Growing Vegetables

&

Useful UAE Climate Information

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Temperature conversion chart

Celsius	-1.11	1.67	4.44	7.22	10	12.8	15.6	18.3	21.1	23.9
Fahrenheit	30	35	40	45	50	55	60	65	70	75
Celsius	26.7	29.4	32.2	35	37.8	40.6	43.3	46.1	48.9	51.7
Fahrenheit	80	85	90	95	100	105	110	115	120	125

Average Temperature Conditions

Sharjah, United Arab Emirates

Month	Average Sunlight (hours)	Temperature Average Min	Average Max	Record Min	Record Max	Discomfort from heat and humidity	Relative humidity am	Relative humidity pm	Average Precipitation (mm)	Wet Days (+0.25 mm)
Jan	8	12	23	3	29	Moderate	81	61	23	2
Feb	9	14	24	8	33	Moderate	81	63	23	2
March	8	16	27	8	40	Medium	74	61	10	1
April	10	18	30	12	39	High	66	63	5	0.3
May	11	22	34	16	43	Extreme	61	63	0	0
June	11	25	36	19	44	Extreme	64	65	0	0
July	11	28	38	23	47	Extreme	64	64	0	0
Aug	10	28	39	23	48	Extreme	66	64	0	0
Sept	10	25	37	21	45	Extreme	73	64	0	0
Oct	10	22	33	18	40	High	77	62	0	0
Nov	10	18	31	12	36	High	78	59	10	0.2
Dec	8	14	26	8	31	Medium	82	62	36	2

UAE Vegetables Growing Calendar

1 - Open Field Planting

Crop		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Produce
	Average Temp.Max.	23	24	27	30	34	36	38	39	37	33	31	26	Ton / Donom
	Average Temp.Min.	12	14	16	18	22	25	28	28	25	22	18	8	
	Days to harvest													
Aubergines	80-120								vvvv	vvvv	vvvv	vvvv	vvvv	4-6
B. Eye B.	60-70		vvvv	vvvv						vvvv	vvvv			1.5-2
Beens	60-70	vvvv	vvvv	vvvv						vvvv	vvvv	vvvv	vvvv	0.8-1
Beets	40-50	vvvv	vvvv	vvvv						vvvv	vvvv	vvvv	vvvv	2-3
Cabbage	60-100	vvvv								vvvv	vvvv	vvvv	vvvv	2.5-3.5
Carrots	60-90										vvvv	vvvv		2.5-3
Cauliflower	60-90									vvvv	vvvv			1.5-2
Cucumbers	45-60		vvvv	vvvv						vvvv				1.5-2
Melons	80-90		vvvv	vvvv										1-2
Melons W.	80-90		vvvv	vvvv										1-3
Mulukhiyya	40-60		vvvv	vvvv	vvvv									1.5-2.5
Okra	60-75		vvvv	vvvv	vvvv				vvvv	vvvv				1-2
Onion	120-150										vvvv	vvvv		2-3
Parsley	60-70									vvvv	vvvv	vvvv		1
Pepper Bell	70-80									vvvv	vvvv			1-1.5
Pepper Hot	70-80								vvvv	vvvv	vvvv			1.5-2.5
Potatoes	90-100										vvvv	vvvv		1.15-2.5
Radish	40-60	vvvv	vvvv	vvvv						vvvv	vvvv	vvvv	vvvv	1-2.5
Saliq	60-70	vvvv									vvvv	vvvv	vvvv	3-4
Spinach	60-90										vvvv	vvvv		1-1.5
Sweet Corn														
Tomatoes	85-105										--vv	vvvv	vv--	2-4
Trooh	40-60		vvvv	vvvv						vvvv				2-3
Zucchini	40-70	vvvv	vvvv	vvvv					vvvv	vvvv	vvvv	vvvv	vvvv	2-3

2 - Warm Greenhouse Planting

Average Temperature +5

Crop		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Produce
	Temp.Max.	23	24	27	30	34	36	38	39	37	33	31	26	Ton / Donom
	Temp.Min.	12	14	16	18	22	25	28	28	25	22	18	8	
	Days to harvest													
Aubergines														
B. Eye B.														
Beans	45-50	vvvv									vvvv	vvvv		2.5
Beets														
Cabbage														
Carrots														
Cauliflower														
Cucumbers	35-40	vvvv									vvvv	vvvv	vvvv	10-7
Melons	70-90	vvvv									vvvv			4-5
Melons W.														
Mulukhiyya	40-50	vvvv	vvvv	vvvv							vvvv	vvvv	vvvv	1.5-2.5
Okra														
Onion														
Parsley														
Pepper Bell	65-80										vvvv	vv--		3-4
Pepper Hot														
Potatoes														
Radish														
Saliq														
Spinach														
Sweet Corn														
Tomatoes	80-100										vvvv			7-12
Trooh														
Zucchini														

3 – White Fly Net Shaded House Planting

Average Temperature -5

Crop		**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Produce**
	Temp.Max.	23	24	27	30	34	36	38	39	37	33	31	26	Ton / Donom
	Temp.Min.	12	14	16	18	22	25	28	28	25	22	18	8	
	Days to harvest													
Aubergines														
B. Eye B.														
Beens														
Beets														
Cabbage														
Carrots														
Cauliflower														
Cucumbers						vvvv								
Melons														
Melons W.														
Mulukhiya														
Okra						vvvv								
Onion														
Parsley														
Pepper Bell														
Pepper Hot														
Potatoes														
Radish														
Saliq														
Spinach														
Sweet Corn						vvvv								
Tomatoes														
Trooh														
Zucchini						vvvv								

Down Garden Services

Measurement and Conversions

This page contains a number of useful equivalences and conversion factors which can be used to equate the many units of measurement. Some are from a previous era and are rarely used to-day, but are interesting and useful if consulting old publications. When measuring, the metric system is the easiest to use since all smaller divisions are factors of 10. Workable lengths are nearly always quoted in millimetres (mm), eg. the standard kitchen unit or appliance is 600mm.
Remember it is always best to measure twice and cut once!

Useful Length Relationships

1 inch (in,") = 1/12th of a foot = 1/36th of a yard
1 foot (ft, ')= 12 inches = 1/3rd of a yard = 1/5280th of a mile = 0.3048 metre
1 rod = 5.5 yards = 5.0292 metres
1 chain = 4 rods = 4 perch = 22 yards = 20.117 metres
1 furlong (furrow long) = 1/8th of a mile = 10 chains = 220 yards = 201.17 metres
1 mile = 63360 inches = 5280 feet = 1760 yards = 1.6093 kilometre
1 nautical mile (international) = 1.8532 kilometres

Length Conversion Factors

from	to	multiply by
inches (in)	millimetres (mm)	25.4
millimetres (mm)	inches (in)	0.03937
inches (in)	centimetres(cm)	2.54
centimetres(cm)	inches (in)	0.3937
feet (ft)	metres(m)	0.3048
metres (m)	feet (ft)	3.2808
metres (m)	yards (yd)	1.0936
yards (yd)	metres (m)	0.9144
kilometres (km)	miles	0.6214
miles	kilometres (km)	1.60934

Imperial to Metric Length Equivalences

inches	=	cm	cm	=	inches
1	=	2.54	1	=	0.39
2	=	5.08	2	=	0.79
3	=	7.62	3	=	1.18
4	=	10.16	4	=	1.58
5	=	12.7	5	=	1.97
6	=	15.24	6	=	2.36
7	=	17.78	7	=	2.76
8	=	20.32	8	=	3.15
9	=	22.86	9	=	3.54
10	=	25.4	10	=	3.94
11	=	27.94	15	=	5.91
12	=	30.48	20	=	7.87
15	=	38.1	25	=	9.84
20	=	50.8	30	=	11.81

Useful Area Reationships

1 acre = 1 furlong (furrow long*) x 1 chain = 4,840 square yards = 4,046.9 square metres

*One acre was about the area that a team could plough in a day.

1 rood = 1/4 of an acre = 1210 sq yds
1 pole = 1/160th of an acre = 30.25 sq yds
1 hectare = 2.4711 acres
1 hectare = 10,000 square metres
1 square mile = 259.0 hectares
1 square kilometre = 0.3861 square miles

Area Conversion Factors

from	to	multiply by
square inches (in^2)	square millimetres (mm^2)	645.16
square inches	square centimetres	6.4516
square centimetres (cm^2)	square inches	0.155
square feet (ft^2)	square centimetres	929.03
square feet	square metres	0.0929
square metres(m^2)	square feet	10.764
square yards(yd^2)	square metres	0.83612
square metres	square yards	1.196
square miles	square kilometres	2.5899
square kilometres	square miles	0.386
square miles	hectares	258.999
acres	square metres	4046.86
acres	hectares	0.40468
hectares	acres	2.471
hectares	square metres	10,000
hectares	square kilometres	0.01
hectares	square yards	11,960

Imperial to Metric Area Equivalences

yd^2	=	m^2	m^2	=	yd^2
1	=	0.8	1	=	1.2
2	=	1.7	2	=	2.4
3	=	2.51	3	=	3.6
4	=	3.34	4	=	4.8
5	=	4.2	5	=	6.0
6	=	5.0	6	=	7.2
7	=	5.85	7	=	8.4
8	=	6.7	8	=	9.6
9	=	7.52	9	=	10.76
10	=	8.4	10	=	12
15	=	12.54	15	=	18
20	=	16.7	20	=	24

Useful Volume Relationships

Imperial (GB)

Although they are called the same thing there is a difference between Imperial or GB measurements and those in the USA.

fluid ounce = 1/20th pint = 1/32nd quart = 1/160th gallon
1 cup = 10 fluid ounces = ½ pint = ¼ quart = 1/16th gallon
1 pint = 20 fluid ounces = ½ quart = 1/8th gallon
1 quart = 40 fluid ounces = 4 cups = 2 pints = ¼ gallon
1 gallon = 160 fluid ounces = 8 pints = 4 quarts = 0.1605 cubic feet (GB) = 0.1337 cubic feet (USA)

Metric

1 millilitre = 1 cubic centimetre (cc, cm^3) ie. 1cm x 1cm x 1cm
1 centilitre (cl) = 10 cubic centimetres
1 litre = 1000 cubic centimetres (cm^3)
1 litre = 1 cubic decimetre (ie. 10cm x 10cm x 10cm)
1 litre = 1/1000th of a cubic metre
1 British Standard metric teaspoon = 5 millilitres (ml)
1 British Standard metric tablespoon = 15 millilitres (ml)

Note that when converting volume units, the linear and volume relationships are not the same

1 foot = 12 inches, but
1 cubic foot = 1728 cubic inches (ie. cube both sides)

Volume (Capacity) Conversion Factors

from	to	multiply by
cubic inches (cu in; in^3)	cubic centimetres	16.387
cubic centimetres (cc; cm^3)	cubic inches	0.061
cubic inches	litres (l)	0.01638
cubic feet	cubic metres	0.0283
cubic metres	cubic feet	35.315
cubic yards	cubic metres	0.7646
cubic metres	cubic yards	1.308
gills	litres	0.142
imp fluid ounces	millilitres	28.41
millilitres	imp fluid ounces	0.0352
US fluid ounces	millilitres	29.57
imp fluid ounces	US fluid ounces	0.961
US fluid ounces	imp fluid ounces	1.041
litres	imp fluid ounces	35.1961
litres	US fluid ounces	33.8150
imperial pints (imp pt)	litres	0.568
litres	imperial pints (imp pt)	1.7598
litres	US pints	2.1134
imperial quarts (imp qt)	litres (l)	1.137
litres (l)	imperial quarts	0.88
imperial quarts	US quarts (US qt)	1.201
US quarts	imperial quarts	0.833
US quarts	litres (l)	0.946
litres (l)	US quarts	1.057
imperial gallons (imp gal)	litres	4.546
litres	imperial gallons	0.2199
imperial gallons	US gallons (US gal)	1.201

US gallons (US gal)	imperial gallons	0.8327
US gallons (US gal)	litres	3.785
litres	US gallons (US gal)	0.2642

Useful Weight Relationships

Imperial

1 pound (lb) = 16 ounces (oz)
1 stone = 14 pounds
1 quarter = 2 stone
1 hundredweight = 8 stone = 112 pounds
1 ton (long 2240lb)= 20 hundredweight

Metric

1 kilogram = 1000 grams
1 tonne = 1000 kilograms
1 metric carat = 200 milligrams
It is sometimes useful to know the weight of material when the volume required is known, This can be calculated from the Density

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

so Mass = Density x Volume.

Some density values		
Concrete	2242	kg/m^3
Copper - pure	8900	kg/m^3
Iron	7830	kg/m^3
Sand	2650	kg/m^3
Water (4 C)	999.97	kg/m^3
White pine	513.00	kg/m^3

Mass (Weight) Conversion Factors

from	to	multiply by
grains (gr)	grams (g)	0.0647
ounces (oz)	grams	28.35
grams	ounces (avoirdupois)	0.0353
grams	ounces (troy)	0.0322
pounds (lb)	grams	453.592
pounds (lb)	kilograms (kg)	0.4536
kilograms (kg)	pounds (lb)	2.2046
stones	kilograms (kg)	6.3503
quarters	kilograms (kg)	12.7006
hundredweights	kilograms	50.8023
tons (GB)	kilograms	1016.05
tons (USA)	kilograms	907.2
tons (GB)	tonnes	1.0160
tonnes	tons (long 2240 lb)	0.9842
tonnes	tons (short 2000 lb)	1.1023

Miscellaneous

A set square can be made using the 3, 4, 5 principal, as a triangle made to these proportions will always have a 90° angle between the two shorter sides, ie. make a triangle from strips of timber 60cm, 80cm and 100cm (or any multiple of 3,4 and 5). Cut the timber slightly longer, placing the fixing screw or nail in the centre at the exact measurement - trim off the protruding overlaps to leave flush corners.

Temperature Conversion

Degrees Fahrenheit °F to Degrees Centigrade C (Celsius °C)

$$C = (°F - 32) \times 0.56$$

Degrees Centigrade C (Celsius °C) to Degrees Fahrenheit °F

$$°F = (C \times 1.8) + 32$$

These two factors can be more easily remembered as five ninths (0.56) and nine fifths (1.8) respectively.

Try here to find out about our local weather

Pressure

$$1 \text{ lb / inch}^2 = 0.070307 \text{ kg / cm}^2$$
$$1 \text{ kg / cm}^2 = 14.2233 \text{ lb / inch}^2$$
$$1 \text{ bar} = 14.5038 \text{ lbf / inch}^2$$
$$1 \text{ bar} = 10^5 \text{ Newtons/ m}^2$$

Speed

1 mph = 1.60934 km/h
1 km/h =0.621371 mph

Fuel Consumption

10 mpg = 28.25 litres/100 km
50 mpg = 5.65 litres/100 km

Useful Formulae

Circumference of a circle = 3.1416 x the diameter(d).

Area of a circle = 3.1416 x the radius x the radius(r).
$3.1416 \times r^2$

Area of a triangle = ½ the height x length of base.

Surface area of cone = slant height x ½ circumference of base.
$$\frac{h \times 3.1416 \times d}{2}$$

Curved surface area of cylinder = circumference x height
$3.142 \times d \times h$

Total surface area of a cylinder = 2 x area of base + area of curved surface.
$2(3.1416 \times r^2) + 3.1416 \times d \times h$

Surface area of sphere = 4 x 3.1416 x radius x radius.
$4 \times 3.1416 \times r^2$

Volume of a sphere = 4 x 3.1416 x radius x radius x radius divided by 3
$$\frac{4 \times 3.1416 \times r^3}{3}$$

Volume of a cone = 3.1416 x radius x radius x height divided by 3.
$$\frac{3.1416 \times r^2 \times h}{3}$$

Volume of a pyramid = area of the base x height divided by 3.

Back to Down Garden Services

Winds in UAE

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The Arabian Gulf specially the southern part opposite to the UAE is almost closed basin which takes the rectangular form, and is surrounded from north and the eastern north parts by chain of mountains on the Iranian coast which reach to 1000 meter high. Height gradually reduces in the west, the north western and in the interior parts. The southern part is mostly flat sandy coasts except in some heights in Ras Alkhaimah, the surrounded area, and the mountain peaks.

The nature of this distribution helps to activate winds, specially the northern and the western winds which have an effect on the UAE when crossing the mountain areas to the opposite coast. Speed of winds increases by 20-30% due to the descending of the mountains. This activity increases during winter season particularly in the central area of the Gulf. The geographical distribution and the existence of mountains chains in the opposite side reduce and restrict the rush of the Siberian cold air towards the UAE, Qatar and Bahrain during winter season. The geographical distribution affects the cycle of land and sea currents.

Distribution of pressure:

The Arabian gulf is an area of weak collide in the prevailed and the influenced air mass because the mountain area in Iran and Turkey rarely passes the polar cold Siberian air during winter season. If this cold current reached to the Gulf then the temperature will become warm especially in the near layer to land.
The Gulf of Oman and the southern east part of the Arabian peninsula admit passing of the sea orbital air from the Indian ocean which is hot and humid.

Affected air mass and distribution of pressure:

1- Continental polar mass:

The source of this mass is Siberia due to air cold raise which extend to cover the Arabian peninsula and the Arabian Gulf in general from October which it reaches its climax in January.
The accompanied air of this mass has remarkable change, and is followed by dry and relatively cold northern and western winds and clear sky which is characterized by remarkable reduce of temperature during the night.
Air low sometimes move towards the Gulf coming from the east of the Mediterranean sea and collide with the cold air of the polar mass which lead to condense clouds and falling of heavy thunder rains especially in the northern part of the Arabian Gulf(Kuwait and the surrounding areas).
Rain falling continues for 2-3 days and it is usually accompanied by eastern and northern eastern winds, they are mild and temperate, sea water in general are quiet during this period.
By the end of winter season i.e. in March, the air mass moves to the south of the Arabian Peninsula, and the air is heated in the air mass near the ground surface which create instability of separate thunder storms in the afternoon.

2-Marine polar mass:

It blows from the north of the cold Atlantic ocean. Cold and humid air reaches to Gulf area after the passing of air lows from the central region in Europe and the east part of the Mediterranean sea.
Due to the far distant that air takes to the Gulf area, its temperature becomes moderate. Its effect is clearly shown on the northern part of the Gulf, however, it sometimes extends to include the eastern south of the Arabian Peninsula and the UAE and activates the eastern or the western south winds and cause sand storms.

3- The Arabian orbital continental air mass:

It is considered as local air mass originated from the natural nature of the Arabian Peninsula. It activates during the end of Spring and Summer seasons due to great heating of the touching air of the ground surface by the sun rays and the geographical nature as well. Winds originated by this air mass are south western, moderate, sandy, and hot. Maximum temperature is usually registered in the region as a result of this mass.

4- Indian orbital continental air mass:

It proceeds from the Indian Peninsula, therefore it is called the seasonal Indian Summer low. It is hot and sometimes very hot air mass and affects the gulf region and the Arabian peninsula and it sometimes reaches to the eastern parts of the Mediterranean sea and rarely to eastern Europe
region. The accompanied wind is usually northern east and changes to northern east soft wind over the southern part of the Gulf. The weather during this period is hot, humid and dusty and rarely causes sandy storms.

The four seasons

Winter: The Arabian Gulf lies under the effect of the Siberian high from the eastern part, and the high extended from the Atlantic ocean in the western part. This shallow low is the main source of the dominated and the affected winds over the region. Air accompanied to this low is usually moderate, winds are northern east to northern west, and they are mild and moderate. In case that the region was affected by lows coming from the Mediterranean sea, the northern and western winds become active and its speed will reach to 30 knots or more.

Spring: The beginning of this season is an extension to Winter season that the pressure distributions will remain the same, however they become milder. As spring forwards, the Siberian high dissolves into smaller cells and small lows sometimes coming from Europe or extended from the south are appeared. Air lows over the Arabian Peninsula and interacts with the air coming from the east of the Mediterranean, accompanied by heavy clouds and heavy rains. These desert lows are characterized with southern east winds which are usually active, sandy and it may arise sandy storms.

Summer: The Arabian Gulf Region is influenced by The seasonal Indian low and the orbital air mass. The Sun becomes semi vertical during this season, and the northern and western winds will be more active especially in the afternoon. This low is divided into two parts, one to the east of the Arabian Gulf and the other over the Arabian Peninsula. This distribution is followed by hot and humid southern and eastern winds. High from the eastern part of the Mediterranean sea as well to the high from the Caspian sea will affect the Indian low and restrict its influence. All this will be accompanied by humid eastern winds. Winds will clearly calm down during August and September. They are often under the influence of the cycle of land and sea breeze i.e. south eastern winds during the morning time and change to northern west by noon.

Autumn: It is characterized by the ambiguity and instability of the pressure distributions. Autumn is a transitional season since the seasonal Indian low starts to abate and decline. This will give the chance for the arrival of lows from Africa which have an influence on the red sea, while the Siberian high is starting to constitute and becomes an effective by the end of the season. Dominating winds during this season will have changeable directions, however, the north eastern wind which is characterized by being mild and temperate is prevailed.

The importance of winds

As previously mentioned we can say that it is possible to forecast the state of weather after studying the maps and utilizing the Satellite photos which will enable us to determine the centers of the low and high pressure and the air masses that affect the state of the sea during the forthcoming period. Through using the tables which links the relation between the speed of wind and the height of waves, in order to obtain the proper marine forecasting which will include marine warning if necessary, as well as the expected direction and speed of wind in the concerned area.

Winds undoubtedly affect the daily activity of man especially if this activity is connected with fishing and marine sports, since winds play an important role related to the movement of waves and sea currents which are increasing by the force of winds. Man realized since long times the seasonal activities of winds particularly in the marine Environment as they directly affect the speed and direction of the fishing boats, he consequently has taken all the necessary precautions that ensure his safety.

Active and violent winds especially during winter season cause the rough movement of waves which may expose the fishing boats to dangers of drowning or crash with rocks or the coral reef, or may be broken by the violent storms. More over the violent movement of waves will establish sea currents which help moving water masses from one place to another carrying food from the deeper and the coastal waters and create rich marine environment of fish that immigrate to these regions for breeding.

