Production Technology of Exotic Vegetables in Jammu & Kashmir

2017

ICAR-Central Institute of Temperate Horticulture

Old Air Field, Srinagar-190 007, J & K, India

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Contents

Purpose

The exotic vegetables of Kashmir are those that are not being traditionally grown in the state. These vegetables include colored sweet pepper, lettuce, broccoli, Chinese cabbage, red cabbage, Swiss chard, parsley, celery, asparagus, baby corn, sweet corn etc. The demand for these vegetables is increasing, especially among the rich and upper middle class clientele of Kashmir and the rest of India. The state has edge over many parts of India in growing high quality exotic vegetables because of cool weather since most vegetables exotic to India are temperate to sub-tropical in nature and respond well to cultivation in hilly regions. There have been reports on their cultivation by some progressive farmers who find this enterprise more lucrative than growing traditional crops, as these vegetables fetch higher prices from connoisseurs of delicacies and five star hotels that cater to the taste of visitors from around the globe. The local farmers can benefit from their cultivation if proper information is popularized. This literature is aimed at empowering the farmers, researchers, students and common people with knowledge about production technology that entails proper cultivars, nutritional requirements, plant protection, harvesting techniques, storage, and transportation practices of exotic vegetables.

Introduction

The less common vegetables demanded by select few consumers owing to their scarce availability and specialized culinary utilization in an area is termed as exotic vegetables for that place. Many exotic vegetables of India are becoming increasingly popular because of the rising awareness on their neutraceutical, medicinal and gastronomical appeal. Although the enterprise of cultivating exotic vegetables is lucrative, not many growers are involved in their cultivation in Kashmir. There is a need to disseminate awareness about the viability of this enterprise and provide technological knowhow to farmers and other stakeholders interested in exotic vegetable production. States like J&K having high altitude and cold to mild climate are especially suitable for cultivation of exotic vegetables, as they thrive best at low temperature and express highest yield and quality. The most important exotic vegetables suitable for cultivation in Kashmir are colored sweet peppers, lettuce, Chinese cabbage, broccoli, red cabbage, parsley, celery, asparagus, baby corn etc.

Colored sweet pepper (*Capsicum annuum* var. *grossum*)

The production technology of colored sweet peppers is similar to the regular green pepper; however, the difference lies in the choice of suitable cultivar. There are several red, yellow, orange, purple, chocolate, vanilla and white cultivars available with private companies as well as public sector that can be adopted by the growers. It is a vegetable highly amenable to protected cultivation under which the duration of crop can reach 9-10 months with several pickings.

Table 1: Popular varieties of colored sweet pepper and their seed source

No.	Variety	Description	Source	
1.	California Wonder	Red, bell shaped fruits yielding 18-20 t/ha	ICAR-CITH, Srinagar, NSC Ltd, Private dealers	
2.	Yolo Wonder	Red, bell shaped fruits yielding 15-18 t/ha	Private dealers	
3.	Nishat-1	Yellow, blocky fruits yielding 18-20 t/ha	ICAR-CITH, Srinagar, SKUAST-K, Shalimar	
4.	Arka Mohini	Dark red, pendent blocky fruits yielding 20 t/ha	ICAR-IIHR, Bengaluru	

No.	Variety	Description	Source	
5.	Arka Gaurav	Yellow-orange, upright blocky fruits yielding 20 t/ha	ICAR-IIHR, Bengaluru	
6.	Arka Basant	Cream to orange fleshed, conical, 2-3 lobed small fruits yielding 16 t/ha	ICAR-IIHR, Bengaluru	

Lettuce (*Lactuca sativa*)

It is a vegetable of choice in countries like US and UK and widely consumed for its crisp fresh tender leaves as salad and main ingredient of commonly eaten fast food items like burgers, sandwiches, wraps and rolls. In India, it is rapidly gaining popularity among urban population and high end restaurants that cater to the customers that relish exotic and health enhancing cuisines. Lettuce is nutrient packed with several vitamins, folic acid, magnesium, manganese and chromium. Increase in obesity world over is another reason for its rising popularity as it forms an important part of the wholesome diet regimen due to its high water and low calorie content. Morphologically, the lettuce is of four main types:

