ivy gourd	<i>Kundsru or Tondli</i>	<i>Coccinia cordifolia</i> (Voigt)L. (syn. <i>C. indica</i> W. and A)	24
20.	Chow- chow or chayote		<i>Sechium edule</i> (Jack) Sw.	28
21.		<i>Meetha Karela</i>	<i>Cyclanthera pedata</i> Schrad.	32

Bitter gourd is rich in vitamin C

Pumpkin contain high carotenoid pigments

Kakrol is high in protein

Chow- chow is fairly high in calcium

• **Bitter gourd**



• **Spine gourd**



• **Sweet gourd of Assam**



• **Bitter gourd**



• **Spine gourd**



• **Sweet gourd of Assam**



- **Bottle gourd**



- **Cucumber**



- **Indian squash**



- **Musk melon**



- **Snap melon**



- **Long and serpent melon**



- **Pumpkin**



- **Squash or pumpkin or winter squash**



- **Sponge gourd**



- **Snake gourd**



- **Pointed gourd**



- **Water melon**



- **Wax or ash gourd**



- **Ivy gourd**



- **Chow – chow
or Chayote**



- ***Meetha Karela***



S.No.	Crop	Center of origin
1.	Bottle gourd	Central Africa, India
2.	Bitter gourd or Balsam Pear	China, Malaysia, India
3.	Small gourd	East India
4.	Ridge gourd	Tropical Asia, India
5.	Sponge gourd	Tropical Asia, India
6.	Snake gourd	India
7.	Pointed gourd	South east Asia, India, Burma
8.	Ivy gourd or Scarlet gourd	India
9.	Ash or Wax gourd	South East Asia , India , China, Malaysia
10.	Sweet gourd	South America

11.	Cucumber	Africa, Asia,
12.	Gherkin or Pickling Cucumber	Africa
13.	Muskmelon	Hot of valley of Iran, Persia, India, ,
14.	Snap melon	Iran, India
15.	Long melon or Serpent melon	India
16.	Watermelon	Kalahari Dessert, Africa
17.	Round melon	India
18.	Pumpkin	Central America
19.	Winter squash	South America, Argentina
20.	Summer squash	Central Mexico
21.	Cucumber	South Mexico and Central America

Crop	Institute	Variety
Cucumber	IARI, Delhi	Pusa Uday, Pusa Barkha
	YSP UHF, Nauni	Khira 75, Khira 90
Bottle gourd	IARI, Delhi	Pusa Samridhi, Pusa Santushti, Pusa Summer Prolific Long , Pusa Summer Prolific Round, Pusa Sandesh, Pusa Naveen, Pusa Hybrid 3
	IIHR, Bangalore	Arka Bahar
	IIVR , Varanasi	Kashi Bahar , Kashi Ganga
Bitter gourd	IARI, Delhi	Pusa Do Mausami , Pusa Vishesh, Pusa Hybrid -2, Pusa Aushadhi(hybrid), Pusa Rasdar and Pusa Purvi
	YSP UHF, Nauni	Solan Hara , Solan Safed
	IIHR, Bangalore	Arka Anupam , Arka Harit
Ash gourd	IARI, Delhi	Pusa Ujwal
	IIVR , Varanasi	Kaski Ujwal, Kashi Surbhi, Kashi Dhawal
Sponge gourd	IARI, Delhi	Pusa Sneha, Pusa Chikni, Pusa Supriya
	IIVR , Varanasi	Kashi Divya
Ridge gourd	IARI, Delhi	Pusa Nutan, Pusa Nasdar , Kashi Khushi
	IIHR, Bangalore	Arka Sumeet, Arka Sujata
Span melon	IARI, Delhi	Pusa Shandar

Crop	Institute	Variety
Pumpkin	IARI, Delhi	Pusa Viswas, Pusa Vikas, Pusa Hybrid 1
	IIVR , Varanasi	Kashi Harit
	IIHR, Bangalore	Arka Chandan
	YSP UHF, Nauni	Solan Badami
Musk melon	IARI, Delhi	Pusa Madhuras , Pusa Sharbati, Pusa Madhurima
	IIVR , Varanasi	Kashi Madhu
Water melon	IARI, Delhi	Sugar Baby
	IIHR, Bangalore	Arka Manik, Arka Akash , Arka Madhuras, Arka Rasraj, Arka Aishwarya
Pointed gourd	IIVR , Varanasi	Kashi Alankar, Kashi Suphal
Summer squash	IIVR , Varanasi	Kashi Shubhangi
Round melon	IIHR, Bangalore	Arka Tinda
	IARI, Delhi	Pusa Raunak
Long melon	IARI, Delhi	Pusa Utkarsh