The technical development, remote sensing studies and satellite photos contributed much to support all necessary information about climate where fishermen could be aware of climate forecasting in the due time before going for fishing. In addition that many of the experienced citizens especially those who have been working for along time as fishermen acquainted sufficient experience to become as guide of reference for the new generations.

Names and specifications of some local winds

In accordance with the distribution of pressure all round the year, we tackle here the names of local winds in the UAE.

1- Al-Mazar wind: Strong wind blows from one direction to another. its speed ranges between (20- 40) knots. It helps to accumulate clouds in its blown area. It may be followed by rainfall which continues for few hours only.

2- Alfayadah: It is the wind which take the direction of the western north. Alfayadah wind blows strongly for short period of time and leads to remarkable and sudden raise of sea waves. Sailors and fishermen usually recognize this phenomena through watching the thin horizontal line of clouds where they can take precautions.

3- Alkoos and Alnaashi: They blow on the eastern and the western coasts of the Emirates, however, their effect on the eastern coasts like Khorfakkan and Fujurah is more obvious. They are summer winds blow from the northern east and the eastern direction, occasionally causes rough sea and humid weather in the coastal areas. Alnaashi is cold wind blows in winter and has the

same direction of Alkoos wind, however it is faster than Alkoos wind and usually rainy.

4- Almatlaai: It influences the eastern coasts during early morning, and usually moderate in temperature and humidity which soften air conditions. It sometimes causes rainfall over the heights if it blows strongly.

5- Alyolat: It is changeable, and mostly blows up in the second half of April over the southern part of the Gulf and it is usually rainy.

6- Alrayha: It is terrestrial wind and blows up from the eastern parts during August and September. It can be noticed by great white cloud which have big vertical growth called cumulus clouds influence the terrestrial areas such as Alain. The sandy wind of Alrayha moves towards the coastal areas, and sometimes followed by rainfall especially over heights.

7- Lkaitheb: It is strong wintry wind that precede by an utter quiet of air, thunder clouds appear followed by sudden heavy rainfall which continue for comparative long period of time.

8- North and Sehaili winds: They are wintry cold winds known by the inhabitants of gulf region and the Arabian Peninsula. They often precedes by (Simoom) winds from three to four days. After the Sehaili winds being abated, an active wind will be blown up, and sea becomes rough. This phenomena usually takes between four days to one week, and sometimes is followed by northern wind which continues for more than one week.

9- Al thamaneen wind: It is wintry wind and harder than the north wind, where waves become very rough. The wind mostly blows up by dawn, and it can be noticed through the clear abatement of the sea exactly like the case of Lkaitheb wind. Althamaneen wind usually blow up during December, January, and the first half of February.

10- Algharbi (western): Temperate winds blow up from west directly after the end of winter season i.e. during March and April. If we compare the directions and the force of the local winds we find that they are correspondent to the pressure distributions and air masses that influence the UAE all round the year. The cycle of land and sea breeze which blow from sea to land during mid day as the temperature of land is raised because the above pressure is rather law due to the heating and elevating of air. The hot air attracts the air of sea which is under high pressure as a result of the lower temperature of sea water.

Land breeze: It usually happens during night and early morning. Water temperature is higher than land temperature during night as land takes longer time to become cool due to its qualitative temperature which equal three times the qualitative temperature of land. It is known that land attain heating quickly and lose it quickly, while water attains heating slowly and loses it quickly as well. The sea breeze is more effective than the land breeze, its effect is depending on the season, the nature of the neighboring land, and the prevailing air masses. The influence of the sea breeze may reach to 20-40 kilometers of land.

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A lecture on meteorology Dr. Salama Hashad – Ministry of Communications

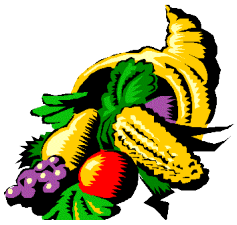
Greenhouse Introduction

The beginning of greenhouse industry in the U.A.E. dates back to the early seventies when the first trials was conducted in an Island of Sadiyat in Emirate of Abu Dhabi carried out by the University of Arizona. The experiment provided valuable information on potentialities and constrains of vegetable production in greenhouses, in addition to providing a model in terms of the most suitable structure components., farming materials , glazing materials , methods of cooling in addition to desalinizing sea water and generating electricity.
In light of these findings a technical and economic feasibility study was carried out by a private consulting firm commissioned by the Government; and on the basis of an encouraging return on investment a joint venture was launched by the government of Abu Dhabi in 1977. However; the federal government started introducing simple Quonset greenhouses by the help of United Nations Development Program (UNDP) .

Greenhouse vegetable crops
Tomatoes and cucumber are in the first ranking order in terms of economic importance and between two to three crops are grown annually. Total production of tomatoes increased drastically following the increase in greenhouse area . Types of Greenhouses

1. Low Tunnels
Low tunnels greenhouse system is introduced by ministry of agriculture and fisheries by which galvanized pipes and polyethylene sheets are used as a protection ss and polyethylene sheets are used as a protection system for vegetable production. These units are also equipped by irrigation system for the production of tomatoes , cucumber and other vegetable crops.

2. Multispan Greenhouses
Several different types of multispan greenhouses are available such as ride and furrow, and multiple modified Quonset system. Most of these are standard. Generally, these house vary in the area from 1,000 to 20,000m2 divide in to units each is 2500 m2
The frame is made out of heavy duty metal or aluminum in order to prevent rust. The shape of the roof is either gable covered with corrugated fiber glass treated with 10% ultra violet (U.V) stabilizer or glass or curved and covered with single or double layer of 200µm



Vegetables A to Z

Growing specific vegetables. First, let's group* the vegetable types so we can discuss them in a reasonable manner. You can jump to a specific category by clicking each bookmarked group link, then click that link for detail information on growing each vegetable type within that group. Also Planting and Harvest Guide for more info.

Vegetable Group

Cabbage	Legumes	Root Vegetables
Fleshy-Fruited Vegetables	Miscellaneous	Salad Vegetables
Greens	Onion	Vine Vegetables
	Perennials	

Perennials The perennial crops, if you have the room, can provide plentiful amounts of some of the earliest, or the longest lasting crops. Included are asparagus, horseradish, rhubarb, but chives, and multiplier onions as well as some of the herbs can be included. Asparagus, horseradish, and rhubarb are the most important, but chives, bottom multiplier onions, and some of the flavoring and condiment plants, chiefly sage and mint, are also desirable. Horseradish is not adapted to our Zones 1 and 2. All the perennial crops should be grouped together along one side of the garden, where they will not interfere with work on the annual crops. Click Herbs for information herein, and this link Wholeherb for an excellent web site covering herbs.

Greens The green crops are usually grown for their tasty leaves, which when cooked, are excellent vitamin rich food sources. These are typically grown throughout the South, but can be grown successfully into the Northern states. Included are Chard, French Endive (Chicory), Collards, Cornsalad, Kale, Mustard, Spinach, New Zealand Spinach, Turnip Greens.

Salad Vegetables The salad crops are also grown for their leafy greens, but are usually eaten raw as salad ingredients. Included are Celery, Endive, Lettuce, Parsley, Upland Cress.

Root Vegetables The root vegetables are the staples of the vegetable garden. In most parts of the country they can be left in the ground over winter and harvested as needed. Included are Beet, Carrot, Celeriac, Chervil, Dasheen, Parsnip, Potato, Radish, Salsify, Sweet potato, Turnip and Rutabaga, and Turnip-rooted Parsley.

Vine Vegetables The vine crops include cucumbers, muskmelons, pumpkins, squashes, watermelons, and citrons. These crops require a large amount of space, in some cases a long, hot, growing season, and are susceptible to insect pests, but, if you have the room, can be a rewarding home grown crop.

Legumes The legumes are known as the beans. Well, also Peas and Soybeans. These vegetables have a wide growing area, can take different climate conditions, and provide a fair amount of protein in the diet. They also replenish the soil with their nitrogen forming ability.

Cabbage Group The cabbage crops include Broccoli, Brussels Sprouts, Cabbages, Cauliflower, and Kohlrabi. These are the cool weather crops. In the south they can be grown through the winter, and in the north can be planted as a spring crop. They thrive in a cool, moist climate.

Onion Group The onion group includes Chives, Garlic, Leek, Onion, and Shallot. In general, these crops are adapted over a wide variety of soils. But, obviously rocky soils aren't going to produce any smooth skinned onions! Many of these can be grown throughout the year, and can over winter in many parts of the US.

Fleshy-Fruited Vegetables Fleshy-fruited crops? Well, there are arguments as to whether some of these are fruits, or vegetables, but who cares? I grow them for their delicious taste and nutrition. These include Eggplant, Pepper, and Tomato.

Miscellaneous Vegetables The miscellaneous crops are some vegetables that are hard to categorize, thus, a group called Miscellaneous. These include Fennel, Okra, Physalis (tomatillo), Sweet Corn.

*Information derived and compiled in part from USDA, Agricultural Research Service.

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Nursery management in vegetable crops

By: Rajinder Kumar Dhall and J.S. Hundal

AS like cradle, nursery is the place where young seedlings are raised and nurtured before planting them in the main field. For raising a good crop, it is utmost essential that seedling should be healthy, vigorous and disease-free. Seedlings are susceptible to a number of diseases due to its delicate, succulent and highly tender nature. Further, skyrocketing cost of hybrid seeds warrants attention of the grower to produce the seedlings under protected conditions because every hybrid seed has its accountability owing to its high cost which is 20 to 50 times higher than the open pollinated seeds. Raising of nursery under polyhouse or greenhouse and sowing the individual seed of hybrid in potting plug with artificial culture media is a well-established practice in developed countries. However, in our country most of the nurseries are raised under open conditions and it is one of the main reasons of setback to development of hybrid programme during rainy season in North India. Therefore, we have to standardise the nursery raising programme on scientific lines.

If anyhow raising nursery is not possible under controlled conditions and there is lack of other facilities like potting plug, rooting media, etc., then proper attention should be paid to the selection of nursery site and treatment of seed and nursery soil. Recently, soil solarisation has been proved as cheapest and eco-friendly approach for soil disinfection of nursery beds. Soil mulching is done with transparent polythene of 25 to 100 cm thickness during the period of high temperature and solar radiation. Soil should be kept moist before mulching to increase the latent heat and thermal sensitivity of resting structures of soil-borne pathogens, harmful pests and weeds. Following this simple practice, population of soil-borne pathogen, nemotodes, pests and weeds can be reduced to a substantial level.

Nowadays the nursery raising of vegetables had become a specialised job with increasing susceptibility of vegetables to biotic and abiotic stresses. The major nursery pests and diseases are whitefly, cut worms, borers, nemaatodes, dumping off, fungal and bacterial leaf spots. Besides, high and low temperatures excess rains, drought, hot and cold winds affect nursery raising. We can raise our seedlings in low tunnels and low-cost polyhouses. Production of early tomato, cauliflower, capsicum, chillies often have problems in high temperature and high rainfall areas. The use of transparent plastic sheets as low tunnel provides ideal conditions for successful raising of seedling than conventional methods. The time taken for seed germination and seedling growth is reduced under low tunnel is sown in winter months for spring transplanting. The utility of low-cost polyhouses for raising of seedlings of cucurbitaceous vegetables in winter months to harvest early summer crops has been very successful and commercially adopted by farmers in Punjab, Haryana and UP. The seeds sown in polybags show early germination and make faster growth under protected cover. When outside conditions are favourable, seedlings are transplanted along with earth ball in the open field in early spring, the crop starts flowering and fruiting in very short time. This technique is capable of giving highly remunerative yields in northern plains. Besides, the seedlings of tomato, brinjal and chilli also get ready for transplanting in short time for spring planting in plains. The use of shade and agronets has been found very effective in raising of seedlings during high temperature. Shade reduces temperature by 5°C to 10°C and protects the seedlings from sun scorching and harmful effects of high temperature. Agronet protects the seedlings

from insects and reduces the vector-borne viruses infestation and damage by other insects.

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Horticulture and Crop Science

2021 Coffey Rd., Columbus, Ohio 43210-1086

Raised Bed Gardening

HYG-1641-92

Pete Lane

Gardening in raised beds, a common practice before colonial times, is enjoying a resurgence of popularity among home vegetable growers. In parts of the world with greater population densities or less tillable land, gardening in beds is still the norm.

What are "raised beds"?

The "raised" part means that the soil level in the bed is higher than the surrounding soil, and "bed" implies a size small enough to work without actually stepping onto the bed. A bed should be no wider than 4 feet, but length can be whatever suits the site or gardener's needs. Wider beds can be subdivided into sections accessible from planks or stepping stones. The bed does not have to be enclosed or framed, but if unframed, the use of power tillers is feasible. Framing offers several other opportunities, however; and a properly maintained bed will not need powercultivation.

Higher Yields

There are many reasons for the raised bed revival, but probably the most important is more production per square foot of garden. In a traditional home garden, good management may yield about .6 pounds of vegetables per square foot. Records of production over three years in a raised bed at Dawes Arboretum near Newark, Ohio, indicate an average of 1.24 pounds per square foot, more than double the conventional yield. Raised beds do not require the usual space between rows because no walking is done in the bed to cultivate or harvest. Hence, vegetables are planted in beds at higher densities - ideally spaced just far enough apart to avoid crowding but close enough to shade weeds.

Improved Soil Conditions

Another reason for greater production in a given space is the improvement of soil conditions. Soil compaction can reduce crop yields up to 50 percent. Water, air and roots all have difficulty moving through soil compressed by tractors, tillers or human feet. Plows, tillers or spades have been the usual answer to this problem, but gardeners can avoid the problem completely by creating beds narrow enough to work from the sides. Soil organic matter content can be increased greatly without getting bogged down.

Raised beds also help in situations where compaction is not the only culprit. Homeowners may have low spots unsuited for conventional gardens because of ponding or excessive erosion from runoff. Raised beds rise above these, with frames as a foundation. Gravity becomes an ally, not only in avoiding soggy soils but in reducing a problem common to western Ohio - alkaline soils. Saturated soils get a dose of lime every spring via percolation. In a raised bed, gravity reduces percolation to a trickle from capillary action. Soil acidity can be maintained in the 5.8 to 6.8 pH range that vegetables prefer.

Ease of Working

The gardener shares some benefits from raised beds as well. The first, and most important, is the increased ease of timely planting and harvesting. Most people avoid working traditional gardens in rainy weather to avoid compaction and muddy feet. Because raised beds are designed for walking around, not in, there is no reason for mud to delay operation. Spaces between beds may be left in sod, mulched or even paved with stone or brick.

Ease of Pest Control

Pest control becomes less difficult in raised beds. If burrowing rodents are abundant, the bottom of the bed can be lined with poultry wire or hardware cloth. Rabbits and groundhogs can be discouraged by placing their favorite foods in a framed bed with a low fence. The narrow dimensions of beds even make bird netting suspended on flexible conduit frames practical. Weed control with plastic mulch can be achieved economically, as the width of the bed can be spanned by one roll.

Water Conservation

The narrow dimensions of beds are advantageous for water conservation. There are several watering systems that ensure the water gets only where it is needed. Canvas soaker hoses, perforated plastic sprinkle hoses and drip-type irrigation disperse water in a long, narrow pattern well-suited to beds. They also reduce disease by directing water to the soil instead of wetting leaf surfaces as with overhead irrigation.

For those who are producing for more than just family or friends, raised beds may not be the answer. Certain vegetables, such as squash, melons and sweet corn might do as well on ground level due to the extensive space they shade.

Construction Tips

There are only a few guidelines to remember in raised bed construction: Keep the beds narrow and match their length to the site and the watering system. A north-south orientation is best for low-growing crops, allowing direct sunlight to both sides of the bed. Beds that will contain taller crops such as pole beans, trellised peas or caged tomatoes might do better on an east-west axis. Thus, lower-growing crops could be planted on the south side of the bed and still get full sun.

Avoid the use of creosote or pentachlorophenol-treated lumber for bed frames. These chemicals can leach out and injure plants. Use pressure-treated lumber, redwood, cement block or brick, and be aware that the cement in block will raise soil pH over time.

Even if the soil is heavy clay, at least one-third of the volume of the bed's root zone should consist of existing soil. There are a lot of good minerals in clay and by loosening it up with one-third compost or peat and one-third coarse sand, it will make a good growing medium. Add a little garden fertilizer and test the soil after the first crop year.

Raised bed possibilities are endless. Beds elevated 2 feet or more offer the promise of gardening without bending and can have benches built on the sides for even more convenience. Because a bed warms up quicker than the ground, it can easily double as a cold frame by covering it with a lightweight clear plastic cover. Imagine being able to start plants early in beds with covers and never having to transplant them! Supports for poles, cages and trellises can be mounted to the frame for longer life and ease of installation and removal.

Many of the same principles used in raised beds are being adopted on a larger scale in field crops. Ridge tillage, solid seeding and controlled traffic are all new techniques designed to deal with drainage, weed or compaction problems and to increase productivity. Traditional gardens with orderly rows on wide intervals have mimicked their larger farm counterparts for years. Maybe it is time for them to change their role model to the new farm, or the ancient garden.

The author gratefully acknowledges James D. Utzinger who reviewed the original fact sheet.

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Hydroponic production

http://oregonstate.edu/Dept/NWREC/greenhouse.html

Hydroponic culture is the growing of plants in gravel, sand, or artificial soilless mixes in troughs, tubes, or tanks suitably built to allow circulation of the nutrient media. Soilless culture is more demanding and less forgiving of mistakes than conventional soil culture. Good nutrient media composition and balance are important.

Hydroponic methods allow production of vegetables in areas where suitable soil is not available or where disease or other conditions make ground bed production unfeasible. Although you can automate this system to minimize irrigation and fertilization labor input, continuous monitoring of all aspects of plant growth and culture media, nutrient balance and a thorough understanding of the crop and its physiology is critical. Costs of the automatic devices and special nutrient media are substantial. All other aspects of production remain the same as with conventional culture. There are no yield or quality advantages over conventional production if the quality of management is equal. None of the package offers of equipment and technical services for hydroponics guarantees success. Investigate thoroughly before making substantial investments.

Due to environmental concerns, restrictions may be in place regarding the disposal of excess fertilizer solutions and growing media. Possible options are to discard fertilizer solutions by using it on pastures or in other agricultural applications, and to recycle growing media by blending it with other potting mixes or agricultural soils. Consult appropriate agencies for available options.
Excellent books on this subject are:

Hydroponic Food Production by Howard M. Resh, Woodbridge Press Publishing Company, Santa Barbara, CA 93160.
A Guide for the Hydroponic & Soilless Culture Grower by J. Benton Jones, Jr., Timber Press, POB 1631, Beaverton OR 97075.
Greenhouse Vegetable Production Guide for Commercial Growers 1993-1994 Edition. British Columbia Ministry of Agriculture, Fisheries and Food., 808 Douglas St. Victoria, British Columbia, Canada V8W 2Z7.

Two major soilless culture systems are used, those in which plant nutrients are recirculated (closed-system hydroponics), and those that utilize artificial media to anchor plant roots but new nutrient solution is constantly provided to the plants and the excess nutrient solution is not collected and recirculated (open-system hydroponics or bag culture).

Closed-system hydroponic culture is the growing of plants in troughs or tubes, where plants are anchored in gravel, sand, or artificial soilless mixes; or without artificial media for anchor, such as nutrient-film technique (NFT). Any system used must be suitably built to allow proper application and recirculation of the nutrient media. Flow rates of 1.5 to 2 quarts per minute are most common. In a closed-system, the nutrient solution is regularly monitored and adjusted for pH as needed. Because plants take up

nutrients at different rates, and roots exude certain chemicals, imbalances and problems can occur. To prevent undesirable build up of certain elements, the nutrient solution may need to be changed every 2-3 weeks with changes as often as once per week during periods of peak growth. By careful, daily monitoring of nutrients in solution and, especially, the electrical conductivity (EC), and by installing activated charcoal filters to remove certain toxic root exudates, a large reservoir of nutrient solution may be maintained for one crop cycle (up to 10-11 months). The EC should be maintained at 2.2 during low light intensity and 2.5 as light intensity increases. Do this by adding fresh water when EC exceeds 2.5 and new, complete nutrient solution is added to bring the EC to 2.5.

Bag Culture uses artificial media (usually rockwool) packaged in 3 or 4 cubic foot bags. Rockwool comes in two densities, standard and low density. The low density is used for one year and discarded. The standard density may be sterilized and reused for up to three crops. Two common trade names are Redi-Earth and Metro-Mix. The 4-cubic-foot bags are best for cucumbers. Two rows of cucumbers are usually planted per bag with plants spaced 16 inches apart in each row with rows 16 inches apart. Bags are placed in rows 6 feet apart, and spaced down the row to allow a uniform 16-inch spacing between plants. A drip irrigation system with spaghetti drippers for each plant is used to distribute the nutrient solution. A 10%-20% excess solution is applied during cloudy cool periods and 25% to as high as 50% under sunny, warm conditions to provide drainage and prevent salt buildup. This excess should be collected and discarded or may be reused with certain restrictions.

Common modifications of this system (to reduce cost) utilize 3-5 gallon plastic bags or pails with saw dust, pine bark or rice hull media. Western Hemlock and Douglas-fir are most commonly available and the main ones used in the Pacific Northwest. Avoid western red cedar because of possible toxicity from chemicals in it. Use a medium-fine grade of horticultural grade (guaranteed to be free of toxic chemicals that may be used by the lumber industry). If too fine a grade, the saw dust will limit oxygen exchange as it breaks down resulting in root suffocation. Before using saw dust, test leachate conductivity for any salt accumulation and leach bags with fresh water if needed. Modifications of the fertilizer program are necessary to compensate for specific media. Of particular concern is possible manganese toxicity since manganese can accumulate in wood to toxic levels. Check the first leaf tissue samples and adjust manganese applications as needed.