1. Head type
2. Leaf type
3. Cos type
4. Asparagus type

Table 2: Popular varieties of colored lettuce and their seed source

No.	Variety	Description	Source	
1.	Simpson	Light green, crinkled loose leaves, yielding	ICAR-CITH, Srinagar; Private dealers	
2.	Lollo Rosso	Purple, crinkled loose leaves yielding	ICAR-CITH, Srinagar; Private dealers	
3.	Grand Rapids	Green, crinkled loose leaves yielding	ICAR-CITH, Srinagar; Private dealers	
4.	Lobjoits	Green, smooth leaves, loosely arranged into elongated head, yield ranges from	ICAR-CITH, Srinagar; private dealers	
5.	Winter Density	Green, smooth, loose leaves yielding	ICAR-CITH, Srinagar; private dealers	
6.	Great Lakes	20-25 t/ha, head type, dark green leaves	ICAR-IARI, Katrain	

No.	Variety	Description	Source	
7.	Chinese Yellow	20-25 t/ha. Open leaf type, light green crisp leaves	ICAR-IARI, Katrain	

Broccoli (*Brassica oleracea* var. *italica*)

It is the third most important cole crop and well recognized for its anti-cancerous properties. It is good source of pro-vitamin A, vitamin K, folic acid, flavonols, beta carotene and glucosinolates. It is a temperate vegetable found to have medicinal value The tender and compact heads of colors varying from golden yellow to green to bluish green are relished when sautéed, or used in soups and salads. It is a low calorie wholesome vegetable suitable for overweight people and developing children.

Table 3: Popular varieties of broccoli and their seed source

No.	Variety	Description	Source	
1.	Palam Samridhi	10-20 t/ha, ready to harvest in 80-90 days after transplanting	CSK Himachal Pradesh Agricultural University, Palampur	
2.	Palam Vichitra	Purple heads with 10-20 t/ha yield	CSK Himachal Pradesh Agricultural University, Palampur	
3.	Palam Kanchan	Late maturing, yellowish green large compact head, 25 to 30 t/ ha productivity	CSK Himachal Pradesh Agricultural University, Palampur	

No.	Variety	Description	Source	
3.	Pusa KTS-1	6-16 t/ha, 350 -450 g head weight, ready to harvest in 90 – 105 days after transplanting, tolerant to mild frost and snow	IARI, New Delhi	
4.	Fiesta	F1 hybrid, 16 – 18 t/ha	Private dealers	
5.	Princess	F1 hybrid, early maturing, fine green heads, 250 – 350 g head, medium heat tolerant	Private dealers	

Chinese cabbage (*Brassica rapa* ssp. *pekinensis*)

Also known as napa cabbage, it is different from subspecies *chinensis* in the formation of heads, whereas, the later one produces loose leaves and is popularly known as *pak choi* in China. Chinese cabbage is very tender, crisp and highly perishable salad vegetable. It finds unique place in Chinese cooking and is being favored by others as salad and a supplement to fast food like burgers, wraps and rolls.

Table 4: Popular varieties of Chinese cabbage and their seed source

No.	Variety	Description	Source	
1.	Tropical Delight	F1 hybrid, ideal for warm low lands, inner leaves of head are yellow, sweet crunchy leaves	Private dealers	
2.	Tropic Princess	Light green, shiny oblong heads, 700 – 900 g head, adaptable to tropical as well as temperate climate	Private dealers	
3.	Optiko	F1 hybrid, bolting tolerant, heat tolerant	Private dealers	

Red cabbage (*Brassica oleracea* var. *capitata* f. *rubra*)

It is similar to cabbage in all characters except leaf coloration. The color may vary from bluish purple to red. It is, however, assumed to have more anti-oxidant power and nutritional value than cabbage by virtue of the presence of pigments. The visual appeal is obviously a merit above regular cabbage. Red cabbage is also known to be tolerant to diamond back moth unlike white cabbage.