Climate

- ❖ Warm season crop
- ❖ Does not withstand even light frost and strong winds
- ❖ Cucumber tolerates a slightly cooler weather than melons.
- ❖ Seed does not germinate at a temperature as low as 11°C.
- ❖ Seed give satisfactory germination at 18°C and speed of germination increases with increase in temperature till 30°C.
- ❖ Grows best at temperature between 18 and 24°C.
- ❖ Abundance of sunshine and low humidity are ideal for the production of cucumber.
- ❖ Cucurbits grow well at day temperature 25-35°C.
- ❖ Maximum temperature 40 °C and minimum 20-25°C.
- ❖ Germination of seed when day temperature is above 25°C.
- ❖ Melons prefer tropical climate with high temperature during fruit development.
- ❖ Day temperature of 35-40°C, cool nights and warm days give better quality fruits in melons.

Seed rate and plating distance

Crop	Seed rate (kg/ha)	Row to row (m)	Hill to hill (cm)
Watermelon	3.5 to 5.0	2.5 to 3.5	90 to 120
Round melon	3.5 to 5.0	1.5 to 2.0	60 to 120
Muskmelon	3.0 to 7.0	1.5 to 2.5	60 to 120
Long melon	2.5 to 3.5	1.5 to 2.5	60 to 120
Cucumber	2.5 to 3.5	1.5 to 2.5	60 to 120
Bottle Gourd	3.0 to 6.0	1.5 to 2.5	60 to 120
Bitter Gourd	4.5 to 6.0	1.5 to 2.5	60 to 120
Ridge Gourd	3.5 to 5.0	1.5 to 2.5	60 to 120
Sponge Gourd	2.5 to 3.5	1.5 to 2.5	60 to 120
Snake Gourd	5.0 to 6.0	1.5 to 2.5	60 to 120
Ash Gourd	5.0 to 7.0	1.5 to 2.5	60 to 120
Pumpkin	6.0 to 8.0	2.5 to 3.0	100 to 150
Squash	8.0 to 10.0	0.6 to 0.75	45 to 60

Crop	Planting time	FYM t/ha	N:P:K	Yield kg/ha
cucumber	Summer season- January end to February Rainy season – June July Hills- April	25-30	55:45:85	8000-10000
Muskmelon	Summer season – November to march North India – February onwards	15	60:18:110	10000-12000
Watermelon	November to march	30	75-80:50:50	
Bottle gourd	Same as cucumber	50-60	50:60	15000-20000
Bitter gourd	Summer – January march Rainy – June July	50-60	50:60	8000-14000
Pumpkin and squashes	Summer season :January- march Rainy season : June- July	30	75:50:50	25000
Apply whole FYM, P and K at time of sowing , one half of N at vining stage and rest 10-15 days after.				
In river bed cultivation sowing is done in November December and the plants are protected from cold by planting wind breaks in north India				

Soil – a well drained loamy soil is preferred for cucurbits. In riverbeds alluvial substrata and subterranean moisture of river stream support the crop

Climate – maximum temperature is 30-35°C while minimum is 20-25°C. Cucumber prefers slightly lower temperature. Cool nights and warm days are ideal for sugar accumulation in fruits.

Planting methods :

1. Hill method – hills are prepared at proper spacing by adding well rotten organic manure and a number of seeds are sown on each hill.
2. Furrow method – furrows are made at proper spacing which are kept from row to row and seeds are sown on the edge of the furrows either on one or both sides of the furrow . Irrigation water flows through the furrows.
3. Ridge method – planting is done on ridges .
4. Bed system – sowing is done on raised beds in high rainfall areas to avoid spoilage of fruits by water.
5. Pit system- practiced during rainy season and vines are trained over trellises, arbours or *pandals* .

Irrigation- in spring summer irrigation is very important while in rainy season no irrigation is required. Too frequent irrigations are said to spoil the quality of melons .

Weed control - a combination of hand weeding , chemical weed control and mulching can be utilized for proper weed control in cucurbits

Harvesting : harvesting stage for cucurbits whose immature fruit is utilized like bottle gourd , Cucumber, sponge gourd, bitter gourd, ridge gourd , parwal etc are harvested when they have attained full size and are still immature , harvesting should be done before seed formation .