Commercial fertilizer mixes are available through horticultural supply companies. Follow directions carefully in preparing and dispensing the nutrient solution. Choose a high quality fertilizer injection pump and system to minimize fertilizer distribution problems. The major advantage of bag culture is the reduced management of nutrient solution monitoring, and the elimination of nutrient circulation, that is required in "closed" hydroponic systems.

All About Herbs

HERBS

Taste to the palate and food for the soul! The herb garden offers us much, whether out the kitchen door or on the window sill. Herbs offer colour and contrast to the landscape, perfume our home, heal our wounds, and tantalize our taste buds. Herbs are easy to grow. Learn their likes and dislikes and pick a location to their liking. Click Herb Pictures for some examples. Go to Wholeherbs for more info on herbs.

CULTURE: Although able to survive in hot dry locations, herbs perform their best when grown in well drained fertile soils. Manures and composts will go a long way in providing a suitable growing bed. Your soil pH should be near 6.5, so when starting out, a soil test will be an important component of your success. When you have seeded or transplanted into your bed, keep the soil moist and vigorously pursue any weeds. Monthly feedings of a good organic fertilizer, either granular (1 tbs/plant) or liquid (1 cup/plant), will help produce good foliage with maximum flavor.

HARVESTING: Harvesting is done at different times for different uses. Nothing can compare with using fresh herbs in cooking, teas, or salads. Simply go out to the garden and snip what you need at any time. However, to preserve herbs for future use, you must harvest them at their peak of maturity. For culinary herbs and herbs for distilling oils, harvest when blooms are just beginning to appear. At this point the leaves contain the highest concentration of their essential oils.

PRESERVE: Drying is the most common way to preserve herbs. Hang small bunches from the ceiling in a dry, dark location with good ventilation. Drying usually takes between 1-2 weeks.

STARTING HERBS FROM SEED: For an early start on the herb garden, start seed indoors. Hardy seedlings can be transplanted after the last frost and tender types after June 1. Most herb varieties can be started six to eight weeks before transplanting into the garden.

1. Good sanitation practices are the key to strong seedling germination and growth. Always use a sterilized growing medium and clean containers.

2. After you have sown the seeds, water them in and cover the container with plastic or a clear dome lid. Remove the covering once germination is complete.

3. You must provide the proper warmth for germination. Never let the soil temperature go above 80°F or below 60°F.

4. A double fluorescent fixture should be operated about six inches above seedling containers for 16 hours per day. One cool white bulb and one warm white bulb should give seedlings the right light spectrum for optimum growth.

5. Keep in mind that seedlings transplant more successfully at a younger age. Don't allow them to become leggy or root bound. When you notice the second set of true leaves appear, this is the correct time to transplant. Small seedlings such as thyme, savory and sweet marjoram may be transplanted successfully in small clumps.

6. Harden off seedlings before transplanting into the garden by gradually exposing them to fluctuating light and temperature.

ANGELICA

ANISE HYSSOP

BASIL

BORAGE

BRONZE AND GREEN FENNEL

CARAWAY

CATNIP

CHAMOMILE, GERMAN

CHIVES

CORIANDER (CILANTRO) SANTO

CUMIN

DANDELION

DILL

EAST INDIAN LEMONGRASS

EVENING PRIMROSE

FEVERFEW

FLAX OMEGA

GARLIC

GROLAU

HOREHOUND

HYSSOP

LAVENDER

LEMON BALM

LICORICE

LOVAGE

MARSHMALLOW

MILK VETCH

MINT

OREGANO

SWEET MARJORAM

ANGELICA- ***Angelica archangelica***. An attractive, shade-loving accent plant for the landscape. Will grow to 3 feet the first year and 6 feet in the second year. Roots, stems, leaves and seeds have a mild licorice-like flavor used in liqueurs and other culinary treats.

ANISE HYSSOP-Blue: A wonderful bee and butterfly plant that grows 3-4 feet in height. The flowers form a dense spike 2-6 inches in length with color variations from indigo-violet to blue. The licorice-flavored leaves make a wonderful tea.

BASIL-***Ocimum basilicum***
DESCRIPTION: Basil is usually treated as an annual and grow's up to 2 feet in height. The flowers range from white to shades of pink and purple and begin to appear

from late July into August.

CULTURE: Do not be in a hurry to plant basil. Sow seeds indoors or outdoors uncovered lightly pressed into the soil when night-time temperatures are consistently above 50°F. Plant in full sun in rows 24-36 inches apart. Use basil that is tested and found to be free of fusarium, a potentially devastating disease for the basil grower.

SOME BASIL VARIETIES:

AFRICAN BLUE- This handsome tender perennial basil is a great garden variety that can also be grown in a pot for indoor kitchen use. The attractive light pink flowers are a perfect contrast for the purple-streaked foliage. Available only as a plant.

BORDEAUX- ***O. purpurascens***. This new red-leafed basil from Germany is the finest culinary red that we know of. Its wonderful mild flavor is rare to find in a red leafed variety. Bordeaux opens a whole new world for red basil use. Will grow to 18 inches in fertile soil.

CINNAMON- This attractive landscape plant has a distinctive culinary value as well. Its unique cinnamon taste and odor lend it easily to the kitchen as well as to fresh and dried arrangements.

FINISSINO VERDE APALLA- ***O. mininum***. From one of the oldest herb breeders in Italy comes this astonishing bush basil, so refined that it forms a globe so perfect that it looks pruned! The bush can reach up to 10 inches in diameter and the leaves are very small, thin, and strongly scented. Perfect for culinary purposes, in window boxes, beds and borders.

HOLY BASIL- ***O. sanctum***. Also called Tulsi or sacred basil, this species grows abundantly in India and is sacred to the Hindus. Very aromatic with the scent of clove and spice. Use as a salad garnish, herbal tea, or as a colorful, fragrant landscape plant. Look for the green and red leafed selections that have been carefully selected and propagated in Thailand.

LEMON- ***O. Citriodorum***. This small-leaf variety grows to 15 inches in height. Leaves are good in vegetable dishes, salads, fruit salads, and with fish. You'll love the lemon twist that lemon basil will add to your tea.

MAMMOTH SWEET- The beginnings of a culinary masterpiece! Hailed by the chefs of Italy, the largest-leafed basil. Known as the wrapping basil, this variety has large bright green leaves with slight puckering and the most heavenly aroma.

PURPLE RUFFLES- ***O. purpurascens***. The beautiful deep purple leaves add rich color to salads and herbal vinegars; they also make beautiful garnishes. Loves hot, bright locations in the landscape. Twelve inches tall.

RED Rubin- ***O. purpurascens***. Red Rubin holds its vibrant dark purple color on and off the plant better than any other basil. Very flavorful and productive; tall purple stalk, with attractive lavender flowers will make Red Rubin a real hit in the kitchen garden.

SIAM QUEEN- This fragrant variety is a must for authentic Thai cuisine, especially with fish soup and beef dishes. The young shoots can be harvested regularly over a period of 4 months. The leaves can also be used raw as a side-dish and are an important ingredient in spicy soups and curries.

SPICY GLOBE- ***O. minimum***. A wonderfully compact basil variety that can be used in the landscape as a summer border. Also a great container plant. Its spicy basil flavor is a compliment to any tomato dish. This uniform 6 inch mound reaches 12 inches across.

SWEET BASIL- This 18 inch vigorous plant yields several harvests. Leaves are used to make pesto, and the larger ones can be used as a food wrap. Great culinary variety.

SWEET DANI- Growing Sweet Dani is like growing a field of lemon drops! Very high in citral and essential oil, these 18-24 inch plants provide lots of leaves just right for cooking with fish, accenting salads, or garnishing deserts. This wonderful lemony, sweet basil was an All-America Selections Award winner in 1998.

BORAGE- ***Borago Officinalis***. The star-like flowers can be frozen in ice for summer drinks, and the flowers and cucumber-flavored leaves are tasty in salads. Borage stays attractive and green long into the fall and for the next season. A favorite of the bees!

CARAWAY- ***Carum carvi***. An herb with a history as old as the Egyptian pyramids, and favored by Queen Victoria as a traditional finish to an Elizabethan feast. The seeds are used to flavor soups, breads and cheeses. The leaves and roots can be used as vegetables. Long thought to aid indigestion and sweeten the breath. Can be direct sown in the spring.

CATNIP- ***Nepeta cataria***. This long lived perennial herb used in gardens and landscapes. The long green and whiteflower spikes are great in fresh and dried arrangements. The leaves are use din salads, sauces, teas, soups and also have medicina1 properties; just ask your cat! Matures to 4 feet.

CHAMOMILE, GERMAN- ***Matriciria recutita***. The German type Chamomile is the most prolific producer of flowers. They are used fresh or dried to make a wonderfully relaxing tea or a refreshing facial. Grows to 16 x 16 inches.

CHIVES- ***Allium schoenoprasum***. Grow in clumps 12 inches apart. Chives are a mild member of the onion family. The chopped stems and the pink flowers are edible and add a fresh, mild, green-onion flavor to salads and other favorite recipes.

GARLIC- A flat leaf variety of chives with a strong flavor of garlic. The white flowers and leaves are used in cooking. Even a few leaves puts its unmistakable taste of garlic in foods.

GROLAU- This essential kitchen herb was selected specifically for greenhouse growing and works wonderfully for windowsill culture. Prolific production of dark, thick leaves with an excellent true oniony flavor. Cut at about 8 inches in height. Grolau is less prone to turning yellow or getting leggy. Keep cutting for best production.

CORIANDER (CILANTRO) SANTO- ***Coriandrum sativum***. Once thought by the Chinese to confer immortality, coriander is now used to enhance salsas and curries with its sweet, spicy flavor. The leaves are used in American cooking and are usually referred to as cilantro.

CUMIN- Cuminum cyminum. A pungent herb that brings life to Indian and Middle Eastern dishes, especially curries. Also used for pickling, and flavoring liqueurs. Grows 6-12 Inches tall with threadlike leaves that have a delicate fragrance. Likes a sheltered sunny location.

DANDELION- Taraxacum officinale. Long known for its tonic properties, our more 'domesticated' selection grows to about 6 inches with slightly wider and thicker leaves that can be eaten fresh or cooked. Loaded with iron and magnesium. The roots can be used as a coffee substitute.

DILL

DUKAT- ***Anethum graveolens***. This special selection produces much more foliage before forming seed than most dills. Dukat has a particularly fine bouquet and flavor; excellent used fresh or dried. Ten inch seed heads.

FERNLEAF- An All-America Selections Award Winner. This unique dwarf dill is suitable for containers and makes a striking annual border plant in the garden. A long season producer of fresh "dill weed".

LONG ISLAND MAMMOTH- Early settlers called dill the "meetin' seed" because children were given dill seed to chew on during long Sermons.. An old time favorite, Long Island Mamnoth is a vigorous plant that matures quickly. Large umbels are covered with masses of seed.
EPAZOTE- ***Chenopodium ambrosioides***. Known to the Mexican Indians as Hierba Santa Maria, this pungent annual is essential in Mexican bean dishes to prevent gas. A few leaves of the herb impart a fuller, richer flavor to cooked beans. Can be dried.

EVENING PRIMROSE- ***Oenothera biennis*** (HB). The clear yellow blossoms of the Evening Primrose open to meet the moon and disperse their fragrant odor into the night air. A handsome landscape addition to any garden. Research continues into its many reported medical uses.

BRONZE AND GREEN FENNEL- ***Foeniculum vulgare*** (P). Deep red-bronze, burgundy, red and green selections of fennel. The young plants have a soft ferny texture and the unmistakable odor of anise. Very useful when harvested it a small size for salad and soup garnishes. This colorful, vigorous strain will also perennialize itself in moderate climates. Non bulbing.

FEVERFEW- ***Tanacetum Chrysanthemum parthenium*** (P). This attractive perennial grows to 3 feet in height and is covered with dainty, white daisy-like flowers with bright yellow centers. Feverfew is a wonderful naturalistic landscaping plant but has gained recent notoriety as a possible remedy to ease the effects of migraine headaches. Rich in the active agent, parthenolide.

FLAX OMEGA- ***Linum usitatissimum***. This flax variety is a widely used agricultural variety that has high levels of omega-3 oil (linolenic acid), a fatty acid essential for cell metabolism. A heavy yielder, Omega Flax can also be used for baking and other uses. Flax straw is used for making linen.

HOREHOUND- ***Marrubium vulgarie***. Once thought strong enough to break the strongest spells, Horehound later gained popularity as a reliever of coughs and to soothe a sore throat. Horehound candy was a favorite of children not so long ago. Grows up to 20 inches and bears small white flower clusters the second year. A good bee attractant as well.

HYSSOP- ***Hyssopus officinalis***. Used by the Benedictine monks to flavor their liqueurs, hyssop is now often used as an attractive hedge plant in knot gardens. Forms beautiful blue spike flowers 2 inches in length. Slightly bitter leaves may be used sparingly in salads, soups, stews and game meats.

LEMON BALM- ***Melissa officinalis***. Counting the virtue of dispelling melancholy, lemon balm is among tile most useful of the ancient herbs. Simply rub the leaves to enjoy a burst of lemon fragrance, or use it in fresh bouquets for aroma therapy. Tea made from the leaves is truly delightful.

EAST INDIAN LEMONGRASS- ***Cymbopogon flexuosus***. This is the source of the lemongrass oil that is used for flavoring in food. Very similar to C. citratus but does not have to be propagated by root cuttings. A vigorous grass that can be used for cooking as well as a stately landscaping grass. Viable seed is very rare.

LAVENDER- ***Lavandula angustifolia***

HIDCOTE- The peace and tranquility associated with the scent of lavender is the source of legends down through the ages. The name lavender derives from the Latin lavare "to wash". Hidcote is a compact cultivar of lavender with dark purple flowers and small silver leaves. A favorite for hedging along the English garden. As with all seed lavenders, you will have off-type plants.

MUNSTEAD- Munstead is a blue lavender, an early flowering selection. Great for drying, hung either by itself or with other tiny flowers. Infuse the flowers with tea to calm jittering nerves.

LADY- This is the first lavender that flowers reliably the first year from seed. The frosty greengray compact mounds reach 10 inches the first year and are topped with masses of lavender flower spikes by late summer. Cut the flower stalks and bring them in for that lovely old-fashioned smell of lavender, or dry for use in potpourri.

FRENCH VARIEGATED- This ornamental lavender makes quite a show with its dark green leaves sashed in a creamy white. Fills the summer breeze with its wonderful fragrance. Grows to 24 inches. Best grown in full sun.

LICORICE- ***Glycyrrhiza glabra***. This perennial herbaceous herb is native to Eastern and Central Europe, where it has been grown for centuries. Its name, glycyrrhiza, in Greek means "sweet root". Taking 2-3 years to become a sizable plant by seed, licorice is a popular confectioner's flavoring as well as having numerous medicinal uses. Easy to start from seed, this herb favors a well dug bed with lots of compost for best root development. The roots are harvested after two years and then washed, trimmed, and dried for future use.

LOVAGE- ***Levisticum officinale***. With a flavor reminiscent of celery and glossy dark green leaves, Lovage makes a dramatic specimen for your garden or landscape. Lovage leaves were laid in the shoes of travelers in the middle ages to relieve weary feet. Grow this herbaceous perennial in a sunny, well-cultivated area. Reaches up to 5 feet.

SWEET MARJORAM- ***Origanum majorana***. In great deman by Ladies during the middle ages as a nosegay, or to put in sweetbags or to sweeten the wash water. Pinching out the top when the plant is 2-3 inches tall will encourage side growth. A great culinary herb that has a sweet oregano-like flavor.

MARSHMALLOW- ***Althaea officinalis***. This perennial relative to the hollyhock grows up to 40 inches in height and has large, single petaled pink flowers similar to other mallows. Likes lots of moisture and organic matter. The leaves and roots are high in mucilage and are suggested for use for digestive troubles. Makes a nice ornamental for out of the way areas.

MILK VETCH- ***Astragalus membranaceus***. Also known as Chinese Milk Vetch or Huang Qi, this is considered one of the most important Chinese medical herbs. Although the list of remedies seems endless, milk vetch is being studied as an enhancer of the immune system. Easy to grow perennial. Likes well dug soils high in organic matter.

OREGANO- ***Origanum spp***

GREEK- ***O.vulgare subsp. hirtum***. You will be surprised by its wonderful spicy flavor. It has tiny white flowers and is very hardy when established. Imparts a wonderful "wild" mountain aroma in the garden.

OREGANO- O. vulgare. Oregano's power to heal and preserve was well known in the ancient world. Today's use is to spice up various Italian dishes and meats. Oregano foliage is dark green, with pink to deep-purple flowers.

HOT AND SPICY- ***O.microphyllum***. This fascinating oregano has a strong spicy flavor and a sprawling havit. Makes a pleasing, fragrant ornamental plant and is great for culinary use in the kitchen.

CUBAN OREGANO- ***Plectranthus sp***. This oregano scented house plant is not a culinary oregano but releases a wonderful odor when brushed. This attractive plant has fleshy, serrated oval leaves and forms a tight mound to 10 inches in height. Makes a great patio plant when grown in a clay pot. Available only as a plant.1a11ahl, m,1, 11, t l,Lnt

KALITERI- ***O. vulgare subsp. hirtum***. This excellent culinary oregano is considered one of the finest in Greece. Even its name, Kaliteri, means the best in Greek. High in essential oils with a spicy full bodied flavor. Your spice collection cannot be complete without this one.

MINT- ***Mentha spp***.

CHEWING GUM- ***Mentha piperita***. Wonderful addition to tea on a frosty winter morning. Vigorous 10-18 inch Plants yield lots of leaves! Available only as a plant.

EAU DE COLOGNE- *Mentha piperita citrata*. This aromatic mint comes to us from the perfume fields of France. Just a hint of rose accentuates the wonderful mint bouguet. Available only as a plant.

LEMON MINT- ***Monarda citriodora***. Lemon Mint is a non-invasive herbaceous member of the mint family grown for its ornamental value. The tiered pinkish-purple flowers are long lasting in fresh bouguets and can be dried for everlasting arrangements.

SCOTCH- ***Mentha spicata***. Recognized as one of the best cooking mints. Clear, smooth flavor. Perfect for cooking vegetables and making mint sauces. Grows to 18 inches. Available only as a plant.

SPEARMINT- ***Mentha spicata***. Sweet-smelling and prolific, spearmint has a wide range of uses. Excellent landscape plant with with attractive pink multi-headed flowers. Great used in teas and many types of salads.

Shade Tolerant Vegetables (and Fruits)

It depends on your climate, soil, and **what kind** of shade you have. Is it **solid** shade cast by a large building, or **dappled** shade cast by trees? Few edibles will produce in all-day solid shade, but if you have broken shade, or direct sun for at least part of the day, there is hope of getting some vegetables to grow.

Shade is a blessing in hot climates. Areas that get 2 to 3 hours of sun in the morning followed by shade the rest of the day are ideal for growing leafy vegetables during the summer in hot climates.

Here is a list of the more shade-tolerant vegetables.

GREENS:

Arugula, cabbage, kale, lettuce, mustard greens, pak choi, parsley, sorrel, spinach.

HERBS:

Cardamom, mint.

LEGUMES:

Peas, bush beans.

ALLIUMS:

Chives, garlic chives, onions.

BERRIES:

Blackberry, currants, gooseberry, strawberries.

A veggie for all seasons

Warm season vegetables do best when temperatures average 65 to 95 degrees. They thrive in warm summers and should be planted after the danger of frost is over in the spring. Favorite warm season vegetables include beans, cucumbers, eggplant, peppers, summer squashes and tomatoes.

Plant cool season vegetables several weeks before the last spring frost is expected in your location. They grow best when daily temperatures reach only 55 to 75 degrees. The most popular cool season vegetables are beets, broccoli, cabbage, carrots, green onions, scallions, kale, peas, radishes and spinach.

You can even bring herbs inside for the winter. Be sure to cut them back about 3 inches or repot them before they start their indoor growing season. Chives, garlic, parsley, rosemary and thyme do better than other herbs when placed near or on a sunny windowsill. Try hanging a group of cooking herbs in a wide, flat basket near a bright window. Or, arrange small pots on waterproof trays for a countertop herb garden.

Cool Season Vegetables

Artichokes
Arugula
Asparagus
Beets
Bell Peppers
Broccoli
Brussels Sprouts
Bush Beans
Cabbage
Carrots
Cauliflower
Celery
Garlic
Hot Peppers
Kale
Leeks
Lettuce
Onions
Parsnips
Peas
Pole Beans
Potatoes
Pumpkins
Radicchio
Radishes
Rutabaga
Scallions
Spinach

Hot Season Vegetables

Beans
Chard
Collard
Cucumbers
Eggplant
Melons
Okra
Squash
Summer Squash
Sweet Corn
Sweet Potato
Tomatillos
Tomatoes
Winter Squash
Zucchini

Farm & Garden
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http://www.farm-garden.com/growing-vegetables/

Below you will find papers for growing some of the more common vegetables grown in North America. Each of these papers provides detailed information on growing these vegetables. These papers are considered guides. Feel free to adjust distances to suit your need

Growing Artichokes

Family: *Asteraceae*
Genus and Species: *Cynara scolymus*

Artichokes are perennials if you live in Zones 7 or greater. For the rest of us, artichokes are considered annuals. Artichokes are members of the thistle family and are often referred to as globe artichokes. The edible bud is actually an immature flower. The artichoke flower is made up of a cone of short, thick-stemmed bracts (leaves) that are tender and edible. The fleshy edible base upon which the flowers sit is known as the heart and is the prized portion of the artichoke.

Climate

Artichokes are a marine climate vegetable and thrive in the cooler coastal climates. The artichoke does best in frost-free areas with cool, foggy summers but will grow almost anywhere there are at least 100 frost free days. Freezing temperatures will kill the buds and hot, dry conditions destroy the tenderness though artichokes do, however, like full sun.

Soil

Artichokes will grow on a wide range of soils, but produce best on a deep, fertile, well-drained soil. The plant is deep rooted and should be planted on soils that afford adequate area for root development.