Table 5: Popular varieties of red cabbge and their seed source

No.	Variety	Description	Source	
1.	Kinner Red	Red to purple rounded head	YS Parmar University of Horticulture and Forestry, Solan	
2.	Red Queen	F1 hybrid, medium maturing, round red heads, 1.5 kg head weight	Private dealers	
3.	Primero	F1, Deep red, round heads for year round cultivation, ideal for close spacing, 1-1.5 Kg head	Private dealers	

Swiss chard (*Beta vulgaris* ssp. *cicla*)

Of the same species but a different subspecies as of Palak or beet leaf (*Beta vulgaris* ssp *bengalensis*), Swiss chard morphologically varies from the latter in terms of leaf structure and midrib coloration. There are red, green, yellow and orange colored varieties of Swiss chard that distinguish it from palak in anti-oxidant and nutritive value. It is considered highly nutritious and visually appealing vegetable.

Table 6: Popular varieties of Swiss chard and their seed source

No.	Variety	Description	Source	
1.	Fordhook Giant	White stalked variety, 20-25 t/ha leaf yield	Private dealers	
2.	Lucullus	White stalked crinkled green leaves yielding 18-22 t/ha		
3.	Ruby Chard	Deep red stalked dark green leaves		
4.	Rainbow Chard	It is a mixture of different varieties having multicolored stalks		

Parsley (*Petroselinum crispum*)

Widely used as a garnish and spice vegetable parsley is a good source of vitamins A and C and calcium. It is also known to have good protein content, which is a rare property to a vegetable. In addition to its culinary use, it is also used as a foliage feature to add beauty to landscape or garden. Parsley has two types of leaves; curly and flat, in latter case its species being *neapolitanum*. The curly leaf parsley is better favored for garnishing. Furanocoumarins are known to inhibit the seed germination in parsley. It is a highly frost tolerant species and a source of apiol.

Table 7: Popular varieties of parsley and their seed source

No.	Variety	Description	Source	
1.	Moss Curled	Bright green curled leaves, used fresh and dried	IARI-RS, Katrain	
2.	Double Curled	Dense, dark green closely curled leaves, frost tolerant	Private dealers	
3.	Extra Triple Curled	Leaves are tightly curled, has ornamental as well as culinary appeal, used fresh or dried	Private dealers	
4.	Italian Flat Dark Green	Flat leaves, dark green color, used fresh as well as dried	Private dealers	
5.	Italian Giant	Large flat leaves, glossy dark green, more pungent than curled varieties	Private dealers	

Celery (*Apium graveolens*)

Celery is relished for its thick, juicy stalks as salad. The blanched stalks are preferred over green ones and are eaten raw or added to soups, stews and sauces. Like parsley, it also enjoys the position of a protein rich vegetable having high vitamin B2 content.

Table 8: Popular varieties of celery and their seed source

No.	Variety	Description	Source	
1.	Standard Bearer	Medium tall plants, pink stalks with white streaks, early variety	Private dealers	
2.	Fordhook Emperor	Dwarf and stocky plant, white stalks, broad leaves, late variety, 30-35 t/ha	IARI, Katrain, Private dealers	
3.	Golden Self Blanch	Thick, deeply ribbed stalks, stringless, easy to grow and maintain, popularly cultivated in Himachal Pradesh	Private dealers	
4.	Wright Grove Giant	Tall plant, fine quality large white stalks, medium late variety, frost tolerant	Private dealers	
5.	EC-99249-1	High essential oil content	Private dealers	
6.	RRL-85-1		RRL, Jammu	

No.	Variety	Description	Source	
7.	NRCSS-A-Cel-1	High yielding, suitable for semi-arid conditions, high essential oil content	National Research Centre for Seed Spices	
8.	Ajmer Celery-1	Suitable for semi-arid conditions, high essential oil content	National Research Centre for Seed Spices	
9.	Tall Utah	Medium early, dark green broad leaves, long thick green stalks	Private dealers	

Asparagus (*Asparagus officinalis*)

It is a perennial exotic commodity in the form of spears, a modification of stem, which may be white or white with purple coloration or green or green with purple coloration. The spears are thick, tender and delicious. Used in salad or as addition to other vegetable dishes, it is a rare exotic favored by many. It has very deep root system and high tolerance to soil salt and strictly a temperate plant. It is considered a good source of vitamin B2.