Pumpkin and ash gourd are harvested at full maturity. Maturity of ash gourd is judged by appearance of white ash like substance on fruit surface .

Maturity indices of watermelon include browning of tendrils, ground spot yellowing and dull thumping sound produced on tapping the fruit instead of metallic sound.

Muskmelon is climatic and its maturity is determined by slip stages . For local market muskmelon is harvested when on removal of fruit from vine a deep smooth scar is formed at the place of attachment of fruit to vine , this is called full slip stage . When only half portion of the scar produced is smooth this is called half slip stage and this is used for distant market. Cantaloupes type of muskmelon like Hara Madhu do not produce slip stage and the maturity is judged by netting.

Storage – pumpkin and ash gourd have long storage life and are stored easily. cucumber is stored at 12.5 °C .

Varieties for cultivation in H.P.

Crop	Institute	Varieties
Cucumber	IARI, Delhi	Poinsette
	UHF, Solan	Khira -75 ,Khira - 90
Bitter gourd	UHF, Solan	Solan Hara, Solan Safed
Pumpkin	UHF, Solan	Solan Badami
Sarda melon		Selection 1, selection 9

Cultivation in Himachal Pradesh

Crop	Seed rate kg/ha	Planting time	Spacing	FYM t/ha	N:P:K kg/ha
Cucumber	3.75-4.35	Low hills- February-march , June Mid hills- march-may High hills- April	250 - 125 cm between hills and 1-2 plant per hill	10	100:50:55
Bitter gourd	5	Same as cucumber	90 cm apart in hills	10	100:50:55
Pumpkin	4	Same as cucumber	240 cm apart in hills	10	90:60:55
Sarda melon	1-1.5	High hills – may	100 X 100cm	10	60:60:60

Apply whole FYM ,P,K and half N at the time of sowing , apply rest N in two splits first one month after planting and second at the time of flowering.

Harvesting

- Harvesting of crop at right time is very important in cucurbits as in most cases, seed development is undesirable.
- Harvest cucumber, bottle gourd, bitter gourd, snake gourd, ridge gourd and sponge gourd when they are still young, tender and having soft seeds inside.
- Harvest before change in fruit colour from green to yellow.
- Musk melon: Climacteric fruit which ripe during transit & storage hence harvested before fully ripe
- ✓ Full slip stage *i.e.* a crack develops around the peduncle at the base of the fruit and when fully ripe the fruit slips easily from the stem.
- ✓ Half slip stage: Only a portion of the disc is removed when the fruit is pulled out. The scar on the fruit is smaller than the full slip stage
- ✓ Water melon: fully ripe stage Maturity signs are withering of tendril, change in belly color or ground spot to yellow and thumping test which gives dull sound on maturity as metallic sound in unripe fruits.

Sex forms in cucurbits

- **Hermaphrodite:** Primitive form where only bisexual or perfect flowers are produced. As for example 'Satputia' cultivar of ridge gourd, cucumber and muskmelon.
- **Monoecious:** Where staminate and pistillate flowers are separately produced in the same plant. As found in cucumber, bottle gourd, bitter gourd, watermelon, pumpkin, squash, ash gourd, ridge gourd, sponge gourd, snake gourd *etc.*
- **Andromonoecious:** Staminate and perfect flowers produced separately in the same plant. For example, watermelon (in some cultivars), muskmelon (dessert type).
- **Gynomonoecious:** Where pistillate and perfect flowers are produced separately in the same plant. As found in cucumber.
- **Gynoecious:** Where only pistillate flowers are produced in a plant. Example, genetic stock of cucumber, it has been evolved from gynomonoecious sex.
- **Trimonoecious or gynoandromonoecious:** Where staminate, pistillate and perfect flowers are produced in the same plant in varying proportion (genetic stock of bitter gourd).
- **Androecious:** Where only staminate flowers are produced (pointed gourd).
- **Dioecious:** Where staminate and pistillate flowers are produced in separate plants, *e.g.*, pointed gourd, ivy gourd and *kakrol* (*Momordica dioica*) among cultivated cucurbits.

Bitter Principles in Cucurbits

- Most cucurbit species have bitter compounds due to presence of oxygenated tetra cyclic triterpene compounds namely *Cucurbitacins* in their foliage.
- *Cucurbitacins* are thought to be toxins produced by these plants as a defense against insects and herbivores.
- The cucurbit cultivars have been selected by plant breeders to have low *Cucurbitacin* content in the fruits except for ornamental gourds where higher level of *Cucurbitacin* is desirable.
- Bitter fruits in cucumber are occasionally produced when plants are exposed to drought during fruiting.
- Another way of producing bitter fruit is when bitter pollen grains (*Cucumis hardwickii*) fertilize the non-bitter ovule, the resulting fruit will be bitter in taste because the gene *Bt* (bitter fruit) is dominant over *bi* (bitter free) gene and the phenomenon is known as **METAXENIA**.