Spacing

As a perennial: Artichoke plants can reach a height of 3 or 4 feet and a spread of up to 6 feet in diameter so allow plenty of space for them to grow. In Zones 7 and above, plant the artichokes to the side so that the more frequent planting of annual vegetables won't disturb them. Space the artichoke plants at 4'-6' feet within the row with 6 to 8 feet between the rows.

As an annual: Artichokes won't reach their full potential if planted in Zones 6 and below. Freezing temperatures will kill the plants before they can reach full potential therefore a tighter spacing may be used. Space artichokes within rows

at 2' - 3' apart and row spacing of 3'- 4' apart.

In general, consider your particular situation. Artichokes planted closer together will yield more bud production but with smaller bud size. Planting artichokes too close together makes harvest difficult and increases chance of disease.

Direct Seeding

Where winters average above 14°F, you can sow seeds in the fall. Sow artichoke seeds ¼" deep in lightly moistened soil. If seeds are soaked ensure the soil has adequate aeration ability or the seeds may rot.

Seeding For Transplants

Sow artichoke seeds indoors about 8 weeks before the last spring frost date. Sow ¼" apart and ¼" deep in lightly moistened potting mix in a flat or in a pot. As soon as seedlings can be handled, transplant to 2-4" pots or cell trays and grow at 60°F - 70°F days and 50°F-60°F nights. If seeds are soaked ensure the potting mix has adequate aeration ability or the seeds may rot.

Germination

These seeds germinate best in soils around 70°F-80°F. Germination will take 10-20 days.

Planting Root Stock

Rootstock can be purchased from a nursery or alternately, a healthy plant can be dug up, the root divided into two or more parts and replanted.

Root sections should be set at 6" - 8" deep in the soil. Irrigate the soil thoroughly before planting.

Transplanting Into the Garden

Transplant artichokes to the garden at 6-8 weeks.

Watering

Artichokes require frequent irrigation during the growing season. Moisture deficiency will result in loose buds of inferior quality. On the other hand, artichokes won't tolerate standing in water, so plant the artichokes either on mounds or in rows with irrigation furrows. Irrigate the artichokes about once a week; irrigate more often in warm areas and less often in areas with heavy soil.

Harvesting

The artichoke is actually an edible bud. It is harvested at an immature stage and selected for size and compactness. Overdeveloped artichoke buds begin to open or spread; the bracts may have a brownish cast and are tough and stringy; the artichoke hearts have a fuzzy, pink to purple appearance.

As a perennial: For artichokes planted in the fall, harvest can begin as early as spring. Maturation and harvest will continue through the following spring unless

interrupted by frost. Peak production occurs in spring.

As an annual: For artichokes planted in the spring, harvest in the fall.

Handle buds carefully during harvest to avoid bruising bud leaves. To harvest artichokes, cut the bud from the stem about 1" - 1½" inches below the bud base. Buds allowed to become over mature will be loose, fibrous and inedible. Artichoke blossoms, however, are attractive as fresh or dried flowers.

Post-Harvest Handling

Use immediately or refrigerate as soon as possible after harvesting.

Storage

Artichokes may be stored for 1 to 2 weeks at 32°F with a relative humidity of 95%. Artichokes have a low sensitivity to ethylene gas.

Diseases

Curly Dwarf, Botrytis Disease

Pests

Artichoke Plume Moth, Aphids, Snails, Slugs

Comments

Artichokes exposed to 8-10 days of temperatures around 50°F will respond with earlier budding.

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Growing Arugula

Family: *Brassicaceae*
Genus and Species: *Eruca vesicaria, subsp. sativa*

Arugula is a mustard green with an unmistakable tangy but mild flavor. It also known as Rocket, Mediterranean Salad, Rucola or Roquette and is popular in Italian cuisine. The Romans grew arugula for both its seeds and leaves. The seed was used to flavor oils and a typical Roman meal would have included a salad containing arugula, romaine, chicory, mallow, and lavender. Arugula does well as a cutting green and is often included in mixes of salad greens.

Climate

Arugula performs best under cool temperatures. Arugula will tolerate dappled sun-light though full sun is best.

Soil

Arugula will grow on a wide range of soils, but produces best in loose fertile loams. Soils should provide good water holding capacity, good internal drainage, and a pH of 6.0-7.0.

Spacing

Arugula is a small leafy plant. It is often grown in a tight spacing of 1 square inch per plant. Suggested commercial row spacing of 12" - 15" apart, with arugula plants 6"-9" apart in the row. Arugula is a very easy to grow plant and spacing can be adapted to suit your needs.

Direct Seeding

Sow arugula seeds 1/8" deep in a 3" wide band with seeds approximately 1" apart. Space rows at 18" apart. Do not thin.

Seeding For Transplants

Plant arugula seed 1/8" deep in 1" cell trays or soil blocks about 3-4 weeks before last spring frost date.

Germination

These seeds germinate best in soils around 40°F - 55°F. Germination will take 3-4 days.

Transplanting Into the Garden

Transplant arugula at 4 weeks in the spring and 3 weeks during the summer.

Watering

Arugula requires a steady supply of water for tender growth. Frequent irrigations are preferred because of shallow rooting. And while the type of soil does not

affect the amount of total water needed, it does dictate how often arugula must be watered. Lighter soils need more frequent water applications, but less water applied per application.

Harvesting

Harvest is done by hand. Arugula is often pulled up roots and all. In commercial operations it is often cut, bunched and packed into cartons in the field, much like spinach.

Ideally, arugula has dark green, somewhat smooth leaves and a spicy taste. Arugula will develop a strong taste and toughness if harvest is delayed and leaves begin to develop a furry underside. Continuous cutting of the young arugula leaves stimulates further leaf production.

Post-Harvest Handling

As with all leafy items, arugula is extremely perishable. Arugula needs to be handled delicately, and marketed/eaten soon after harvest.

Storage

Cool arugula quickly after harvest. Hydro cooling or vacuum cooling is preferred. It may be held temporarily at 32-34°F and 90-95% relative humidity.

Diseases

For all practical purposes, no diseases bother arugula.

Pests

In many locations, no pests bother arugula. A reader did write us to say that flea beetles are a problem in South Western Washington.

Growing Asparagus

Family: *Liliaceae*
Genus and Species: *Asparagus officinalis*

Asparagus is a perennial crop that will be in the ground for at least 10 to 15 years. Asparagus does not do well if summers are extremely hot and long and winters are mild.

Climate

Asparagus produces the best in areas where freezing temperatures or drought terminates plant growth and provides a rest period. Without this rest period the asparagus plants experience reduced yields. Asparagus is very tolerant to large temperature variations and therefore well suited to a variety of Zones.

Asparagus can be grown in a wide range of soils and under various climatic conditions, but it thrives in fertile well-drained soils in moist temperate regions that have long growing seasons and sufficient light for maximum photosynthesis. Asparagus likes full sun or at worse, partial sun.

Soil

Attention to selection and preparation of the planting site is especially important. Asparagus performs best if the soil pH is within a range of 6.5 to 7.5. Phosphorous, potassium, and lime amendments - based on a soil test - should be incorporated prior to planting.

If perennial weeds are a problem, a sequence of tillage and cover cropping with sorghum-sudan or buckwheat at least a year in advance of planting will help control weeds. Green manure crops also improve soil structure and enhance soil fertility but be sure to till them in before they reach seed maturity.

Spacing

Plant asparagus with a spacing of 8"-14" between plants and 4' - 6' between rows. At 8" the spears will be more slender and at 14" the asparagus spears will be more robust.

Direct Seeding

Direct seeding is not normally practiced.

Seeding For Transplants

Plant asparagus seeds ½" deep in a cell trays, soil blocks, or 4" pots of potting mix. Soak the seeds in water overnight before planting.

Germination

These seeds germinate best in soils around 60°F - 85°F. Germination will take about 21 days.

Planting Root Stock

Plant the asparagus crowns 2-4 weeks before last spring frost. Asparagus crowns can be purchased from a nursery. Soak the crowns in lukewarm water for a few hours before planting. Plant asparagus in furrows with a spacing of 8"-14" between plants and 4' - 6' between rows. At 8" the spears will be more slender and at 14" the asparagus spears will be more robust.

Transplanting Into the Garden

Transplant asparagus to the garden at 12-14 weeks.

Watering

Asparagus roots can penetrate up to 10 feet to obtain soil water but their greatest water uptake will occur within top 6 to 24 inches of rooting zone. It is very important to ensure the asparagus plants have adequate soil moisture in this zone during the fern stage. Inadequate soil moisture during fern development can cause significant reduction in next spring's spear production. Dry soil conditions during spear growth can also affect quality and yield. Adequate soil moisture is also necessary for newly planted crowns to establish good root development and fern growth. Asparagus planted in sandy soils require frequent irrigation.

Light, frequent irrigation applications should be avoided during fern growth to minimize foliage disease development.

Harvesting

Asparagus planted from seed will take 2-3 years to establish and produce significant yields. Asparagus planted as crowns will begin producing between 1-2 years.

Harvest is done by hand when the spears reach approximately 9". Diameter is not a good indicator of
maturity.

Fresh, high quality asparagus will be dark green and firm with tightly closed, compact tips.
Asparagus stalks will be straight, tender and glossy in appearance. The harvest period in a mature
asparagus planting lasts about eight to nine weeks. Spears are hand picked by snapping or cutting them just
above the ground. Most commercial growers build their own harvest aids to increase harvest efficiency.
These low-lying platforms can either be attached to the front or rear end of a tractor, or are
self-propelled. Once harvest begins, picking takes place every other day in cool weather, and every day
later in the season.

Be aware that asparagus spears grow more rapidly as temperature increases. Asparagus will grow 7" in a
day when the temperatures reach 90°. Also taller spears grow more rapidly than shorter ones.

Post-Harvest Handling

Fresh asparagus is highly perishable and deteriorates rapidly above 41°F and therefore some method of cooling the asparagus after harvest is necessary. Pre-cooling to remove field heat prior to shipment is commonly practiced via hydro cooling. Hydro cooling is the process of spraying or immersing vegetables in chilled water.

Storage

Asparagus can be kept successfully for about 3 weeks at 35°F. High relative humidity (95% to 100%) should be maintained, with good ventilation to reduce carbon dioxide and ethylene buildup. Do not store asparagus in a plastic bag or other non-breathable container. A lack of ventilation will allow the build up of ethylene gas which will cause the asparagus spears to toughen. Asparagus is commonly stored
standing on end, bound with a rubber band, and with the butt ends on a wet pad.

Diseases

Fusarium, Asparagus Rust, Needle Blight, Purple Spot

Pests

Asparagus Beetle, Spotted Asparagus Beetle, and Asparagus Aphid

Comments

Allow the ferns to grow naturally for the remainder of the season. Don't cut them back until they die naturally. Apply compost or well-aged manure in the fall or spring.

Keep asparagus bed weeded to reduce the possibility of disease and competition for water.

White asparagus has a milder flavor than green asparagus. To create white asparagus, deny the asparagus plant sunlight. Simply mound up soil or straw over the asparagus row and keep the spears covered.

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Growing Beets

Family: *Chenopodiaceae*
Genus and Species: *Beta vulgaris*

Beets have been cultivated for thousands of years and were originally grown strictly for their leaves. It wasn't until the Roman Empire that people began to eat the roots as well.

Beets are a very popular vegetable because they are relatively easy to grow. Not only that but nearly the entire beet plant is edible. Beets come in a variety of shapes and sizes and you can even find yellow and white beet cultivars as well as the standard red. The tops, often referred to as beet greens, are excellent in salads or lightly steamed if harvested young. Older beet greens are just as edible but with a bit more steaming.

Climate

Beet varieties prefer cool weather but many will do well in a wide range of conditions. Air temperatures of 60°F - 65°F and bright sunny days are ideal for beet plant growth and development. Beets will withstand a light frost.

Soil

Beet plants will grow in almost any soil but are sensitive to soil acidity. A low soil pH results in stunted growth. Beets prefer a pH of 6.2 to 6.8 but will tolerate 6.0 to 7.5. Loose, well-drained, sandy loam soils rich in organic matter are ideal for beets. As with all root crops, remove stones and debris since these will hinder growth. If you have heavy soil, amend it well with compost prior to planting. Break up large clods of soil and rake the area smooth prior to planting your beet seeds.

Spacing

Beet seeds are actually a cluster of seeds and will produce more than one plant. While spacing is flexible, it is recommended that you allow 2"-4" between seeds.

Direct Seeding

Sow beet seeds ½" deep, 2"-4" apart within rows spaced at 12"-18" apart. Sow beet seeds as soon as the soil has warmed somewhat after thawing. Do not thin. The tighter spacing is encouraged if you want smaller beets and/or just the beet greens.

An alternate spacing of roughly 10 seeds per foot is great when combined with thinning as the greens become of edible size.

If seeding for baby beets, beets that are no thicker than a pencil, sow seed at 30-35 seeds per foot of row and space the rows at 10"-12".

Avoid seeding during daytime temperatures of 80°F or more.

Seeding For Transplants

Beets are not normally transplanted. If, however, you want to give it a go, sow beet seeds in flats or in a cold frame 5-6 weeks before you expect the soil to be workable. Sow beet seeds ¼" deep, 3 seeds to the inch.

Germination

These seeds germinate best in soils around 75°F-85°F. Germination will take 5-16 days.

Transplanting Into the Garden

Transplant beet plants at 5-6 weeks, 3" between plants within rows 12"-18" apart.

Watering

Beets need consistent moisture especially during the early part of their development. Take care not to over water beets. Over watering can cause beet leaves to turn red and plants to stop growing for a time.

Too much water early in beet development can result in damping-off and other seedling disorders. Water deficiency, however, can aggravate boron deficiency.

Harvesting

Beets and beet greens can be harvested at any time. To harvest beets, pull the entire plant up. Beet greens are best when four to 6" tall. Beets are generally most tender after growing for 40 to 50 days. Full-grown beets can be the size of a tennis ball depending upon variety. Cylindrical beets will grow to be about 5" long and 2" in diameter.

Flavor and vitamin levels are at their peak immediately following harvest.

Post-Harvest Handling

Beets benefit from cooling immediately after harvest. Clean the beets of dirt and cool using hydro cooling. Hydro cooling is the process of spraying or immersing vegetables in chilled water.

Storage

Beets should be stored at 32°F and relative humidity of 98%-100%. Topped beets stored at 32°F will last between 4 to 6 months. Either cold storage of cool-cellar (root-cellar) storage is suitable, provided the humidity is kept sufficiently high to prevent shriveling.

Temperatures in root cellars fluctuate and are often higher than 32°F, so the period of successful storage will be comparatively shorter. Temperatures should not exceed 45°F to minimize sprouting and decay. Beets wilt readily from loss of water; therefore, they should be kept where the humidity is sufficiently high to prevent excessive evaporation. Small beets soften and shrivel earlier than larger ones.

Before beets are stored, they should be topped and sorted to remove all those with disease or injury. Beets should be stored in well-ventilated containers.

Bunched beets are much more perishable than topped beets, but they can be stored at 32°F for 10 to 14 days. Use of crushed ice is helpful in keeping the bunched beets cold, especially if refrigeration is not available.

Beet greens and other greens are handled like spinach. Because beet greens are a very perishable crop, they should be held as close to 32°F as possible. At this temperature, they can be held for 10 to 14 days. Relative humidity of at least 95% is desirable to prevent wilting.

Diseases

Damping Off, Alternaria, Cercospora, and Ramularia

Pests

Leaf Miner, Leafhoppers, Mexican Bean Beetles, Wireworms, Mice, and Rabbits

Comments

Hybrid beets are typically more resistant to diseases. The increased resistance is often offset by the fact that they may quickly exceed optimum size and grade if harvest is delayed.

Crop rotation with beets is important to prevent cercospora.

Keep in mind that beets and chard are of the same family and should never follow each other in crop rotation.

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Growing Bell Peppers

Family: *Solanaceae*
Genus and Species: *Capsicum annuum*

Bell peppers are crispy and sweet and come in a variety of colors including green, red, purple, orange and bright yellow. Bell peppers can be picked when they are green, when they have reached their final color or anywhere in between. The bell pepper's sweetness increases as their color changes from green to their final color. Bell peppers are warm season plants that do best in areas with long growing seasons but many northern gardeners like the challenges and rewards of growing these beautiful vegetables.

Like their relatives, hot peppers, bell peppers originated in South America. and like many other foods native to this region, bell peppers were carried throughout the world by the Spanish and Portuguese explorers.

Climate

Bell peppers love heat. They need warm soil and air temperatures throughout the growing season and are very sensitive to frost. Many northern gardeners use plastic mulches, row covers, hoop houses, anything that will help grow this wonderful vegetable more quickly in cooler climes.

Soil

Bell peppers need high amounts of nitrogen, potassium, and phosphorus. Bell peppers like well drained soil in full sun. Bell peppers do well in raised beds filled with good topsoil, compost, and rotted manure mixed in. A pH near neutral (7.0) is ideal.

Spacing

Bell peppers grow into small bushes and need good air circulation. Give bell peppers enough room by spacing them 12"-18" apart in rows at least 24"-36" apart.

Direct Seeding

Direct seeding bell peppers is not normally practiced.

Seeding For Transplants

Start bell peppers indoors 8 weeks before the last frost. Using a 2" or slightly larger pot will produce larger bell pepper plants with better-developed root systems.

Sow bell pepper seeds shallowly, about ¼" deep in a moistened **lightweight** growing mix. Keep the mix moist (but not wet) and warm - about 80°-85° during germination. Keeping the mix warm results in a quicker germination and healthier bell pepper plants. After the first true leaves have appeared, thin the bell pepper plants to one per pot. If the bell pepper seedlings are out-growing their cell-tray or pots, pot them up to 2"-3" pots.

Do not use plastic covered seed starting trays to start bell pepper seeds. They

create a very humid environment that is too stagnant.

Do not use peat pots as they tend to absorb and retain too much moisture for growing some types of bell peppers.

Germination

These seeds germinate best in soils around above 80°F. Germination will take 6-8 days.

Transplanting Into the Garden

Many gardeners transplant their bell pepper plants too early. Wait until the soil is 70°-85° before setting the bell pepper seedlings out. Use black plastic mulch to warm the soil. Place it on the beds when you start the seeds.

Watering

Bell peppers need consistent moisture during germination. Keep bell peppers evenly moist, don't keep them soggy. Not enough water and the bell peppers will acquire a bitter taste. The use of mulches will help in keeping the soil moist. If you use black plastic mulch, plants will needs more frequent waterings. The use of a soaker hose underneath the black plastic will save time and make watering the bell pepper plants much easier.

Harvesting

Bell peppers are mature when they turn their final color. Most bell pepper fruits are green when immature and can be harvested at that time. Mature bell peppers can be red, orange, yellow, green, or purple depending on the variety.

Harvest bell peppers as they mature by using garden shears to clip them off the plant - don't pull them off. Continual harvesting of the bell peppers produces continuous fruit set so pick the bell peppers off your bushes regularly.

Post-Harvest Handling

Wash and dry bell peppers thoroughly.

Storage

Bell peppers will last up to three weeks if stored at 45°-55°, 90%-95% relative humidity.

Bell peppers are very sensitive to ethylene gas so do not store them with fruits and vegetables that produce ethylene gas.

Diseases

Anthracnose, Blossom End Rot, Bacterial Spot, Early Blight, and Verticillium Wilt

Pests

Aphids, Colorado Potato Beetles, Tarnished Plant Bugs, Flea Beetles, and Hornworms

Comments

Use an inexpensive heating pad underneath the cell-tray to help achieve the desired soil temp. Never water bell pepper seedlings directly. Allow the bell pepper seedlings to drink by immersing cell trays or pots with holes in the bottom into a pan with water ½" deep. Allow the bell pepper seedlings to drink for a few minutes before removing them. Do not let the bell pepper seedlings get water-logged.

Bell pepper seedlings like light - lots of light. Use flourescent lights to supplement natural light if growing the bell peppers indoors. Bell pepper plants will become tall and leggy (weak) if there isn't enough light.

Don't plant bell peppers in the same bed with other plants in the *Solanaceae* (tomatoes, potatoes, eggplant) as they are susceptible to the same diseases.

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Growing Broccoli

Family: *Brassicaceae*
Genus and Species: *Brassica oleracea*

Broccoli is one of the most popular garden vegetables to date. Broccoli is an easy-to-grow vegetable rich in vitamins A and C, potassium, magnesium, dietary fiber, and is an excellent source of iron and calcium. It is eaten raw as often as it is cooked.

Climate

Broccoli is often referred to as a cole crop. Broccoli thrives in cool weather and can withstand light frosts. Flavor improves with cooler temperatures because plant cells are working to convert starches to sugars to protect the plant against the cold. The result is a sweet, fresh taste that surpasses that of store-bought greens.

Broccoli does not normally do well in hot weather though more heat tolerant cultivars are being developed.

Soil

Crop rotation is especially important with Broccoli and other members of the *Brassicaceae* (previously referred to as the *Cruciferae* or crucifer) family that includes kale, radish, mustard greens, turnips, and Brussels sprouts. 2 - 4 years between plantings of the same family is recommended.

Broccoli plants will grow in almost any soil but prefer a pH between 6.0 and 7.0 for optimum growth. A pH within this range will discourage clubroot disease and maximize nutrient availability. Well-drained, sandy loam soils rich in organic matter are ideal for broccoli plants and especially early plantings of broccoli.

Spacing

Broccoli yields and the size of broccoli heads are affected by plant spacing. The tighter the spacing the better the yields but the broccoli heads will be smaller.

For an average head of broccoli (approx. 8 oz.) plants should be 8"-10" apart with 30"-36" between the rows.

Some growers use and alternate spacing of 12"-24" between broccoli plants with an 18"-36" spacing between rows.

Direct Seeding

A well-prepared seedbed with adequate moisture is a must for direct seeded broccoli. Sow broccoli seed ¼" deep, every 8"-10" within rows set between 30"-36" apart. Gently press the soil after planting to ensure the seed is in contact with the soil.