Table 9: Popular varieties of asparagus and their seed source

No.	Variety	Description	Source	
1.	Perfection	Recommended by IARI, New Delhi	Private dealers	
2.	Red Asparagus	Developed by IARI, New Delhi	IARI, New Delhi	
3.	Black Asparagus	Developed by IARI, New Delhi	IARI, New Delhi	
4.	Argenteuil Early		Private dealers	
5.	Connovers Colossal	First harvest after 3 years, bright green spears with deep purple tips, high yielding	Private dealers	
6.	Martha Washing-ton	Productive for 25 years, produces long thick spears, suitable for freezing	Private dealers	
7.	Mary Washing-ton	Most commonly planted variety, has high productivity and tolerance to rust	Private dealers	

Baby corn and sweet corn (*Zea mays*)

Belonging to family Poaceae, baby corn is favored for its tender juicy cobs with immature grains or ovules and sweet corn is priced for its tender and sweet grains.

Table 10: Popular varieties of baby corn and sweet corn and their seed source

No.	Variety	Description	Source
1.	HM-4	Single cross, 90-95 days maturity, yield 7q/ha, yellow to cream ovules	CCSHAU, Karnal
2.	VL Baby Corn-1	Matures in 70-75 days, 1-1.5 t/ha, yellow grain	VPKAS, Almora
3.	VL-78	Baby corn, Yields 3-3.5 t/ha	VPKAS, Almora
4.	Win Orange Sweet corn	Composite variety. Matures in 90-95 days	DMR, IARI, New Delhi
5.	Win Sweet Corn-1 (WSC-1)	Derived from Win Orange Sweet Corn, has yellow, dent grain, has high sugar and TSS (25.30%), 70-75 days maturity	DMR, IARI, New Delhi
5.	Madhuri	sweet corn variety, Matures in 80-85 days, with yellow dent grains, 30-36 % sugar, ideal for boiling	ANGRAU, Hyderabad

Nursery production

The scientific production of exotic vegetable crops can give very high quality produce with high yield. It is important to adopt suitable cultivar, season, nutrition and crop protection regimes to obtain a successful and remunerative crop. Although, all these parameters vary with crop, an important and basic factor for a successful crop is scientific nursery production, which is universal to vegetable crops that have tiny seeds that can't be directly sown in field. A grower should be very specific at following all the important recommendations of a proper nursery production and maintenance as it not only ensures vigorous transplants but may also prevent the occurrence of diseases and insect pests in nursery as well as transplanted crop. Additionally a nursery ensures proper care of seedlings, easier plant protection measures

The site of nursery should be changed every year. The land should be leveled, away from shade and well aerated. The soil should preferably be sandy loam, friable, well ploughed and properly drained. This will avoid common nursery problems like damping off and wilts. Before preparing nursery beds, the soil should be properly ploughed and FYM at the rate of 1 Kg per square meter be incorporated. To make a nursery, shape the soil into a bed measuring ½ meter height, 1 meter width and as long as required. If space is a constraint, shorter beds can also be made. Make sure that the surface of bed is properly leveled to avoid water stagnation. Get rid of pebbles and stones on the surface of nursery bed. Broadcast the beds with fertilizers for nitrogen, phosphorus and potassium. Before starting the sowing, make straight and shallow furrows parallel to each other distanced about 5-7 cm from each other on the surface of bed with the help of a wooden stick. Sow the seeds treated with captan 50 WP or thiram 75 WP at the rate of 1g per kilogram of seed thinly in these furrows. Alternatively, a suspension of these fungicides in water in 0.1-0.2% concentration (0.1-0.2g powder in 100 ml water) may also be used to drench the nursery soil. This will prevent pre-emergence damping off or seed rot. If seeds are very fine, mix them with little sand before sowing. Afterwards, immediately cover the furrows lightly with surrounding soil. If available, vermicompost may also be used to cover the seeded furrows.