River Bed Cultivation

Cucurbits have following salient features which make them fit for river bed cultivation:

- ✓ Long tap root system which makes use of subterranean moisture.
- ✓ These are more space planted crops, less number of plants per unit area are to be managed.
- ✓ Hot & dry weather with maximum sunshine prevails right from March-June/July which is an essential requirement for melons.

It is kind of vegetable forcing being used in India where cucurbits are sown during winter season in the river beds. Method of cultivation is as under:

- Pits or trenches are made during October-November.
- They are of convenient length, 30 cm wide and 60 cm deep or to a depth at which the sand is moist.
- Between the trenches a distance of nearly 2-3 m is kept.
- Normally, 3-4 pre-germinated seeds are planted/hill in pits or trenches.
- Before sowing, the trenches are manured with FYM.
- Sprouted seeds are carefully sown.
- Protection from low temperature/chilling winds during Dec-Jan (1-2°C) is provided probably with the leaves of *Sacchara* spp. on the northern side of the pit.

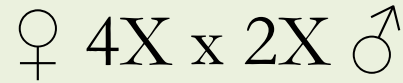
Application of *Saccharus* species on the north of a trench/pit serves following purposes:

- ✓ Checks the sand drifting from dug up trenches.
- ✓ Provide protection against chilly winds.
- ✓ This grass spread over the sand and later on vines spread over this grass.
- ✓ Sand does not blow off in hot months.
- ✓ Spot watering during the initial stages.
- ✓ Fruits from river bed are available 30-50 days before then the normal field sown crop.