Broccoli may be direct seeded in both spring and fall. Sow the spring crop 4 weeks before last spring frost or as soon as the soil can be worked - whichever is later.

Seeding For Transplants

Sow broccoli seed into flats, cells, or soil blocks of soil-less mix. Avoid crowding the seeds. Provide 1½"- 2½" square inches per plant. Ideal temperatures for broccoli growth are between 50°F at night and 85°F during the day. Begin hardening off the seedlings seven days before transplanting.

Germination

These seeds germinate best in soils around 75°F-85°F. Germination will take 4-20 days.

Transplanting Into the Garden

Transplant broccoli plants at 6-8 weeks, 4 weeks before to 2 weeks after the last spring frost. Broccoli seedlings should be 8"-10" apart with 30"-36" between the rows.

Watering

An even moisture supply is needed for broccoli transplants to become established and to produce good heads. Never let the seedbed dry out. In sandy soils this may require two to three waterings per day. You must maintain adequate moisture until broccoli seedlings are well established.

Harvesting

Harvest broccoli heads when the buds are still small and tightly closed. Broccoli heads should not have any yellow petals. Side heads will develop rapidly in some varieties after the main head has been harvested. Harvesting of the broccoli side heads may continue for several weeks.

Post-Harvest Handling

Broccoli is highly perishable. The respiration rate of freshly harvested broccoli is very high and it is therefore necessary to hydro cool broccoli very soon after harvest and to keep it cool. Hydro cooling is the process of spraying or immersing vegetables in chilled water.

Storage

Store broccoli at 32°F with a relative humidity of 95% to 100% to maintain its fresh green color and vitamin C content. Store broccoli with adequate air circulation. Broccoli should keep for between 10 to 14 days under ideal conditions.

Broccoli should not be stored with fruits, such as apples or pears, which produce substantial quantities of ethylene, because this gas accelerates yellowing of the buds.

Diseases

Club Root, Black Rot, Black Leg, Wirestem, Alternaria Leafspot, and Downy Mildew

Pests

Aphids, Cabbage Loopers, Imported Cabbageworm, Cutworms, Flea Beetles, and Diamond Back Moth

Comments

The trick to producing excellent broccoli heads is to keep the broccoli plants growing at a steady pace. Top-dress the plants with compost or manure tea; or side-dress with blood-meal or fish emulsion; and water deeply. Repeat this process every 3-4 weeks until just before harvest.

Mulch will help keep the ground cool and moist as well as reduce weed competition.

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Growing Brussels Sprouts

Family: *Brassicaceae*
Genus and Species: *Brassica oleracea*

Brussels sprouts are like mini cabbages with a big flavor. Brussels sprouts originated in Belgium during the 18th century. Brussels sprouts were named *Brassica oleracea* variety gemmifera meaning "garden cabbage bearing gems".

Climate

Brussels sprouts are often referred to as a cole crop. Brussels sprouts need a long cool growing season. Brussels sprouts can withstand hard frosts and even snow. Flavor improves with cooler temperatures because plant cells are working to convert starches to sugars to protect the plant against the cold. The result is a sweet, fresh taste that surpasses that of store-bought greens.

Brussels sprouts become puffy and soft when they mature at temperatures above 80°F and stop growing at temperatures below 52°F. At maturity, warm, sunny days and light frosts at night are ideal to produce tender, sweet sprouts.

Soil

Crop rotation is especially important with Brussels sprouts and other members of the *Brassicaceae* (previously referred to as the *Cruciferae* or crucifer) family that includes kale, radish, mustard greens, turnips, and broccoli. 2 - 4 years between plantings of the same family is recommended.

Brussels sprouts prefer well-drained, loam soils rich in organic matter with a pH of 6.0 and above. Sandy loam soils are fine for earlier plantings of Brussels sprouts.

Spacing

Brussels sprouts are a rather large plant that may grow to be 2'-3' with an umbrella like foliage. Space plants at 18"-24" within the row and space rows at 30" apart. Stake the plants in areas with strong winds.

Direct Seeding

A well-prepared seedbed with adequate moisture is a must for direct seeded Brussels sprouts. Sow Brussels sprouts seed ¼"- ½" deep, every 18"-24" within rows spaced 30" apart. Gently press the soil after planting to ensure the seed is in contact with the soil.

Brussels sprouts require a long growing season so indoor seeding may be required to provide sufficient time for adequate growth. Plan on sowing Brussels sprouts seed 80-100 days before the first hard frost in your area to allow for adequate growth. Adjust this estimate, as needed depending on variety and local conditions.

Seeding For Transplants

Sow Brussels sprouts seed into flats, cells, or soil blocks of soil-less mix at 3-4 seeds per inch/unit. Ideal temperatures for Brussels sprout growth are between 45°F at night and 85°F during the day. Begin hardening off the seedlings seven days before transplanting.

Germination

These seeds germinate best in soils around 45°F-85°F. Germination will take 4-20 days.

Transplanting Into the Garden

Transplant Brussels sprouts seedlings at 6-8 weeks, 3-4 weeks before the last spring frost. Brussels srouts seedlings should be set out at 18"-24" within rows spaced 30" apart.

Watering

An even moisture supply is needed for transplants to become established and to produce good yields. Never let the seedbed dry out. Sandy loam soils may require two to three waterings per day. You must maintain adequate moisture until seedlings are well established.

Harvesting

Harvest Brussels sprouts that are firm and well formed from the bottom up when they reach 1" - 1 ½" inches wide. Harvesting of the Brussels sprouts may continue for several weeks. The upper Brussels sprouts will continue to form and grow as the lower ones are harvested.

Post-Harvest Handling

Brussels sprouts are highly perishable. Brussels sprouts respiration rate is very high and it is therefore necessary to hydro cool Brussels sprouts very soon after harvest and to keep them cool. Hydro cooling is the process of spraying or immersing vegetables in chilled water.

Storage

Brussels sprouts should be stored at 32°F with a relative humidity of between 95% and 100%. Brussels sprouts can be kept in good condition for a maximum of 3 to 5 weeks at 32°F. The rate of deterioration of Brussels sprouts escalates significantly at temperatures of 40°F and above.

Brussels sprouts require sufficient air circulation to allow good cooling and to prevent yellowing and decay. Also, Brussels sprouts should not be stored with fruits because ethylene from the fruits will accelerate yellowing and can cause abscission of leaves.

Diseases

Club Root, Black Rot, Black Leg, Wirestem, Alternaria Leafspot, and Downy Mildew

Pests

Aphids, Cabbage Loopers, Imported Cabbageworm, Cutworms, Flea Beetles, and Diamond Back Moth

References

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Growing Bush Beans

Family: *Fabaceae*
Genus and Species: *Phaseolus vulgaris*

Beans are one of the easiest of vegetables to grow. Beans have such a diversity of colors and flavors it is easy to see how beans are one of agriculture's favorite crops. In fact, humans have cultivated beans for about 6000 years. Bush beans are so called because they produce small bushes of beans.

Bush beans can be found as both fresh and dry varieties. The fresh beans within this species are often referred to as snap beans, green beans (green in color), and yellow or wax beans (yellow in color). Dry beans offer the most variety of colors and flavors and include some of the oldest seed varieties available.

Climate

Bush beans are very easy to grow, as they will tolerate a variety of climates as long as there is good sunlight available. An air temperature of 70°F-80°F and a soil temperature of at least 60°F is ideal for beans.

Soil

Bean plants will grow in almost any soil with a pH above 6.0. Loose sandy loam soils warm rapidly and are ideal for beans. Soggy soil will cause the bean seeds to rot. Bush beans will do best in well-drained soils rich in organic matter. Beans prefer lighter soils. If you have heavy soil, amend it well with compost prior to planting. Break up large clods of soil and rake the area smooth prior to planting your bean seeds.

Spacing

Plant bush beans 1"- 1½" deep at 2" apart within rows. Space rows at 24"-36".

Direct Seeding

For a continuous harvest of bush beans throughout the growing season, plant beans every two weeks (called staggering) until about 45 days before the first expected frost date. Gently press soil cover so that the beans have good contact with it.

Seeding For Transplants

Bush beans are not normally transplanted. If you want to give it a go, sow one bean seed per 1½" cell or soil block at 1" deep. If using a flat, sow at 1" deep, 2" apart, in row with 2"-3" between rows. Gently press the potting mix so that the beans have good contact with it. Start seeds 2-3 weeks before the last spring frost.

Germination

These seeds germinate best in soils around 75°F-80°F. Germination will take 7 days.

Transplanting Into the Garden

Transplant bean plants at 3-4 weeks.

Watering

Maintain a consistent moisture rate during germination. Deep watering once a week is recommended as long as the soil drains well. Saturated soil increases the risk of seed rot. Once plants have sprouted less frequent irrigation is required until just before bean plants are about to blossom. Just prior to and during the blossom stage, ensure the bean plants have consistent moisture and deep water once a week if there is no rainfall. Be sure to water the plants at their base and be careful not to knock off blossoms while watering.

Harvesting

Fresh Beans: Fresh (snap) beans are normally ready for harvest about 8-10 days after flowering. Pick beans when they are pencil thin, the fruit is bright green, the pod is fleshy and seeds are small and green. The bean pods should snap easily when bent - thus the name snap beans. Pinch or cut the beans off rather than pulling them as pulling the beans may pull up the plant.

Harvest the beans frequently - if not daily - to keep the plants producing. The bean plants will stop producing if bean pods are allowed to reach maturity.

Over-mature beans loose their bright green color and become pithy and tough.

Do not pick beans while the plants are wet if it can be avoided. Wet bean plants are ripe for the transmission of disease. Harvest and remove from the field any overly mature pods that may have been missed earlier.

Dry Beans: Leave the plants alone and let the bean pods dry right on the plant until late fall. If the climate has high humidity or your crop is in danger of being blanketed by snow, pull the plants and hang them upside down in a shed or other protected location with good air circulation.

Post-Harvest Handling

Fresh Beans: Snap beans are a moderately sensitive vegetable with a high-respiration rate. This means the beans must be cooled quickly after harvest to maintain their flavor, texture, color, and freshness. Pre-cooling to remove field heat prior to shipment is commonly practiced via forced air-cooling. Do not use ice or water, as the beans will become damaged. Significant post-harvest decay will occur if the beans remain wet after harvest.

Dry beans: Once the bean pods have completely dried, gather the bean plants on a large sheet or tarp and thresh to separate the beans from their pods. Winnow to separate the beans from the chaff and place in storage containers.

Storage

Fresh Beans: Snap beans are best stored at 41°F -46°F with 95% to 100% relative humidity. Snap beans can be stored for up to 8-12 days in these conditions.

Dry beans: Store dry beans in containers in a cool, dry, dark place. Dry beans stored in these conditions will be at their best for up to 4 years.

Diseases

Anthracnose, Bacterial Blight, Mosaic, Rust, Downy Mildew

Pests

Mexican Bean Beetles, Aphids, Cabbage Loopers, Corn Earworms, European Corn Borers, Japanese Beetles

Comments

Beans perforom much better with the use of inoculants. Inoculants are typically dry powders that contain symbiotic rhizobial bacteria. When the seeds of legumes like bush beans are treated with inoculant, the plants will form nitrogen nodules on their root systems as well as produce increased yields. The beans plants don't need the nitrogen fixed by the inoculant. Rather, when the bean plants are tilled under, the nitrogen in the nodules becomes available in the soil for the next crop of plants - preferably one that likes nitrogen like tomatoes.

To apply the inoculant, dust the bean seeds with a light amount of inoculant as you plant. Inoculant is an especially good idea if you haven't planted beans in the chosen area before.

Till bean plants under in the fall after they're done producing unless disease has struck. In the spring, plant a nitrogen feeder to take advantage of the nitrogen provided by the bean plants.

Beans are very prolific. A 100' row of bush beans can produce about 50 quarts of beans.

Beans are self-pollinating and therefore different cultivars can be grown side by side with little danger of cross-pollination.

Never weed or work among the beans while they are wet to prevent the spread of disease.

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Growing Cabbage

Family: *Brassicaceae*
Genus and Species: *Brassica oleracea*

Cabbage is one of the oldest vegetables in Europe. The ancient Greeks adored the smell of cooked cabbage. Romans thought that it was good for you (which it is) but they also thought that eating it before a party would stave off drunkenness (which it doesn't).

Cabbage cultivars can be found that produce red, purple as well as green heads.

Climate

Cabbage is often referred to as a cole crop. Cabbage will tolerate a wide range of environmental conditions but thrives in cooler temperatures. Cabbage can tolerate hard frosts, but severe freezes can be damaging. Cabbage flavor improves with cooler temperatures because plant cells are working to convert starches to sugars to protect the plant against the cold. The result is a sweet, fresh taste that surpasses that of store-bought greens. Cabbage planting dates should be planned so that harvest dates occur in cool weather.

Soil

Crop rotation is especially important with cabbage and other members of the *Brassicaceae* (previously referred to as the *Cruciferae* or crucifer) family that includes kale, radish, mustard greens, turnips, and broccoli. 2 - 4 years between plantings of the same family is recommended.

Cabbage will grow fine in a wide variety of soils but prefers well-drained, loam soils rich in organic matter with a pH of 6.0 and above. Sandy loam soils are fine for earlier plantings of cabbage. Cabbage is a heavy feeder.

Spacing

Cabbages produce large leafy plants. Space cabbage plants at 12"-18" within the row and space rows between 18" and 34" apart.

Direct Seeding

A well-prepared seedbed with adequate moisture is a must for direct seeded cabbage. Sow cabbage seeds ½" deep, four per foot, within rows spaced 24"-36" apart. Gently press the soil after planting to ensure the seed is in contact with it. Thin to one seedling within each foot.

Seeding For Transplants

Sow cabbage seed into flats, cells, or soil blocks of soil-less mix at 3-4 seeds per inch/unit. Ideal temperatures for cabbage growth are between 45°F at night and 85°F during the day. Begin hardening off the seedlings seven days before transplanting. Ensure good sunlight exposure to prevent the cabbage seedlings from becoming leggy.

Germination

These seeds germinate best in soils around 75°F. Germination will take 4-14 days.

Transplanting Into the Garden

Transplant cabbage seedlings at 4-6 weeks. Cabbage seedlings should be set out at 12"-18" within rows spaced 34" apart.

Watering

An even moisture supply is needed for transplants to become established and to produce good yields. Do not over-watering transplants after setting them out.

Harvesting

Heads should be harvested when firm and before they split or burst. If harvesting for fresh market, leave 4-6 wrapper leaves attached to the head for display. The wrapper leaves are usually removed when harvesting for kraut.

Post-Harvest Handling

Cabbage should be handled carefully from field to storage, and only solid heads with no yellowing, decay, or mechanical injuries should be stored. Before the heads are stored, all loose leaves should be trimmed away; only three to six tight wrapper leaves should be left on the head. left on the head. Loose leaves interfere with ventilation between heads, and ventilation is essential for successful storage.

Storage

Store cabbage at 32°F and a relative humidity of 98% to 100%. A large percentage of the late crop of cabbage is stored and sold during the winter and early spring, or until the new crop from the southern states appears on the market. If stored under proper conditions late cabbage should keep for 5 to 6 months. The longest keeping cultivars belong to the Danish class. Early-crop cabbage, especially southern grown, has a storage life of 3 to 6 weeks.

Root cellars or other limited control storage should be insulated sufficiently to prevent freezing of the cabbage. Heaters are sometimes needed to prevent freezing of cabbage in common storage during severe cold weather.

Cabbage wilts quickly if held under too dry storage conditions.

Cabbage should not be stored with fruits emitting ethylene.

The most common decays found in stored cabbage are watery soft rot, bacterial soft rot, gray mold rot, alternaria leaf spot, and black leaf speck.

Diseases

Club Root, Black Rot, Black Leg, Wirestem, Alternaria Leafspot, and Downy Mildew

Pests

Aphids, Cabbage Loopers, Imported Cabbageworm, Cutworms, Flea Beetles, and Diamond Back Moth

Comments

Some varieties of cabbage may split from a sudden supply of water such as a rainfall after a dry spell.

Heads the size of softballs will have the most flavor.

Mulch will help keep the ground cool and moist as well as reduce weed competition.

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Growing Carrots

Family: *Umbelliferae*
Genus and Species: *Dacus carota*

Sweet and delicious, carrots are one of the best loved and well known of the vegetable kingdom. Carrots were first cultivated in Europe in the 10th century. In the 1600s, settlers of America brought carrots with them. Carrots come in white, yellow, crimson, and orange cultivars and can be long and slender or short and fat. A single mature carrot meets or exceeds the recommended U.S. dietary allowance of vitamin A and also provides a rich source of vitamins B, C, D, E, and K. High-pigment carrot varieties are also an excellent source of antioxidants thought to help prevent cancer.

Climate

Carrots are relatively tolerant of a wide variety of temperatures but prefer cooler growing conditions. Carrots are hardy and can be planted in the garden as soon as the soil can be prepared in the spring.

Carrots require relatively large amounts of moisture and are not tolerant of drought. Prolonged hot weather in the later stages of development may not only retard carrot growth but may result in an undesirable strong flavor and coarseness in the roots.

At the other extreme, carrots exposed to prolonged temperatures below 55°F tend to grow longer roots and become more slender and paler in color than expected. The ideal air temperature for carrots is between 60°F-70°F.

Soil

Carrots prefer a deep well drained, sandy loam soils with a pH of 6.5 to 7.0. Root crops in general do not grow well in acidic soils. Soil should be loose to a depth of 12" or more to allow for good root development.Carrots are a root crop and grow downwards and therefore soil preparation is very important. Soils may be bedded (formed into a raised bed) to obtain optimum drainage, maximum root length and smoothness, and to reduce soil compaction.

Do not add compost or manure to the carrot beds prior to planting unless it is very well decomposed, as too much nitrogen will encourage roughness and branching. Make sure soils are free of debris such as rocks and twigs. Smooth carrot beds before planting.

Spacing

Carrots are relatively compact vegetables that do not require much space. Spacing is dependent upon cultivar and desired root size at time of harvest. Carrots benefit from adequate space and when crowded are sure to grow deformed roots. If you're planning on harvesting carrots with immature roots (baby carrots) then a tighter spacing of ¾"-2" should be fine but if you intend to let the carrots grow to maturity, thinning to a final spacing of 2"-4" is the goal.

Direct Seeding

A well-prepared seedbed with adequate moisture is a must for direct seeded carrots. Sow carrot seeds ¼"-½" deep, ¾"-1" apart, within 2" rows spaced 16"-24" apart. Sprinkle the soil with water but do not allow the soil to form a crust before the seedlings emerge. Thin carrots at about 3 weeks to a spacing of between ¾"-4" depending upon cultivar and root size desired.

Sow carrots as soon as the soil can be worked. Sow a fresh batch of carrots every 3 weeks until early to mid-July to provide a continuous supply of fresh carrots.

Seeding For Transplants

Carrots are not normally seeded for transplants.

Germination

These seeds germinate best in soils around 85°F. Germination will take 6-18 days.

Transplanting Into the Garden

An even moisture supply is needed for carrots to become well established and to produce good root development. Carrots need at least 1" of water from rainfall or irrigation each week during the growing season. Always soak the soil thoroughly when watering. This will also help promote good root development. On most soils, watering once a week is sufficient. Very sandy soils may require more frequent watering.

Watering

An even moisture supply is needed for carrots to become well established and to produce good root development. Carrots need at least 1" of water from rainfall or irrigation each week during the growing season. Always soak the soil thoroughly when watering. This will also help promote good root development. On most soils, watering once a week is sufficient. Very sandy soils may require more frequent watering.

Harvesting

Carrots are an easy to harvest crop. Simply pull up the plant by the tops - the foliage. Carrots are usually harvested when the roots are ¾"-1½"in diameter at the upper end, but you can harvest them any time they reach a usable size. For baby carrots, harvest the roots when they reach finger size and 4"-5" in length.

Carrots destined for storage must be handled carefully during and after harvest to avoid bruising, cutting and breakage.

It is not uncommon for carrots to be left in the ground and covered with mulch until early-mid winter as long as they don't freeze. If kept at just above freezing, they will become sweeter and keep quite nicely until harvested. Some growers cover their carrots at the onset of winter with a cold frame to prevent the snow from piling up directly on the carrots.

Post-Harvest Handling

Carrots harvested and handled in hot weather are more likely to decay and require extra care to prevent wilting. Wash carrots if they are harvested under wet conditions and are to be stored. Many potential decay-causing organisms are removed by washing. Also, clean, washed carrots allow freer air circulation.

Prompt cooling to 40°F or below after harvest is essential for extended storage. Poorly precooled roots decay more rapidly.

Storage

Ideal storage for carrots is 32°F and 99% relative humidity.

Mature carrots are well adapted for storage and are stored in large quantities during the fall and winter. Mature topped carrots can be stored 7 to 9 months at 32°F-34°F with a very high relative humidity, 98%-100%.

Do not store carrots with vegetables and fruits that give off ethylene gas such as apples and pears. Some surface browning or oxidative discoloration often develops in stored carrots.

Diseases

Aster Yellow, Leaf spot and Soft Rot

Pests

Leafhoppers, Wireworms, and Carrot Rust Fly Larvae

Comments

Use scissors to thin carrots in their earliest stages to guarantee you don't harm the adjacent seedlings as pulling them up will most likely disturb adjacent carrot roots.

If leaving carrots in the ground with mulch watch for the presence of rodents as they find carrots irresistible.

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Growing Cauliflower

Family: *Brassicaceae*
Genus and Species: *Brassica oleracea*

Cauliflower probably originated in Asia, but was available primarily in Italy until the 16th century when it was introduced to northern Europe through France. The colonists brought Cauliflower with them when they came to America in the late 1600s.

Cauliflower is actually a cabbage plant. The natural flowers of the cabbage plant that, through selective breeding, gathered together to create a mass became cauliflower over time. Depending on type, the heads can be pale green, white or even purple.