After sowing, sufficient irrigation is to be done with the help of rose can with sprinkler, avoiding both over and under watering the nursery bed. Proper care of the nursery should be done before and after germination of seeds by regular irrigation, clearing of weeds and a constant look out for the diseases and insects. If thicker than required, the seedlings should be thinned out manually to avoid fungal infections like damping off and wilt by creating space for ventilation and evaporation of excess moisture. The most commonly used fungicide and insecticide, namely, mancozeb (0.1%) and chlorpyriphos (0.2%) can be sprayed as and when needed. If required nursery can also be protected from hot winds or scorching sunshine by raising low cost structures using garden net or wind breaks. About a week before transplanting, irrigation should be withheld and any weather protection structure removed to help seedlings harden enough to bear transplanting shock. Irrigation of the nursery should be done few hours before transplanting to ease pulling out of the seedlings and provide them sufficient moisture to adjust well after transplantation. The transplanting should be done preferably in the evening followed by flood irrigation. Soil ball should be kept intact with the root of seedling while uprooting from the nursery and kept well moist until transplanting it in field. Generally, vegetables seedlings are transplanted at 3-5 true leaf stage.

As a better alternative, the nursery can also be produced in pro-trays that allow convenient transplanting of seedlings, portability of the nursery and avoid root damage. Secondly, this technique requires lesser seed rate. For producing successful nursery in pro-trays, the growth medium can be prepared by mixing soil, sand, well decomposed compost and rice hull in equal proportions, or by mixing cocopeat, well rotten FYM and soil in 2:1:1 ratio or mixing cocopeat, perlite and vermiculite in 2:1:1 ratio.

Cultivation

Crop	Seed rate (per ha)	Time of sowing	Spacing	Nutrition
Sweet pepper	1 Kg	Protected: February Open: March	60 cm x 45 cm	FYM: 25 t/ha Urea: 200 Kg/ha DAP: 150 Kg/ha MoP: 50 Kg/ha[1]
Lettuce	1 Kg	Protected: September – October Open: August Seed production: March	45 cm x 45 cm	FYM: 10-15 t/ha Urea: 200 Kg/ha DAP: 130 Kg/ha MoP: 100 Kg/ha[2]
Broccoli	500 g	Protected: September – October Open: First fortnight of August Seed production: March	60cm X 45cm	FYM: 25-30 t/ha Urea: 115 Kg/ha DAP: 250 Kg/ha MoP: 100 Kg/ha[3]

Crop	Seed rate (per ha)	Time of sowing	Spacing	Nutrition
Chinese cabbage	500 g	Protected: September – October Open: First fortnight of August Seed production: March	60cm X 45cm	FYM: 10 t/ha Urea: 130 Kg/ ha DAP: 100 Kg/ ha MoP: 50 Kg/ ha[4]
Red cabbage	500 g	Protected: September – October Open: First fortnight of August Seed production: March	45cm X 45cm	FYM: 25 t/ha Urea: 110 Kg/ ha DAP: 130 Kg/ ha MoP: 60 Kg/ ha[5]
Swiss chard	2 kg	Protected: September – October Open: First fortnight of August	45cm X 45cm	FYM: 25 t/ha Urea: 160 Kg/ ha DAP: 55 Kg/ ha MoP: 43 Kg/ ha
Parsley	1 Kg, Soaking of seeds in water overnight enhances germination	Protected: First fortnight of February Open: First fortnight of March	45cm X 30cm	FYM: 25 t/ha N: 65 Kg/ha P: 40 Kg/ ha K: 25 Kg/ha[6]

Crop	Seed rate (per ha)	Time of sowing	Spacing	Nutrition
Celery	1 Kg	Protected: First fortnight of February Open: First fortnight of March	45cm X 30cm	FYM: 25 t/ha N: 125 Kg/ha P: 50 Kg/ ha K: 50 Kg/ha[7]
Aspara-gus	3-5 Kg	July to November in open conditions	Transplant after one year at 2m x 60cm	FYM: 7.5 t/ha Urea: 160 Kg/ ha DAP: 77 Kg/ ha MoP: 60 Kg/ ha[8]
Baby corn, sweet corn	Baby corn: 25 Kg Sweet corn: 8Kg	March, June, August for spring, *kharif* and *rabi* seasons, respectively	Baby corn: 60 cm X 20 cm Sweet corn: 75 cm X 30 cm on ridges, raised beds or flat beds	FYM: 10 t/ha Urea: 285 Kg DAP: 165 Kg MoP: 125 Kg ZnSO4: 25 Kg[9]