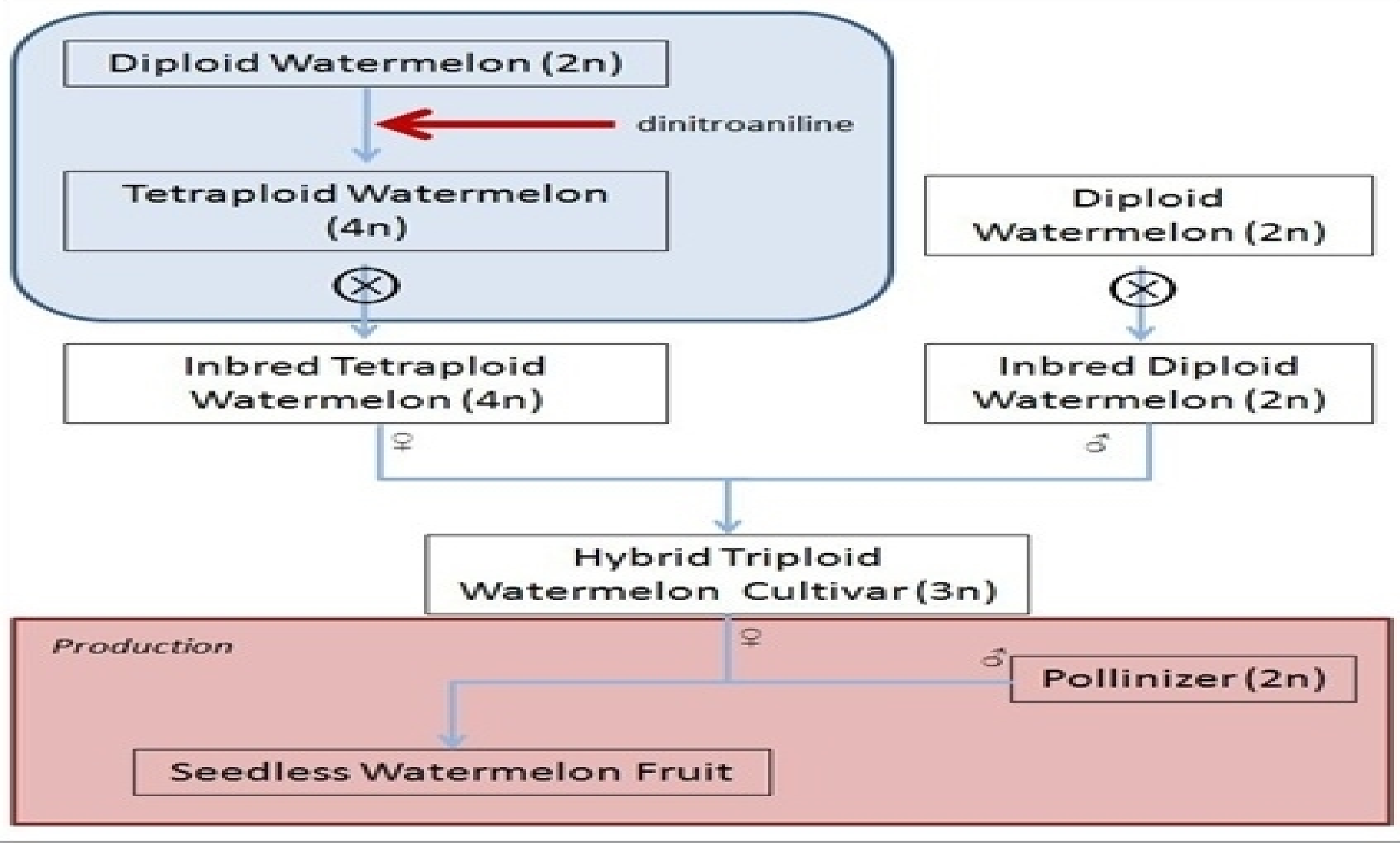
Problems

- ✓ Leaching of nutrients,
- ✓ If floods due to winter rains occur
- ✓ Occurrence of diseases &
- ✓ Fruits having undesirable quality.

Production of Triploids



- It is done by hand pollinating the female flowers of tetraploid line with pollen from the male flowers of diploid parent
or
- by pinching the all male flowers from the tetraploid line and then allow for insect/natural cross pollination, where 4X and 2X plants are grown in the same plot at the ratio of 4:1.



The seedless trait of triploids has been desirable especially in fruits. Commercial use of triploid fruits can be found in crops such as watermelons and are produced artificially by first developing tetraploids which are then crossed with diploid watermelon. In order to set fruit, the triploid watermelon is crossed with a desirable diploid pollen donor

Diseases

Powdery mildew	<i>Erysiphe cichoracearum</i> powdery fungal growth is present on leaves stem and fruits	Spray hexaconazol @ .25 %
Downey mildew	<i>Pseudoperonospora cubensis</i> yellow to reddish brown spots appear on upper surface of leaves while on lower surface purplish spores appear .	Spray zineb@.5%
Anthracnose	<i>Colletotrichum lagenarium</i> small yellow water soaked areas which enlarge and turn brown appear on leaves .later symptom also appears on fruits .	Crop rotation Weed eradication Seed treatment with corrosive sublimate solution 2.5ml/40l
Bacterial wilt	Caused by <i>Erwinia trachephila</i> Carried by striped cucumber beetle plant wilts from tip to downwards and stem shows ooze on cutting.	Spray malathion to control the vector
Angular leaf spot	<i>Pseudomonas lachrymans</i> water soaked lesions on fruits and leaves which later turn grey or tan .	Spray streptomycin at 400 ppm
Fusarium wilt	<i>Fusarium sp.</i> leaves turn yellow and wilt. Vascular system is discolored. Also called sudden wilt	Treat the seed with bavistin Ensure proper drainage
Cucumber mosaic	Plants show mottled mosaic leaf pattern fruiting is less and deformed	Grow resistant varieties
Phylloidy	Caused by mycoplasma like organisms . Internodes and leaf size is greatly reduced and floral parts are converted to leaf like green structures	Destroy affected plants Control vector

Cucurbits are sensitive to sulphur so never use sulphur based fungicide on cucurbits

Insect - Pests

Red pumpkin beetle	Most serious pest of cucurbits. Grubs and adults eat away interveinal leaf tissue , and flowers.	Soil application of carbofuran or phorate @ 10 kg /ha
Aphids	Nymphs and adults suck the cell sap	Spray malathion @ .1%
Fruit fly	Adults puncture the fruit and lay eggs , eggs hatch and larvae feed inside the pulp leading to rotting of fruits.	Spray attractant bait i.e. gur and malathion Use fruit fly traps
Nematodes	Cause formation of galls on roots above ground symptom appear as poor growth and stunted plants	Follow crop rotation Apply nemagon
Mites	Mites suck cell sap and the leaf eventually dries up . It is a very serious pest of protected cultivation	Spray dicofol @ 2.5 kg/h