Climate

Cauliflower is often referred to as a cole crop. Cauliflower thrives in cool weather and can withstand light frosts. Flavor improves with cooler temperatures because plant cells are working to convert starches to sugars to protect the plant against the cold. The result is a sweet, fresh taste that surpasses that of store-bought heads. Cauliflower does not tolerate wide temperature fluctuations very well.

Soil

Crop rotation is especially important with Cauliflower and other members of the *Brassicaceae* (previously referred to as the *Cruciferae* or crucifer) family that includes kale, radish, mustard greens, turnips, and broccoli. 2 - 4 years between plantings of the same family is recommended.

Cauliflower plants will grow in most soils but prefer a pH between 6.4 and 7.4 for optimum growth. Well-drained, loam soils rich in organic matter are ideal for cauliflower plants and especially early plantings of cauliflower.

Spacing

Cauliflower likes room to grow. Plants should have 18" between them with 24"-36" between the rows.

Direct Seeding

A well-prepared seedbed with adequate moisture is a must for direct seeded cauliflower. Sow cauliflower seeds 4 weeks before last spring frost, ¼" deep, at 18" between plants and 24"-36" between rows.

An alternate method is to plant 2 cauliflower seeds about 1" apart every 18". After cauliflower seedlings emerge and have established, thin to one seedling per couple choosing the strongest.

Seeding For Transplants

Sow cauliflower seed into flats, cells, or soil blocks of soil-less mix. Avoid crowding the seeds. Provide 1½"- 2½" square inches per plant. Ideal

temperatures for cauliflower growth are between 45°F at night and 65°F during the day. Begin hardening off the seedlings seven days before transplanting.

Germination

These seeds germinate best in soils around 75°F-85°F. Germination will take 5-10 days.

Transplanting Into the Garden

Transplant cauliflower plants at 6-8 weeks, 4 weeks before to 2 weeks after the last spring frost. Cauliflower seedlings should be 18" apart with 24"-36" between the rows.

Watering

An even moisture supply is needed for transplants to become established and to produce good heads. Do not over-water in the first 2-3 weeks after transplanting, or 4-5 weeks after direct seeding, especially if club root is suspected. Do not let the seedbed dry out. Such fluctuations in moisture especially when cauliflower reaches the 6 to 7-leaf stage may cause cauliflower to button or form heads prematurely.

Harvesting

Harvest cauliflower heads when they are 5-6 inches in diameter. If harvesting for sale, the cauliflower heads should be white, not discolored, ricey, or blemished. Cauliflower heads are easily damaged so handle with great care. To harvest cauliflower, cut it off the stalk just below the head. If harvesting for sale be sure to include at least 2 leaves for presentation and protection.

Post-Harvest Handling

Cauliflower is highly perishable. The respiration rate of freshly harvested cauliflower is very high and it is therefore necessary to hydro cool cauliflower very soon after harvest and to keep it cool. Hydro cooling is the process of spraying or immersing vegetables in chilled water. Ice water is not recommended as cauliflower heads are easily damaged.

Storage

Cauliflower should be stored at 32°F with a relative humidity of at least 95%. Cauliflower can be held for up to 3 to 4 weeks at 32°F. The storage life for cauliflower is about 2 weeks at 38°F, 7-10 days at 40°F, 5 days at 50°F, and 3 days at 60°F.

Slightly immature, compact heads keep better than more mature ones. Cauliflower is not sensitive to ethylene gases produced by other fruits and vegetables.

Diseases

Club Root, Black Rot, Black Leg, Wirestem, Alternaria Leafspot, and Downy Mildew

Pests

Aphids, Cabbage Loopers, Imported Cabbageworm, Cutworms, Flea Beetles, and Diamond Back Moth

Comments

To get those prized white heads of cauliflower, commercial growers practice a method called 'blanching'. When small white cauliflower heads become visible through the leaves, gather the outer leaves over the head and tie them in place with a string, twine, or large rubber band. This practice will not harm the growth of the head since it is the leaves that conduct photosynthesis.

Cauliflower may form heads early as a result of being stressed. Early head formation results in a small plant with small `curds' often referred to as "buttoning". Cold temperatures, a lack of fertility or water, the use of transplants with poor root growth, rootbound transplants, insect damage, and disease often cause plant stress.

Mulch will help keep the ground cool and moist as well as reduce weed competition.

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Growing Celery

Family: *Umbelliferae*
Genus and Species: *Apium graveolens*

Celery is 94% water and is considered a great diet food. Celery is considered a difficult crop to grow, but isn't, though this explains why it is not often found in home gardens. Celery as food doesn't show up in the literary record until the 16th century. While blanching does retard nutrient buildup, it helps remove the bitterness in celery.

Climate

Celery requires a long growing season and does not grow well in hot, dry summer weather. Celery prefers cool, but not cold, growing conditions.

Soil

Muck soils are ideal for growing celery because of their high moisture-holding capacity. A pH of 5.2-6.5 is required for good celery production. Fertile, well-drained mineral soils are also suitable where sufficient water can be provided throughout the growing season. Sandy soils are not recommended.

Spacing

Celery requires a bit tighter spacing than you might expect. Celery plants should be 6"-8" apart within rows spaced 15"-20" apart. If wider spacing is used the celery plants will open up more than is desirable plus make it difficult to control blanching.

Paired rows should be 12"-14" between each row of the pair with 40" center-to-center between the paired rows.

Direct Seeding

Direct seeding is not normally practiced.

Seeding For Transplants

Sow celery seeds at about 6 seeds per inch in a suitable soil mix or sterilized soil at 1/8" deep.

Alternate method is to broadcast celery seed into flats and transplant to other flats when seedlings are 1"-2" tall.

Care must be exercised to protect celery plants from average daily temperatures of 55°F and below for extended periods of time (10-14 days), and particularly below 45°F for even short periods. These temperatures will precondition celery to bolting and may result in severe losses in yield and quality. Celery varieties differ in susceptibility to bolting.

Germination

These seeds germinate best in soils around 70°F -75°F. Germination will take 10-14 days.

Transplanting Into the Garden

Move celery plants to the field when seedlings are 4"-5" tall (6-8 weeks) and temperatures are above 55°F. Height is important for celery transplants as the larger transplants are more susceptible to bolting, transplant shock, and will mature later. Clipping the leaves of the celery seedlings will result in greater uniformity, stronger stems, and allows more light to reach the smaller seedlings.

Watering

To say celery is fussy about water is an understatement. Celery requires a uniform and regular supply of water. Celery also prefers frequent irrigations. Irregular or infrequent water applications may aggravate black heart as well as produce bitter or underdeveloped stalks.

Celery is often irrigated by drip irrigation to reduce risk from foliar diseases such as Septoria leaf spot for which there is little practical control.

Harvesting

Cut the celery plant off at just below the soil line. You can also cut individual stalks as needed but remember to replace the soil or mulch used for blanching.

Post-Harvest Handling

Celery should be hydro cooled as soon as it is harvested. Hydro cooling is the process of spraying or immersing vegetables in chilled water. Celery is often trimmed to produce "hearts" but this is not necessary.

Storage

Celery should be stored at 32°F and 90%-95% relative humidity. Celery should keep for 2 to 3 months in these conditions. Wilting is a major cause of deterioration.

To improve longevity, celery should be harvested before the outer stalks become pithy and with a small piece of root attached.

Some growth takes place in celery while in storage; the central stalks lengthen considerably.

Some blanching of the stalks also takes place in most cultivars during storage.

Celery is rather perishable, and under unsuitable storage conditions it is especially subject to watery soft rot. This disease originates in the field and is caused by a fungus that is able to develop to some extent even at 32°F-34°F.

Do not store celery with fruits and vegetables that produce ethylene gas.

Diseases

Black Heart, Early Blight, Late Blight, Aphids, Nematodes, Viruses and Septoria leaf spot

Pests

Aphids and Earwigs

Comments

Gently pull weeds up, as celery does not compete well with weeds.

To blanch celery, gradually pile soil or mulch up around the plants as they grow keeping the leaves exposed.

Celery leaves are great for flavoring soups and stews.

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Growing Chard

Family: *Chenopodiaceae*
Genus and Species: *Beta vulgaris*

Chard (aka Swiss Chard) is actually a chard that over centuries of selection produces tender, abundant greens. Chard is a healthy, easy-to-grow alternative to spinach, and it's more heat tolerant. Chard can be found different colored stalks of white, yellow, and red. Chard is packed with vitamins K, A, C, E, and B6. Chard is also very good source of copper, calcium, phosphorus, and a good source of thiamin, zinc, niacin, folate and selenium.

Climate

Chard varieties prefer cool weather but many will do well in a wide range of conditions. Chard will even tolerate partial shade but won't be as prolific. Air temperatures of 60°F - 65°F and bright sunny days are ideal for chard growth and development. Chard will withstand a light frost. In some warmer climates chard will grow fine through a mild winter.

Soil

Chard plants will grow in almost any soil but are sensitive to soil acidity. A low soil pH results in stunted growth. Chard prefers a pH of 6.2 to 6.8 but will tolerate 6.0 to 7.5. Loose, well-drained, sandy loam soils rich in organic matter are ideal for chard. If you have heavy soil, amend it well with compost prior to planting. Break up large clods of soil and rake the area smooth prior to planting your chard seeds.

Spacing

Chard seeds are actually a cluster of seeds and will produce more than one plant. Spacing will determine size of the plants. Space plants at 4"-6' apart within rows spaced at 18"-24" apart.

Direct Seeding

Sow chard seeds ½" deep, 6 seeds to the inch within rows spaced at 12"-18" apart. Sow chard seeds 2-3 weeks before the last expected spring frost. When chard seedlings are established, thin them to a spacing of 4"-6".

An alternate spacing of 2"-4" is used if harvesting baby chard leaves on a regular basis, or 8"-10" if you plan to harvest less often.

Avoid seeding during daytime temperatures of 80°F or more.

Seeding For Transplants

Chard is not normally transplanted. If, however, you want to give it a go, sow chard seeds in flats or in a cold frame 5-6 weeks before you expect the soil to be workable. Sow chard seeds ¼" deep, 3 seeds to the inch.

Germination

These seeds germinate best in soils around 75°F-85°F. Germination will take 5-16 days.

Transplanting Into the Garden

Transplant chard plants at 5-6 weeks, 4-6" between plants within rows 12"-18" apart.

Watering

Chard plants are not too fussy about their water requirements. It is best to maintain consistent moisture in the chard bed, especially during the early part of their development.

Too much water early in chard development can result in damping-off and other seedling disorders. Water deficiency, however, can aggravate boron deficiency.

Harvesting

Chard can be harvested at any time after the leaves develop. Break or cut off the outer leaves, as needed leaving the rest behind. Be careful not to nick or damage the inner leaves. Harvesting in this manner will yield a continual crop throughout the growing season.

Alternate method is to cut the plants off an inch above the soil line.

Flavor and vitamin levels are at their peak immediately following harvest.

Post-Harvest Handling

Chard will deteriorate very quickly after harvest because it will lose water fast and produce a great deal of heat therefore chard benefits from cooling immediately after harvest. Clean the chard of dirt and cool using hydro cooling. Hydro cooling is the process of spraying or immersing vegetables in chilled water.

Pack loosely and do not expose to direct sunlight once harvested.

Storage

Chard should be stored at 32°F and relative humidity of 98%-100%. In ideal conditions chard may last up to 2 weeks.

Chard is sensitive to ethylene gases so do not store it with fruits and vegetables that produce ethylene gas.

Diseases

For all practical purposes, no diseases bother chard.

Pests

Aphids, Leaf Miner and Slugs.

Comments

Avoid working among chard plants while they are wet as diseases can be spread more readily while the plants are wet.

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Growing Cucumbers

Family: *Cucurbitaceae*
Genus and Species: *Cucumis sativus*

Cucumbers are climbing vines that are easy to grow. There are many different varieties from small, yellow lemon cucumbers to long and thin slicers. Cucumbers are usually divided into two groups: the smaller, faster growing varieties used for pickling and the larger varieties used for slicing. Try growing a "burpless" variety, these can be eaten with the skin left on. You get the benefit of the vitamins and minerals present in the cucumber skin without the associated stomach upset.

Climate

Cucumbers are frost sensitive plants native to the tropics. They like humid weather, warm soil, and sunlight. Cucumbers grow grow well in most zones of the United States, as long as they are planted after the danger of spring frost has passed and harvested before the autumn frosts. Cucumbers have a 55-60 day growing period (from planting to picking) that fits neatly into the spring and summer months in many locales.

Soil

Cucumbers do well in warm, moist soil. Cucumbers grow best in fertile clay soils with a lot of humus - but don't plant them in a perpetually wet spot as they hate "wet feet". The optimal pH range for cucumbers is 6.0-7.0 and cucumbers benefit from moderate amounts of nitrogen and high amounts of phosphorus and potassium.

Adding compost to your garden soil and using a complete organic fertilizer, like fish emulsion, will help get your cucumbers off to a good start and provide nutritive support throughout their growing season.

Spacing

Most varieties of cucumbers are vines, they love to climb! Try growing them on a trellis or pole. Cucumbers grown on trellis' tend to produce 2-3 times more cucumbers. Trellised cucumbers tend to produce healthier fruits that are uniform in size and shape. Cucumbers grown on trellises are also cleaner at harvest time and the air circulation provided by the trellis helps prevent diseases. Trellising cucumbers frees up space in the garden - consider planting lettuces or other greens under the trellis in the shade provided by the growing vines.

Trellised: Cucumbers grown on a trellis should be planted 18 inches (45 cm) apart.

Building a trellis: A good trellis framework is approximately 6' high. If using wire use a No. 8 for the top and No. 12 wire for the bottom with plastic or sisal twine tied between the two wires at each plant. Posts should be no more than 15 ft apart and the top wire should be very tight. A "stiff knee" (additional brace) between posts may be required as the fruit load may become very heavy.

On Ground: Cucumbers grown on the ground should be given more space, plant them 36 inches (90 cm) apart and space the rows at least two feet apart.

Direct Seeding

The problem most gardeners have with direct seeding cucumbers is planting too early. Direct seeding should be done after the frost - free date when soil temperatures reach 70°-80°. Soils are usually this warm 3-4 weeks after the last frost. Consider covering the cucumber bed with black plastic for several days to one week to warm up the soil before you plant your cucumber seeds.

Seeding For Transplants

Plant cucumber seeds ½" deep in a warm moist growing mix. Use peat pots so the roots are not disturbed during transplanting.

Germination

These seeds germinate best in soils around 80°-95°. Germination will take 3-4 days.

Transplanting Into the Garden

Transplant cucumbers carefully, trying not to disturb their roots. If seeds were planted in peat pots, plant the peat pot in the prepared bed when soils are warm enough. If peat pots were not used be careful, quick, and gentle when transplanting. Make sure the cucumber starts are planted in moist, warm soil.

Watering

Cucumbers need plenty of water to be juicy and crisp. Cucumber plants that do not get enough water produce small, bitter, deformed fruits. Soak the soils deeply during dry periods with soaker hoses or use a hand held watering wand to water the bases of the plants (not the leaves). If a sprinkler is used, water the plants in the morning so the leaves dry during the warm hours of the day. Watering at night can keep the leaves wet and encourage disease.

Harvesting

Cucumbers are mature when the skin is entirely dark green and they are large enough to use.

It is important to pick cucumbers before they are completely mature. A vine with a completely mature fruit will stop producing so regular, even daily, harvest is recommended. A cucumber with yellowed skin at the end of the fruit with the blossom is past its prime. Cucumbers are mature 60-70 days from germination in optimal growing conditions.

Check your cucumber vines daily so you can pick the maturing fruits before they become over ripe. Gently twist the cucumber until it comes off or clip it with gardening shears.

Post-Harvest Handling

Wash and dry cucumbers thoroughly.

Storage

Cucumbers can be stored for 2-4 weeks at 50°-55° and 90% - 95% relative humidity. Pickling cucumbers is the most popular way to preserve them.

Cucumbers are very sensitive to ethylene gas so do not store them with fruits and vegetables that produce ethylene gas.

Diseases

Bacterial wilt, mildews, and leaf spot

Pests

Cucumber beetles

Comments

Mulches are used to increase soil temperatures and rowcovers are used to maximize nighttime temperatures.

Ensuring that vines have proper spacing, air circulation, and are watered properly helps alleviate and disease problems.

Insects can be hand-picked off the plants. Floating row covers or mesh can be put over the vines to protect them from the bugs (as well as keeping them warmer at night). Remember to pollinate the flowers by hand if the plants are covered after flowering begins.

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Growing Eggplant

Family: *Solanaceae*
Genus and Species: *Solanum melongena*

The Spaniards of the 16th century called eggplants *berengenas*, or "apples of love". The botanists of northern Europe of the same period called the species *Mala insana*, or "mad apple," because they thought that eating eggplant would drive a person to madness. Medieval Europe swore that eggplant made an an excellent aphrodisiac.

Eggplants are grown as perennials in hot climates and as annuals in colder climates. They have a long growing season and need hot days and warm nights. Growing eggplants is easier in warm climates, northern gardeners often have to use some tricks to get the plants to produce a crop (or even a fruit).

Climate

Eggplants need warmth throughout the growing season to do well. Eggplants need soil temperatures above 70° and daytime air temperatures above 70°. Eggplant seeds will not germinate in cool soil. Nighttime temperatures should be above 60°. Eggplants have a growing season of 100-150 days in ideal conditions. Although they do best in warm climates, they can be grown in northern climates if mulches, row covers, or hot houses are used.

Soil

Eggplants prefer well-drained sandy loam of pH 5.5 to 6.5 with high organic matter content. Eggplants need a moderate amount of nitrogen and high amounts of phosphorus and potassium. Eggplants like temperatures between 80° and 90° for optimal growth.

Spacing

Eggplants are typically spaced 18-24" apart in rows 30-36" wide. Rows should be 30-36" apart. Don't crowd eggplants, they will do better with a little extra room. They can be staked and supported like tomatoes to ensure proper air circulation.

Direct Seeding

In hot climates with long growing seasons, eggplants can be direct seeded in rows ½" deep and 18-24" apart after soil and air temperatures have warmed. Keep seeds evenly moist. For best results soil temperature should be 80°-90°.

Seeding For Transplants

Eggplants are most commonly started indoors or in a greenhouse. Soak seeds in water overnight to encourage germination. Eggplants are very sensitive to transplant shock so use peat pots that can be planted directly into the ground. Plant seeds singly in peat pots ¼" deep and grow under lights if available. Use bottom heat to keep the soil warm, optimal soil temperature for germination is 85°. Air temperature should be above 70° during the day and above 60° at night.

Germination

These seeds germinate best in soils around 75°F - 90°F. Germination will take 7-10 days.

Transplanting Into the Garden

Eggplants are very sensitive to transplant shock and benefit from several days of hardening off. About one week before transplanting, gradually expose them to the outside air by bringing the eggplant starts outside during the day and inside at night. Gradually increase the exposure each day (weather permitting, of course) until the plants are out until after dark.

When the eggplants are ready to be transplanted carefully place the peat pots in moist garden soil. In the north, use mulch to keep the soil warm and row covers over the plants to keep them warm at night.

Watering

Eggplants need regular watering, but they do not like to be kept too moist. Water eggplants to maintain uniform moisture. Water plants in the morning so the leaves are not damp through the night.

Harvesting

Eggplants are ready to harvest when the skin takes on a high gloss, at a third to half their mature size. To test for readiness, press the skin with your finger. If the indent does not spring back, it is ready to harvest. Fruits with dark brown seeds inside are past their prime.

Harvest eggplants when they are tender by clipping the fruit off with garden shears. Harvesting fruits regularly stimulates further production.

Post-Harvest Handling

Be careful not to damage the skin of eggplants. Wash and dry eggplants thoroughly.

Storage

Eggplants are not suited to long-term storage but they can be kept 1-2 weeks at 55° with a relative humidity of 85%-90%.

Eggplants are sensitive to ethylene gas so do not store them with fruits and vegetables that produce ethylene gas.

Diseases

Verticillium wilt

Pests

Flea beetles, aphids, potato beetles

Comments

Use black plastic to increase the yield of eggplant by helping to warm the soil, conserve moisture, and control weeds.

Rotate crops to prevent diseases.

Insects love eggplant. Use row or mesh covers help alleviate this problem. If covers are used, however, the flowers must be pollinated by hand.

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Growing Garlic

Family: *Liliaceae*
Genus and Species: *Allium sativum, A. ophioscorodon, A. ampeloprasum*

Garlic is mentioned in the Chinese Sanskrit writings as early as 3000 BC. Garlic is also mentioned in the Bible, was packed by the Vikings for long voyages, was considered an aphrodisiac in Elizabethan England and was an ingrediant in a compress applied on the field of battle during WWI.

Garlic is a staple of many cuisines. Its sharp flavor is used as a seasoning in all kinds of dishes throughout the world. Garlic is grown most often for the cloves but the young greens of the plant are also used in cooking: add them to salads or sauces the same way chives are used.

Garlic is grown vegetatively from a bulb, which is called a clove. The garlic bulb is not a true seed - it is not the product of sexual reproduction. Each clove will reproduce a bulb of garlic identical to the original bulb.

Garlic is divided into three types: stiff-neck (*A. ophioscorodon*), also known as hard-neck, soft-neck (*Allium sativum*), and elephant (*A. ampeloprasum*). Stiff-neck garlic has a central ring of cloves around a stiff central stem or neck. Soft-neck garlic does not have a hardened stock. Elephant garlic is known for it's milder flavor and much larger size. Elephant garlic is actually a close relative to leeks. Soft-neck and elephant garlic do not store as well as stiff-neck cultivars.

Climate

Garlic is grown in both cool and warm climates. In warmer locales, plant garlic in fall. It will grow throughout the cool fall and winter months. This allows the plants to mature then produce bulbs as the days lengthen in spring. In cooler climates garlic cloves are planted in the fall before the soil freezes. The garlic cloves remain dormant throughout the winter and are one of the first plants to come up in the spring.

Soil

Garlic likes deep, loose soil that is well drained and has plenty of organic matter. Growing garlic in a raised bed with good organic compost and soil that is 8-12 inches deep almost guarantees a good crop. Garlic does best when soil pH is between 6.0 and 7.0. Garlic needs moderate amounts of nitrogen, phosphorus, and potassium.