Crop protection

Crop	Disease/ pest	Symptoms	Control
Sweet pepper	Damping off and wilt (Several fungi like *Fusarium, Pythium, Colletotrichum, Phytophthora, Rhizoctonia*)	 	Follow nursery raising technique properly
	Phytophthora blight (*Phytophthora capcisi*)		• Follow crop rotation with cros other than sweet pepper, chilli, tomato and brinjal • Grow crop on ridges in well drained soil • Spray of ridomil MZ, chlorothalonil, strobilurin etc can be employed
	Anthracnose (Colletotrichum *gloeosporioidis*)		Adopt phytosanitation, remove and bury infected fruits and leaves, spray 0.3% mancozeb 75 WP at 10-15 days interval when disease appears
	Sunscald		Avoid excessive irrigation, prevent defoliation by spraying dithiocarbamates @ 2g per litre water

Crop	Disease/ pest	Symptoms	Control
Lettuce Broccoli Chinese cabbage Red cabbage Swiss chard	Damping off (Several fungi like *Fusarium, Pythium, Colletotrichum, Phytophthora, Rhizoctonia*)		Follow nursery raising technique properly
	Downy mildew (*Peronospora parasitica*)		Adopt phytosanitation, seed treatment, spray crop with 0.3% metalaxyl MZ 72 WP or mancozeb 75 WP at 10-15 days interval when disease appears
	Alternaria leaf spot (*Alternaria brassicae* and *Alternaria brassicicola*)		Spray 0.03% hexaconazole 5 EC, or 0.25% copper oxychloride 50 WP or 0.2% Zineb 80 WP or 0.3% mancozeb 75 WP at 10-15 days interval when disease appears
	Black leg (*Phoma lingum*)		Spray 0.2% dithane M-45
	Soft rot (*Erwinia carotovora*)		Seedling treatment with 0.01% Streptocyclin Spray 0.01% Streptocyclin

Crop	Disease/ pest	Symptoms	Control
	Black rot (*Xanthomonas campestris*)		-do-
	Aphids (*Brevicoryne brassicae*)		Spray dimethoate 30 EC @ 100ml/100L water
	Leaf miner (*Phytomyza rufipes*)		Spray cypermethrin or fenthion @ 0.01 %
	Cabbage looper/ butterfly (*Pieris brassicae*)	  	Manually remove egg clusters and caterpillars, spray dichlorvos 76 EC @ 70ml/ 100L water or malathion 50 EC @ 140 ml per 100 L water
	Diamond back moth (*Plutella xylostella*)	 	Spray dichlorvos 76 EC @ 70ml/ 100L water or malathion 50 EC @ 140 ml per 100 L water

Crop	Disease/ pest	Symptoms	Control
Parsley Celery	Septoria leaf blight (*Septoria petroselini*)		• Field sanitation • Seed treatment with thiram @ 2g/Kg seed
	Bacterial leaf blight (*Pseudomonas syringae* pv *apii* and *Pseudomonas syringae* pv *coriandricola)*		• Rotate with non-host crop • Avoid overdose of nitrogen • Apply copper based fungicides
	Fusarium wilt		Follow proper nursery production technique and maintain field sanitation
	Aphids (*Myzus persicae, Dysaphis apiifolia, Aphis gossypii*))		• Encourage Lady bird beetle and lacewings in the field • Spray 0.05% malathion or 0.01 % cypermethrin
Aspara-gus	Purple spot (*Stemphylium vesicarium*)		Spray of mancozeb, cholorthalonil, azoxytrobin

Crop	Disease/ pest	Symptoms	Control
	Rust (*Puccinia asparagi*)	 	Plant Martha Washington or other rust resistant variety Ensure proper ventilation of the plantation by planting the rows parallel to wind flow Remove infected plant parst after each harvest[10]
	Fusarium crown and root rot	 	Don't plant asparagus where previous plantation existed Treat seed with hot water before sowing Avoid excessive harvest Maintain nutrition to the plant to increase plant vigor[11]
	Beetles		Employ early harvest of spears if possible Wipe off the beetle eggs on spears Pick the beetles and dispose them off at distant place or kill Encourage ladybird beetles and lacewings in the field Use neem oil or chemical spray for beetles as last resort