Spacing

Garlic plants do not use much horizontal space but they do not like to be crowded. Plant the garlic cloves in the prepared bed with 6 inches between each clove in all directions. Rows of garlic should be at least 2 feet apart.

Direct Seeding

Plant garlic cloves 2 inches deep. Use cloves that are of medium size for the best production. Garlic "germinates" best in soils that are cool: 55°. Garlic grows best in temperatures from 55°-75°.

Seeding For Transplants

Garlic is not normally grown for transplant.

Watering

Garlic does not need to be watered unless the ground is extremely dry. In dry climates, irrigation may be necessary. Over-watering your garlic will encourage rot and diseases. For most gardeners, covering the bed with straw mulch helps keep the soil moist enough for optimal yield.

Harvesting

Garlic is ready when the bottom two or three leaves have yellowed. Before this time, the garlic may send up a flowering shoot that should be clipped or folded over. Clipping the flower allows the plant to put its energy into the garlic clove and not into developing seeds. Garlic flowers are a wonderful taste treat and can be added to salads and scrambled eggs.

To harvest garlic, loosen the soil with a small shovel or fork and gently ease the clove out of the ground.

Post-Harvest Handling

Garlic is easy to plant and grow but the real work is preparing the garlic for storage. Garlic needs time to cure and is not ready to eat until it has gone through 1-2 weeks of drying. After harvesting, brush the dirt off the plants and bulbs and lay them on a screen or flat basket making sure that air can circulate around each plant. Cure the plants in a dry area in full sun or partial sun. Curing is complete when the skins are dry and the necks (the stems) are tight.

Storage

After the garlic is fully cured, you can cut the bulbs off from the rest of the plant. Clean them using a brush to remove the first few layers of skin. You can also braid soft-neck garlic in the same way that you French braid long hair. Store the garlic in a cool dry place. Cured garlic lasts for 5 to 8 months in ideal conditions.

Garlic is not sensitive to ethylene gas.

Diseases

Bacterial Soft Rots, Basal Rot, Black Mold, Blue Mold Rot, Botrytis Leafspot, Botrytis Bulb Rot, Downy Mildew, Pink Root, Purple Blotch and Stemphylium Leaf Blight, Rust, Sour Skin, White Rot

Pests

Bulb Mites, Maggots, Pea Leafminer, Thrips, Wheat Curl Mite

Comments

Garlic is easy to grow. Garlic will remain disease and pest free if grown in healthy, well drained soil.

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Growing Hot Peppers

Family: *Solanaceae*
Genus and Species: *Capsicum annuum, Capsicum frutescens*

Hot peppers are fun and beautiful. Hot peppers come in a variety of colors including green, red, purple, orange and bright yellow. The number of varieties of hot peppers is amazing and the heat generated by the peppers also varies greatly depending on variety. You will find hot peppers can range from mild to fiery hot. The heat of the hot pepper is produced by a substance called capsaicin and is measured in what are known as Scoville units. Hot peppers are native to Mexico and Central America.

Climate

Hot peppers love heat. They need warm soil and air temperatures throughout the growing season and are very sensitive to frost. Many northern gardeners use plastic mulches, row covers, hoop houses, anything that will help grow this wonderful vegetable more quickly in cooler climes.

Soil

Hot peppers need high amounts of nitrogen, potassium, and phosphorus. Hot peppers like well drained soil in full sun. Hot peppers do well in raised beds filled with good topsoil, compost, and rotted manure mixed in. A pH near neutral (7.0) is ideal.

Spacing

Hot peppers grow into small bushes and need good air circulation. Give hot peppers enough room by spacing them 12"-18" apart in rows at least 24"-36" apart.

Direct Seeding

Direct seeding hot peppers is not normally practiced.

Seeding For Transplants

Start hot peppers indoors 8 weeks before the last frost. Using a 2" or slightly larger pot will produce larger hot pepper plants with better-developed root systems.

Sow hot pepper seeds shallowly, about ¼" deep in a moistened **lightweight** growing mix. Keep the mix moist (but not wet) and warm - about 80°-85° during germination. Keeping the mix warm results in a quicker germination and healthier hot pepper plants. After the first true leaves have appeared, thin the hot pepper plants to one per pot. If the hot pepper seedlings are out-growing their cell-tray or pots, pot them up to 2"-3" pots.

Do not use plastic covered seed starting trays to start hot pepper seeds. They create a very humid environment that is too stagnant.

Do not use peat pots as they tend to absorb and retain too much moisture for growing some types of hot peppers.

Germination

These seeds germinate best in soils around above 80°F. Germination will take 6-8 days.

Transplanting Into the Garden

Many gardeners transplant their hot pepper plants too early. Wait until the soil is 70°-85° before setting the hot pepper seedlings out. Use black plastic mulch to warm the soil. Place it on the beds when you start the seeds.

Watering

Hot peppers need consistent moisture during germination. Keep hot peppers evenly moist, don't keep them soggy. Not enough water and the hot peppers will acquire a bitter taste. The use of mulches will help in keeping the soil moist. If you use black plastic mulch, plants will needs more frequent waterings. The use of a soaker hose underneath the black plastic will save time and make watering much easier.

Harvesting

Hot peppers are mature when they turn their final color. Most hot pepper fruits are green when immature and can be harvested at that time. Mature hot peppers can be red, orange, yellow, green, or purple depending on the variety.

Harvest hot peppers as they mature by using garden shears to clip them off the plant - don't pull them off. It is best to wear gloves when handling hot peppers. Continual harvesting of the hot peppers produces continuous fruit set so pick the hot peppers off your bushes regularly.

Post-Harvest Handling

Wash and dry hot peppers thoroughly. Hot peppers contain oils on their skins and seeds that can seriously irritate skin and mucous membranes. Be very careful not to touch your eyes, nose, or even mouth when handling hot peppers. Also be careful that pets and children not mettle in the hot peppers.

Storage

Hot peppers will last up to two weeks if stored at 45°-50°, 60%-70% relative humidity. Hot peppers can also be canned, frozen, dried whole or dried and ground.

Hot peppers are very sensitive to ethylene gas so do not store them with fruits and vegetables that produce ethylene gas.

Diseases

Anthracnose, Blossom End Rot, Bacterial Spot, Early Blight, and Verticillium Wilt

Pests

Aphids, Colorado Potato Beetles, Tarnished Plant Bugs, Flea Beetles, and Hornworms

Comments

Use an inexpensive heating pad underneath the cell-tray to help achieve the desired soil temp. Never water hot pepper seedlings directly. Allow the seedlings to drink by immersing cell trays or pots with holes in the bottom into a pan with water ½" deep. Allow the hot pepper seedlings to drink for a few minutes before removing them. Do not let the hot pepper seedlings get water-logged.

Hot pepper seedlings like light - lots of light. Use flourescent lights to supplement natural light if growing the hot peppers indoors. Hot pepper plants will become tall and leggy (weak) if there isn't enough light.

Don't plant hot peppers in the same bed with other plants in the *Solanaceae* (tomatoes, potatoes, eggplant) as they are susceptible to the same diseases.

Sprays made of ground hot pepper are often used on other plants with insect infestations. In most situations, bugs don't bother hot peppers.

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Growing Kale

Family: *Brassicaceae*
Genus and Species: *Brassica oleracea*

Kale was developed by seed selection from the early cabbages. By the 5th century B.C., continued preference for the larger leaved cabbages had led to the development of what we now know as kale. Kale is known botanically by the name *Brassica oleracea* variety *acephala* which roughly translates into "cabbage of the vegetable garden without a head."

Kale is a hardy plant that thrives in cool or cold weather. In many cool climates, it is planted in the early spring for harvest after the first few frosts of the following autumn. In more temperate climates kale is planted after the hot days of summer and grown throughout the cooler months. Kale is a nutritious food that is wonderful prepared in salads or stir fried dishes. There are many varieties of kale available.

Climate

Kale grows best in cool climates and will benefit from a fall frost. Cold days and nights sweeten kale while hot weather produces bitter tough leaves.

Soil

Kale grows best in cool moist soil that is enriched with compost. Optimal soil temperature for growing kale is between 60°-65°. Kale does best when pH of the soil is between 5.5 and 6.5. Kale requires moderate amounts of nitrogen, phosphorus, and potassium.

Spacing

If you plan to harvest the kale leaves at their youngest stage plant kale 8"-12" apart in rows 18-30" apart. Young leaves are great for salads.

An alternate spacing is to give the kale plants more room to grow using a 16" spacing. This spacing allows for good air circulation and will allow the kale to grow longer without harvest. Older leaves are good for cooking but are too tough for salads.

Direct Seeding

In cool climates direct seed kale as soon as the soil can be worked in the spring. Kale germinates in soils that are 45°-95°. In warm climates plant kale seeds in early spring or in late summer or early fall for growing during the winter months. Plant the seeds ½ inch deep in prepared beds. Make sure the seeds do not dry out before germination.

Seeding For Transplants

Kale can be started indoors 6 weeks before the last frost. Start seeds in seed flats in a good growing mix. Place plants under grow lights if available.

Germination

These seeds germinate best in soils around 65°F-85°F. Germination will take 5-7 days.

Transplanting Into the Garden

Transplant kale to the garden making sure that the soil is enriched with compost and moist. Plant kale with 8"-16" between plants in all directions.

Watering

Kale produces sweet, crisp leaves if soils are kept moist. Kale does not like to dry out. Using straw mulch around the plants helps retain soil moisture but kale does need to be watered regularly throughout the growing season.

Harvesting

Kale can be harvested as soon as the leaves are ready to be used although the leaves are most delicious after the first frosts.

Harvest kale by clipping off the outer leaves if you want the plant to keep producing. Or harvest the entire plant when there is a large rosette of leaves.

Post-Harvest Handling

Wash and dry leaves thoroughly.

Storage

Store kale at 32°F with a relative humidity of 95% to 100% to maintain its fresh green color and vitamin content. Store kale with adequate air circulation. Kale should keep for between 14 to 21 days under ideal conditions.

Do not store kale with vegetables and fruits that give off ethylene gas such as apples and pears.

Diseases

Black Rot, Club Root, Fusarium Wilt

Pests

Aphids, Cabbage Loopers, Imported Cabbageworm, Cutworms, Flea Beetles, and Diamond Back Moth

Comments

The trick to producing excellent kale heads is to keep the kale plants growing at a steady pace. Top-dress the plants with compost or manure tea; or side-dress with blood-meal or fish emulsion; and water deeply. Repeat this process every 3-4 weeks until just before harvest.

Mulch will help keep the ground cool and moist as well as reduce weed competition.

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Growing Leeks

Family: *Liliaceae*
Genus and Species: *Allium ampeloprasum*

Leeks are a member of the onion family, but leeks have much more refined flavor. Leeks are thought to be native to the Mediterranean area and Asia. Leeks have been cultivated for more than 3,000 years and have been popular in Europe. Leeks are one of the foods mentioned in the book of Numbers in the Bible. Leeks are sometimes called the "poor man's asparagus."

Cultivated leeks come in long season and short season varieties. The short season leeks have a thinner stem and do not keep as well as long season leeks. The sweet and delicate flavor of leeks and their striking appearance makes many gardeners grow these vegetables year after year.

Climate

Leeks are adapted to growing in many zones. The flavor of a leek is best after a light frost.

Soil

Good soil is the key to growing leeks. Leeks need nutrient rich, well-drained soil with a pH between 6.0 and 7.0. A good crumbly loam is what leeks truly prefer. But, they will do well in almost any garden soil as long as it is well aerated and deep (12 inches or more). Leek grows best in soils that are 60°F.

Spacing

Leeks do not take up a large amount of horizontal space, but they do need deep soil to do well. Leeks should be spaced about 6" apart. Rows of leeks should be at least 2' apart. Alternatively, plant leeks in beds 3-4' wide in a zig-zag pattern. Make sure you don't make your bed wider than what you can comfortably reach across.

Direct Seeding

Sowing leek seeds directly into the garden or field is possible, but not recommended for areas with shorter growing seasons. But if you want to give it a go, sow leek seeds in early spring, roughly 6 leeks seeds per foot ¼" to ½" deep. Thin to 6" apart.

Seeding For Transplants

Sow leek seeds in flats indoors in late winter. Soil temperature should be 75° for germination. When leek starts are about 2" tall, transplant them to individual pots or starting trays with individual cells. Grow the leek seedlings under lights if available.

Germination

These seeds germinate best in soils around 68°F-78°F. Germination will take 10-14 days.

Transplanting Into the Garden

Leeks are ready to transplant 4-6 weeks after starting. Transplant leeks 1-2 weeks after the last frost. Leek seedlings should be about 7" tall. Transplant the leeks into the prepared bed. Use a dibble to make a hole about 6" deep and drop the leek seedlings in. Only 1"-2" of the seedling need be above ground. Do not firm the soil. Lightly draw soil up to the leek seedling and let irrigation or rain do the rest. Make sure the soil is moist and handle the seedlings gently during transplanting, making sure that they do not dry out.

Watering

Leeks will need to be watered during the growing season. Keep the soil evenly moist. Applying a straw mulch to the beds help retains moisture. Leeks also benefit from bi-monthly or monthly applications of an organic fertilizer like fish emulsion.

Harvesting

Leeks are mature when they are approximately 24" tall or about ¾" - 1" in diameter.

Leeks are mature after 70-110 days from germination. Long season leeks can be harvested after the first frost and throughout the fall and winter while short season leeks should be harvested during the summer. Use a garden fork to gently loosen the soil around the leek and lift it from the soil. Leeks can be left in the ground and harvested as needed where winters stay above 10°F.

Post-Harvest Handling

Leeks benefit from cooling immediately after harvest. Clean the leeks of dirt and cool using hydro cooling. Hydro cooling is the process of spraying or immersing vegetables in chilled water.

Storage

Leeks can be kept in a refrigerator for up to a week. Only harvest what you will need as leeks can be harvested into the fall and winter. Leeks can be kept for 2-3 months if they are stored at 32°F and 95-100% relative humidity.

Leeks are very sensitive to ethylene gas so do not store leeks with vegetables and fruits that give off ethylene gas such as apples and pears.

Diseases

Smut, Downy Mildew, Pink Root and Neck Rot

Pests

Onion maggots, and Thrips

Comments

Leeks are in the onion family. Scatter planting leeks throughout a garden or field will help ward off aphids, Japanese beetles, and carrot flies.

Many gardeners like to bank soil around the leeks as they grow. This is called blanching and it increases the amount of the stem that is whitened resulting in a sweeter stem. Do not cover up more than 3-4 inches of the lower stem of the plant.

A good frost will help sweeten the flavor of leeks.

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Growing Lettuce

Family: *Asteraceae*
Genus and Species: *Lactuca sativa*

Lettuce as we know it today originated from the weed Lactuca serriola (prickly lettuce). There is evidence that lettuce was cultivated during Egyptian times. Lettuce is easy to grow in many climates. Lettuce can be tucked in flowerbeds, grown under cucumber trellises or in raised beds and containers. Lettuce can be started indoors or direct seeded in the garden.

There are several types of lettuce and many cultivars to choose from - each with its own texture, taste, and color.

Crisp head (a.k.a. iceberg) is a crispy and juicy type. It needs to be planted early.

Butterhead, Boston, or Bibb lettuce is a soft and succulent type. It has large leaves that form a lose head that can be harvested all at once.

Leaf lettuce is the easiest kind of lettuce to grow. The leaves form an open rosette and lettuce leaves can be harvested singly.

Summer Crisp lettuce is also known as French crisp or Batavia lettuce. It is a crisp lettuce that can be harvested at any stage.

Romaine or Cos lettuce has long, broad leaves that form bunches when mature. It is sweet, crispy, and juicy.

Climate

Lettuce grows in many climates given the right soil and season conditions. Lettuces generally like to grow in partial to full shade. Lettuce is best when it is grown quickly and pampered a bit with good soil and adequate moisture so it doesn't bolt (send up a flowering stalk) or become bitter and tough.

In warmer climates grow lettuce varieties that are heat tolerant. During the summer and grow cool season lettuces in the fall, winter, and early spring.

In cool climates, grow warm season cultivars in the summer and cool season lettuces in the early spring and fall- you can even sow seeds in late fall for an early spring crop.

Soil

Lettuce likes a partly sunny to shady spot with soil rich in humus that retains moisture. Lettuce grows best in temperatures ranging from 55°-65°. The optimum pH is 6.5 to 6.8.

Spacing

Spacing for lettuce depends somewhat on the kind of lettuce planted. If you are planning to harvest the entire head of lettuce then give the plants more room. For example, lettuce grown to produce heads should be given 8"-12" apart in all directions. Lettuce that will be harvested leaf by leaf should be planted much

closer, with ½" between the starts. Spacing can even be random and tight if you intend to harvest the lettuce very young.

Lettuce is pretty forgiving and great crop to use for interplanting - planting in and among other vegetables. Give the main crop room to grow and allow enough space for good air circulation.

Direct Seeding

Lettuce is a good crop for direct seeding. Make sure the bed is prepared well and the soil is moist. Lettuce germinates best in cool soil (40°-60°) and becomes temporarily dormant if it is too hot.

Sow lettuce seeds ½" deep in rows 1½" apart. Lettuce plants have a shallow, compact root system. Make sure there are enough nutrients available by mixing in compost before sowing the seeds.

Broadcast lettuce seeds over the bed and rake lightly so they are covered with a very thin layer of topsoil for harvest as young lettuce.

Seeding For Transplants

Lettuce can be started indoors for early planting in the spring or for succession planting. Start lettuce seeds in trays with individual cells. Start them under lights if available as lettuce seeds need light to germinate. Be careful not to cover the seeds with soil, gently pressing the seeds into the moist starting mix is enough to ensure good germination. For best results, start seeds one month before planting out.

Try to start successive batches of lettuce instead of starting a whole tray or seed package. You will be able to use more lettuce if you have a continuous supply rather than a huge crop ready all at once.

Germination

These seeds germinate best in soils around 40°F-60°F. Germination will take 7-14 days.

Transplanting Into the Garden

Transplant lettuce to the garden when there are at least 4 true leaves on the starts. Make sure the soil is moist before planting.

Watering

Lettuce does not need a lot of water but it does need to be continuously moist. It is important to make sure your lettuce bed does not dry out as this will cause the lettuce to bolt and become bitter. Growing lettuce in a semi-shaded to shaded location and using a straw mulch around the plants helps retain moisture. Water lettuce with a watering wand and concentrate the water at the base of the plant, not on the leaves. Watering the leaves encourages diseases and may damage some varieties of the more delicate lettuces.

Harvesting

Lettuce grows quickly and is ready before flowers appear. The trick to harvesting lettuce is picking it before it is bitter. If flowering stalks appears, the plant is past its prime. Lettuce can be harvested as soon as true leaves appear but let the lettuce plants develop enough so that harvesting 3-4 leaves from the outside of the rosette of each plant will not harm the plant's growth. If you are harvesting the whole lettuce head, wait until it is bigger than the size of your fist and harvest the lettuce before it becomes bitter. If in doubt, try a leaf!

Harvest either the largest, outside leaves or the whole plant. If harvesting tender young lettuce that is tightly spaced use a pair of scissors to cut the lettuce above the soil line.

Post-Harvest Handling

Clean the lettuce of dirt and cool using hydro cooling. Hydro cooling is the process of spraying or immersing vegetables in chilled water.

Storage

Clean, dry lettuce lasts 3-5 days in optimum conditions though lettuce is best eaten fresh. Lettuce can be stored for 2-3 weeks at 32° and 98%-100% relative humidity.

Lettuce is very sensitive to ethylene gas so do not store lettuce with vegetables and fruits that give off ethylene gas such as apples and pears.

Diseases

Big Vein, Damping-Off, Downy Mildew, Mosaic Virus, Nematodes, Sclerotinia Drop, Soft Rot, and Tip Burn

Pests

Bulb Mites, Cutworms, Darkling Beetles, Field Cricket, Garden Symphylans, Leafminers, Springtails, Armyworm, Beet Armyworm, Corn Earworm and Tobacco Budworm, Loopers, Saltmarsh Caterpillar, Foxglove Aphid, Green Peach and Potato Aphids, Lettuce Aphid, Lettuce Root Aphid, Silverleaf Whitefly, and Slugs

Comments

The key to growing lettuce is starting successive batches a week or two apart to ensure that you have a continuous supply throughout the growing season.

An insecticidal soap or handpicking usually alleviates the majority of lettuce pests. Use a beer trap for the slugs. A beer trap is a shallow dish placed level with the soil and filled with beer.

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Growing Melons

Family: *Cucurbitaceae*
Genus and Species: *Cucumis melo, Citrullus lanatus*

Melons, also know as muskmelons, were cultivated in Egypt, Iran and Northwest India as far back as 2400 BC. In the ancient world no distinction was made between melons that were netted, such as the cantaloupe, or non-netted, as in the honeydew. During 1600's melons were grown in North America from Florida to New England, but melons did not attain popular acceptance until the 19th century. It was not until after the Civil War that cantaloupes became a major crop in United States.

Melons are a hot weather crop. They need long, hot summer days and warm nights. There are many cultivars and varieties of melon. Despite needing extra care in cooler climates, melons are very satisfying to grow, especially when you sit down to a fresh, juicy slice.

Climate

Melons grow on vines and are native to the tropics. They need plenty of hot days (3 to 4 months) and moisture to grow. In northern climates, melons need extra care to ensure the soil is warm enough, they are watered enough, and there are enough hot days. In northern climates, mulches like black plastic and row covers help produce fruits before the summer turns cool again.

Soil

Melons need nutrient-rich soil with a pH between 6.0 and 7.0. Melons require low levels of nitrogen, and moderate amounts of potassium, and phosphorus. Melons do best in deep soil that is well drained but also retains moisture. In northern climates, pick the sunniest spot to plant melons. Melons grow best when soil temperatures are 70°-85°.