Crop	Disease/ pest	Symptoms	Control
	Dark sided cutworm (*Euxoa messoria*) and white cutworm (*Euxoa scandens*)		Collect and remove larvae away from field Ensure frequent weedings Drench soil with Chlorpyriphos (0.04%) or cypermethrin (0.01%)
	Yellow striped armyworm (*Spodoptera ornithogalli* Guenee)		Efficient weed control Spray of malathion, permethrin, pyrethrins, chlorpyriphos can be done
	Rose chafer (*Macrodactylus subspinosus)*		Not harmful to spears Pheromone traps can be used if desired
	Asparagus miner (*Ophiomyia simplex*)		Assure field sanitation Remove volunteer asparagus plants
Baby corn/ Sweet corn[12]	Turcicum leaf blight (*Exserohilum turcicum*)		Spray mancozeb at 2.5g/L at 8-10 days interval

Crop	Disease/ pest	Symptoms	Control
	Maydis leaf blight (*Drechslera maydis*)		Spray mancozeb or zineb @ 2.5g/L
	Common rust (*Puccinia sorghi*)		Prefer early maturing varieties Spray mancozeb at 2.5g/L at first appearance of pustules
	Banded leaf and sheath blight (*Rhizoctonia solani* f.sp. *Sasakii*)		Strip off lower 2-3 leaves along with sheath Treat seed with peat based formulation of Pseudomonas fluorescence @ 16g/Kg or soil application @ 7g/L water Soil application of validamycin @ 2.7ml/L or tolcofos-methyl @ 1g/L on 30-40 days old crop

Crop	Disease/ pest	Symptoms	Control
	Stem borer (*Chilo partellus*)	  	• Intercropping with cowpea • Release of 8 Trichocards (*Trichogramma chilonis*) per hectare 10 days after germination • Spray of Endosulfan 35 EC @ 700ml/250L water
	Shoot fly (*Atherigona* sp.)	 	Seed treatment with Imidacloprid @ 6ml/Kg

Pre-harvest and harvest practices

Before harvesting, application of any pesticide should be withheld according to the prescribed waiting period. This will minimize the chemical toxicity to the consumer and the person handling the crop. Harvest during early morning or evening hours. The sweet peppers are ready by the end of about two months following transplanting depending upon cultivar. Picking is done at the onset of change in fruit color. Normally, 5-10 pickings are possible depending upon whether the cultivar is variety or hybrid. To harvest, the peduncle should be twisted while leaving some of its portion intact with the fruit. Broccoli is harvested when buds in the curd are still closed, tender and tightly clustered. The head should have attained proper size and color specific to the cultivar. The head should be harvested with the help of sharp knife leaving little portion of stem intact. Red cabbage is harvested when the heads have attained full size and are compact without cracking. The harvesting technique is similar to broccoli. Chinese cabbage is an extremely perishable commodity and must be harvested immediately before transportation. The heads are harvested with sharp knife with some portion of stem intact with the head. In asparagus, the harvesting of spears should be started after 3 years. Cut should be made 3-5 cm below ground. Spears can be harvested every day or every other or third day depending on environmental temperature. Higher temperature means fewer harvestings. Lettuce and Swiss chard are extremely perishable and must be marketed on the same day. Multiple pickings are possible and should be done strictly in the evening or early morning. Only the tender and sweet tasting leaves should be harvested.

Post harvest handling and transportation

Immediately following harvesting, the commodities can be sprinkled with water for keeping them fresh for long and release field heat, if any. Pre-cooling at around 4-7C facilitates plenty of time for transportation. Either ice-cold water dipping or refrigerators or CA storage facilities can be used. Grading of commodity on the basis of size, shape, weight, color etc should be done before transportation. It is best to pack them in perforated polythene, nylon mesh or gunny bags before loading in containers, which may be plastic crates, cardboard or paper containers etc. Lettuce, Swiss chard, Chinese cabbage, and fresh parsley and celery can't be stored for long and must be marketed immediately after harvesting. For transportation, about 95% RH and 4-5 C temperature may be maintained to suppress quality deterioration of exotic vegetables but leafy crops like lettuce, Swiss chard, Chinese cabbage, parsley and celery should never be frozen. If marketplace is far away temperature and humidity controlled load carriers may be employed, if possible. Sweet pepper can be stored up to a month at 0C and 95-98 % RH. In Broccoli, the harvested heads may be stored at around 4-5 C temperature for a week before marketing.

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