Spacing

Melons can take up a large amount of space. Melon vines can grow up to 100' long. Try growing a bush-cultivar and/or grow your melons on a (very) strong trellis. Plant melons 16" apart or plant melons in hills 4'-12' apart depending on the variety.

If planting melons in rows, plant them in a zig-zag pattern and keep the rows at least 24"-36" wide.

Direct Seeding

Only direct seed melons if the soil is warm enough (70°-80°) and your growing season will provide enough time for the melons to reach maturity.

Plant melon seeds 8" apart, ½" deep then thin to every 16" after 3 or 4 true leaves have appeared. If planting melons in hills, plant 6 seeds per hill and then thin to 3 seeds per hill.

Seeding For Transplants

Melons do not transplant well so use peat pots for the best success. Plant melon seeds 2-3 weeks before the last frost date. Keep the soil warm as the melon seeds germinate, grow under lights and on a heating pad if available. Keep seedlings evenly moist. Plant melons seeds ½" deep. Some melon varieties have more specific growing directions.

In northern climates, put a sheet of black plastic on the melon bed 2-3 weeks before planting to warm the soil.

Germination

These seeds germinate best in soils around 80°F-86°F. Germination will take 4-10 days.

Transplanting Into the Garden

Transplant seedlings when 3-4 true leaves appear and the soil is between 70°-85° degrees. If you are using black plastic as a mulch, punch holes in the plastic with a bulb planter. Make sure the seedling and the soil are moist and warm as your transplant.

Watering

Melons need different amounts of water throughout the growing season. Keep the soil evenly moist, give deep soakings at the roots during dry times and apply generous amounts of water after transplanting and as the fruits reach their mature size. Don't water or water very little as the fruits ripen and change color.

Harvesting

It takes some practice to know when melons are ripe. Look at the part of the melon on the ground, if it is a rich warm, gold, or yellow, the melon is ripe and ready to harvested. Another clear indication is if the melon is detached or detaches easily from the vine when handled.

All the fruits on the same melon vine will mature around the same time. If one melon is ripe, the others are likely to be ready for harvest as well.

Most ripe melons do not need to be picked or cut off the vine, they should come off the vine with no resistance at all.

Post-Harvest Handling

Wash and dry melons thoroughly.

Storage

Melons are best eaten fresh but most varieties can last up to 2 weeks in optimum conditions. Melons should be stored at 35°-40° with a relative humidity of 95%.

Melons is very sensitive to ethylene gas so do not store Melons with vegetables and fruits that give off ethylene gas such as apples and pears.

Diseases

Root-knot, Fruit and stem rot (Southern blight), Fusarium wilt, Powdery mildew, Downy mildew, Gummy stem blight, Anthracnose, Alternaria leafspot, and Soft rot.

Pests

Beet Armyworm, Cabbage Looper, Crickets, Cucumber Beetles, Cutworms, Darkling Beetles, Driedfruit Beetles, European Earwig, False Chinch Bug, Flea Beetles, Grasshoppers, Green Peach Aphid, Green Stink Bug, Leafhoppers, Leafminers, Melon Aphid, Seedcorn Maggot, Spider Mites, Squash Bug, Thrips, Vinegar Flies, Whiteflies, Wireworms, and Yellowstriped Armyworm

Comments

Mulching a melon patch with straw aids in retaining moisture, reducing weeds, and provides a better bed for the melons to rest on while they grow.

Floating row covers and transplanting starts later in the season are good ways to avoid the bugs and diseases that bother melons. Crop rotation and insecticidal soap can also help alleviate these problems.

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Growing Okra

Family: *Malvaceae*
Genus and Species: *Abelmoschus esculentus*

Okra is thought to have originated in Ethiopia. Okra was cultivated by the ancient Egyptians. Okra came to the Caribbean and the U.S. in the 1700s. In Louisiana, the Créoles learned how to use okra (gumbo) to thicken soups from the slaves. Okra is popular in Africa, the Middle East, Greece, Turkey, India, the Caribbean, South America and the Southern U.S. In Spanish okra is called quibombo; the French word for okra is gombo, bamia or bamya, in India it is bhindi, and in the eastern Mediterranean and Arab countries okra is called bamies.

Okra is prized and used often in dishes of the Southern US. It is in the same family with passionflower and cotton. The okra plant is beautiful and interesting. Okra does well in hot climates but also grows well in shorter seasons with some extra help. Okra is eaten in a myriad of ways: it can be boiled, fried, canned, or stewed.

Climate

Okra is native to hot climates but it can do well in northern summers given the right soil conditions and extra effort to keep it warm on cool nights. Okra likes full sun and good soil. In warm climates, plant a early and late spring okra crop for harvest through the later summer. In northern climates, put okra transplants in the ground in early spring and use plastic mulch and floating row covers to ensure warm temperatures.

Soil

Okra does best in fertile loamy soil. In northern climates, warm the site with black plastic for about 3-4 weeks before planting. Okra grows best when soil temperatures are 70°-90°. Okra grows best in neutral to slightly alkaline soils, pH 6.5-7.5.

Spacing

Okra should be planted with about 12"-18" between each plant. Rows should be at least 2' apart. Okra can also be planted in a zig-zag pattern in a bed 2'-4' wide. Don't make the beds wider than you can comfortably reach across.

Direct Seeding

Make sure the soil is warm enough when direct seeding okra. Soil temperature should be at least 70°-90°. Nick the okra seeds and soak overnight in water or scarify them slightly with a file to encourage germination. Plant seeds ½"-¾" deep in moist, prepared soil.

Seeding For Transplants

Start okra seeds in peat pots. Plant 3 okra seeds per pot and thin to the strongest plant in each pot once the okra starts have 3-4 true leaves. Use scissors to snip the weaker okra seedlings as pulling them out will disturb the roots of the remaining one.

Germination

These seeds germinate best in soils around 80°F-95°F. Germination will take 5-14 days.

Transplanting Into the Garden

Transplant okra seedlings to prepared, moist soil after a hardening off period. Expose the okra starts to outside light and temperature gradually over a period of 5-7 days.

Watering

Okra needs to be evenly moist throughout the growing season. Okra also benefits from monthly side dressings of manure and monthly applications of a complete organic fertilizer like fish emulsion or liquid seaweed.

Harvesting

Okra matures in 50-60 days. In general, okra pods are ready for harvest 4-7 days after the flower opens. Harvest okra pods daily so they do not become overly ripe. Okra will continue to produce pods until frost if they are picked regularly.

Harvest tender okra pods by gently pulling or clipping them off the plant. Use gloves when harvesting as the okra skin has prickly spines. Cut the pods while they are tender and free of fiber, 2"-4" inches long for most varieties. Harvest pods every other day. Remove mature pods and discard as they reduce the plant?s production ability. The large pods rapidly become tough and woody. When the stem is too difficult to cut, the pod is too old to use.

Post-Harvest Handling

Wash and dry okra thoroughly.

Storage

Okra is best eaten just after it is picked but it can be stored for several days. Okra will keep for 7-10 days if kept at 45°-50° with a relative humidity of 90%-95%. Okra does not freeze well.

Okra is very sensitive to ethylene gas so do not store Okra with vegetables and fruits that give off ethylene gas such as apples and pears.

Diseases

Fusarium Wilt, Root Knot Nematode, Leaf Spot, Blossom and Fruit Blight, Seedling Disease, Virus, Cotton Root Rot, Charcoal Rot, and Southern Blight.

Pests

Corn earworm, Japanese beetle, Aphids, Leaffooted bugs and Stink bugs, European corn borer, Vegetable leafminer

Comments

With every 18° F rise in temperature, okra pods develop twice as fast, so harvesting every other day is important in hot weather.

Okra rarely succumbs to pests or diseases. As with all crops, crop rotation will help prevent many soil borne problems with okra.

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Growing Onions

Family: *Liliaceae*
Genus and Species: *Allium cepa*

Onions were grown in Ancient Egypt and eventually arrived in Rome. Romans were the first to call this pungent vegetable an onion. The word onion came from the Latin word UNIO, which means large pearl. In Middle English, onions were known as UNYON. But it took the French to raise the status of the onion with the creation of the culinary treat French Onion Soup, made popular by Stanislaus I, the former King of Poland.

Onions are a cool season plant which grows well in a wide range of temperatures. Young onion plants are highly resistant to frost. Onions may be established by planting seed or transplanting sets (young onion plants). Onions are divided into storage and fresh onions depending on their storage life. Fresh onions do not keep as long and are best eaten fresh.

Climate

The onion is adapted to a wide range of temperatures and is frost-tolerant. Onions produce best when cool temperatures (55°-75°) prevail for an extended period of time. This will permit the onions to generate considerable foliage and root development before bulbing starts. After bulbing begins, considerably warmer temperatures and low relative humidity into the harvest and curing period are desirable.

Onion development is very dependent upon the length of day or photoperiod. Photoperiod, along with temperature, controls when the onions form bulbs. Some onion varieties are short-day in response and form bulbs when the days are 12 hours or less in length. Other onion varieties are long-day plants forming bulbs when there are 15 or more hours of daylight. This effect of day length makes some onion varieties unsuitable for northern climates because they begin to bulb when the plants are too small. The influence of day length also requires that Sweet Spanish and Bermuda onions be grown from plants rather than seed in northern climates.

Soil

Soil is the key to growing good onions. Some onion varieties are very particular about soil type. In general, deep, loose, fertile, friable soil works well for onions. Mix in compost or rotted manure to your bed before you plant. Onions grow best when soil temperatures are between 55° and 75°. Avoid heavier soils such as clay and silt loams unless modified with organic matter to improve aeration and drainage. Onions do not like highly acidic soils. The ideal soil pH for onions is between 6.2 and 6.8.

Spacing

Plant several rows of onions in beds 3'-4' wide. Onions can be planted in a zig-zag pattern with 1½"-2" between plants for the highest yield in fertile soil.

Alternately, set onions in rows 4" apart.

Alternate spacings include 3"-4" for larger onions and 4" for mild or sweet types.

Direct Seeding

Direct seeding onions provides the least amount of disturbance to the growing cycle. Onions grown by direct seeding are more resistant to disease. Direct seeding takes longer so it is not always the best option in northern climates.

Direct seed in a prepared bed after the soil has warmed to 60°. Sow onion seeds in rows about ¼" - ½" deep (plant onion sets 1" deep.). Keep rows 4" apart. After the seeds are up and the starts are 2"-4" all, thin onion plants to desired spacing.

Seeding For Transplants

Onion seeds can be started indoors underneath growing lights 8-10 weeks before the last frost.

Germination

These seeds germinate best in soils around 55°F-95°F. Germination will take 5-7 days.

Transplanting Into the Garden

Onions grow best when the early part of their growth cycle is cool. Plant them in early spring in cool climates. In mild winter areas, plant onions in the fall to grow through the winter.

Watering

Onions need a constant supply of adequate moisture for best results. Onions started from plants will benefit from a light mulch to help conserve moisture for uniform growth.

Harvesting

Onions are mature when most of the tops fall over. Once several tops fall over, use the back of a rake to bend the rest of the onion tops to the ground. Leave the onions in the ground until the tops have dried.

Harvest onions by gently pulling on the tops. Use a garden fork to carefully loosen soil around the onions if needed.

Post-Harvest Handling

Clean the dirt off onion bulbs with a soft brush or your gloved hand. On sunny, breezy days, onions may be pulled and left in the garden for a day or two to dry before they are taken to a curing area. Curing must take place for the onions to be stored for any length of time. Cure onions by placing them in a warm, well-ventilated area until the necks are thoroughly dry. With warm temperatures, good air circulation and low humidity, curing should be completed within two weeks after harvest. Onions are cured when the outer skins are completely dry.

Storage

Storage types: Storage onions are best stored in a cool, moderately dry area in ventilated containers. Storage onions can keep for 1-6 months at 32° and 65%-70% relative humidity.

Fresh onions, like Walla Walla, are best used within several weeks of harvest.

Diseases

Smut, Onion Blast, Onion Neck Rot, Downy Mildew, Bacterial Soft Rot, and Pink Root.

Pests

Onion maggots and Thrips.

Comments

Growing onions from sets provides a bit of ease for the gardener but if you want variety and stronger onion plants, grow your onions from seed.

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Growing Parsnips

Family: *Umbelliferae*
Genus and Species: *Pastinaca sativa*

Parsnips, have a long history that dates back into Roman times. In the Middle Ages, growers developed a tastier and fleshier parsnip variety. In fact, back then, the Europeans favored the parsnip because of its flavor, nourishment and ability to satisfy hunger through meatless fasting periods. Parsnips were so revered they were more popular than either potatoes or carrots.

Parsnips are low in calories and loaded with nutrition. A single 9" parsnip yields plenty of fiber, folic acid, calcium, potassium, and vitamins B1, B2, B3, vitamin C, iron, and zinc. Parsnips have a nutty, sweet taste that can be added to many recipes or enjoyed alone.

Climate

Parsnips require a long growing period but can still be grown in many climates. In warm climates, plant parsnips in the fall for a spring harvest. In cool climates, plant them in the spring for harvest the next spring. A hard frost or over-wintering will increase the flavor of parsnips significantly.

Soil

Parsnips need very deep soil. In fact, the soil conditions parsnips require is very similar to carrots: deep, loose fertile soils that have good water-holding capacity and a pH of 6.0. Well-drained sandy loams, peat, and mucks are ideal for parsnips. Prepare the bed to a depth of 2' if possible. Make sure to remove rocks and mix in plenty of compost. Parsnips thrive in a soil rich in potassium and phosphorus, so work in a dusting of wood ashes (potash) for good measure. Parsnips grow best in soil that is 60°-65°.

Spacing

Space parsnips so there is 4" inches between the plants in all directions. Plant parsnips in a zig-zag pattern in beds that are 2'-4' wide. Don't make you beds wider than you can comfortably reach across.

Direct Seeding

Direct seeding parsnip seeds is the easiest way to plant parsnips. Sow seeds ½" deep and 1" apart in rows 4" apart.

Seeding For Transplants

Transplanting parsnips is not normally practiced.

Germination

These seeds germinate best in soils around 60°F-75°F. Germination will take 21 days.

Transplanting Into the Garden

Make sure the parsnip seeds are kept evenly moist during the germination period. Use a straw mulch or wood chip mulch after parsnips are established to help retain moisture in the beds and control weeds. Parsnips have long roots and can tolerate some dry conditions but benefit from an even water supply.

Watering

Make sure the parsnip seeds are kept evenly moist during the germination period. Use a straw mulch or wood chip mulch after parsnips are established to help retain moisture in the beds and control weeds. Parsnips have long roots and can tolerate some dry conditions but benefit from an even water supply.

Harvesting

In warm climates, where parsnips were planted in the fall, the parsnips should be mature in the spring. In cool climates, parsnips started in spring are ready the spring of the following year.

Even though parsnips can be harvested at the end of the growing season, they don't develop their delicious, sweet and nutty flavor unless they go through hard frosts or over-winter in cold winter temperatures.

If you plan to overwinter your parsnips, mulch them to protect them from severe coldness.

Loosen the soil around parsnips before attempting to remove them. Some parsnips can grow to be quite long and loosening the soil will help significantly.

Post-Harvest Handling

Wash and dry parsnips thoroughly.

Storage

Parsnips can be stored for several months. Clip the leaves off the parsnips. Parsnips will store for 24-26 weeks at 32° and 90%-95% relative humidity.

Diseases

Parsnip canker.

Pests

Root Aphid, Carrot Fly Maggots, and Celery Leaf Miner Maggots.

Comments

Keep the soil surface moist while germination takes place until the parsnip seedlings emerge. Thin parsnip seedlings to 4" after they are established.

The trick for growing monster parsnips is to plant them in conical holes. Drive a crowbar into the soil to a depth of about 2 and rotate the bar in a circular motion

until the hole is about 6" across the top. Fill the hole with a mixture of sand, peat moss, and sifted soil, leaving a slight depression at the top of the hole. Place two or three sprouted parsnip seeds in the depression then cover with ½ inch of sifted sphagnum moss and water. Space the holes 8" apart in the bed.

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Growing Peas

Family: *Fabaceae*
Genus and Species: *Pisum sativum* var. *macrocarpon*

Peas have been a part of our diet since at least the egyptian times. Around the sixteenth century more tender varieties of peas were developed and eaten fresh. Today only about 5% of all peas grown are sold fresh. The rest of the peas sold are canned and frozen. Peas are members of the legume family. This family includes plants that bear pods enclosing fleshy seeds. Peas are a good low calorie source of protein. A 100-calorie serving of peas (about ¾ cup) contains more protein than a whole egg or a tablespoon of peanut butter and has less than one gram of fat and no cholesterol.

Fresh peas from the garden eaten in spring have turned many people into gardeners. Peas have a sweet flavor, sublime flowers, and vines that are a joy to see after the long, cool months. Peas are easy to grow and suitable in many areas.

Peas are separated into two groups, those with edible pods and those whose pods must be removed or "shucked". Peas with edible pods include snow peas and snap peas. English peas, more commonly known as garden peas, must be shelled before they can be eaten. Cultivars refered to as cow peas or field peas are actually beans.

Peas commonly grow on vines though you can find dwarf (bush) cultivars that do not need trellising.

Climate

Peas are a cool climate crop and prefer the cooler moist days of spring. Make sure you choose a variety or cultivar suited to your region. Grow peas during the cooler days of late spring and early summer. If growing peas during the summer choose a partly shady area.

Alternately plant peas in late summer for a fall harvest.

Soil

Peas need a fair amount of soil nutrients to produce a uniform crop. Loam soils offer good drainage and nutrient availability. Peas planted in early spring do well in raised beds. Since peas can be started as soon as the soil can be worked, it is easiest to prepare the bed during the previous fall for spring planting. Soil temperatures should be 65°-70° with a pH range from 6.0 to 7.0.

Spacing

Vine peas: Pea vines that are trellised should be planted 1"-1½" apart in rows 4'-6' apart.

Bush peas: Bush peas should be planted 1"-1½" apart in all directions in rows 12"-18" apart.
If you are planting a large bed of peas, they can be planted in a zig-zag pattern with 12"-18" between the plants.

Direct Seeding

Peas are not normally thinned so make sure you plant the peas at the proper spacing to begin with to avoid wasting seed. Plant your peas ½"-1" deep in soil that has been moistened over a few days ahead of the planting.

Seeding For Transplants

Transplanting peas is not normally practiced.

Germination

These seeds germinate best in soils around 60°F-70°F. Germination will take 7-14 days.

Watering

Peas need to be kept evenly moist throughout the growing season. Use a mulch to retain soil moisture and water the peas during dry times to help keep your peas moist but not permanently wet. Peas like soil with good drainage, they suffer from root rot if they have "wet feet". Overhead watering should be done early in the day to reduce the incidence of leaf diseases that occur when the leaves remain wet overnight.

Harvesting

Peas are mature when their pod reaches the mature length and the pods are plump but not bursting. The length of the pea pod varies depending on the variety so save your seed packet. Overripe peas acquire a starchy flavor.

Harvest peas every 2-4 days to encourage continued production. Harvest peas even if they are overripe. Leaving overly mature peas on the vine slows production. Harvest by pinching or snapping the viney connectors which hold the pea pod to the vine.

Post-Harvest Handling

Wash and dry peas thoroughly. Peas are a moderately sensitive vegetable with a high-respiration rate. This means the peas must be cooled quickly after harvest to maintain their flavor, texture, color, and freshness. Pre-cooling to remove field heat prior to shipment is commonly practiced via forced air-cooling or hydro cooling. Hydro cooling is the process of spraying or immersing vegetables in chilled water.

Storage

Peas can be frozen, canned, or stored for 7-10 days at 32° with 98%-98% relative humidity.

Peas are very sensitive to ethylene gas so do not store them with fruits and vegetables that produce ethylene gas.

Diseases

Blindness, Bud Drop, Chimaera, Anthracnose, Black Root Rot, Botrytis (Grey Mould), Downy Mildew, MLO, Powdery Mildew, Ramularia Leaf Spot, Sclerotinea, Streak, and Virus.

Pests

Aphids, Pea Weevils, and Thrips.

Comments

Inoculants are typically dry powders that contain symbiotic rhizobial bacteria. When the seeds of legumes like bush peas and vine peas are treated with inoculant, the plants will form nitrogen nodules on their root systems as well as produce increased yields. The pea plants don't need the nitrogen fixed by the inoculant. Rather, when the pea plants are tilled under, the nitrogen in the nodules becomes available in the soil for the next crop of plants - preferably one that likes nitrogen like tomatoes.

To apply the inoculant, dust the pea seeds with a light amount of inoculant as you plant. Inoculant is an especially good idea if you haven't planted peas in the chosen area before.

Consistent, adequate soil moisture is important for good germination. Too much and the pea seeds will rot. Too little and the germination will stall or even stop altogether.

Weed control is essential especially in the first six weeks after planting. Shallow cultivation and hand-pulling are the preferred methods for weed removal.

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Growing Pole Beans

Family: *Fabaceae*
Genus and Species: *Phaseolus vulgaris*

Beans are one of the easiest of vegetables to grow. Beans have such a diversity of colors and flavors it is easy to see how beans are one of agriculture's favorite crops. In fact, humans have cultivated beans for about 6000 years. Pole beans are indeterminate and will produce vines of beans. Pole beans require some form of support. Poles have been used for centuries and thus the name pole beans but the beans will grow up trellis, netting, or any support that affords them purchase to climb.

Pole beans can be found as both fresh and dry varieties. The fresh beans within this species are often referred to as snap beans, green beans (green in color), and yellow or wax beans (yellow in color). Dry beans offer the most variety of colors and flavors and include some of the oldest seed varieties available.

Climate

Pole beans are very easy to grow, as they will tolerate a variety of climates as long as there is good sunlight available. An air temperature of 70°F-80°F and a soil temperature of at least 60°F is ideal for beans.

Soil

Pole bean plants will grow in almost any soil with a pH above 6.0. Loose sandy loam soils warm rapidly and are ideal for beans. Soggy soil will cause the bean seeds to rot. Pole beans will do best in well-drained soils rich in organic matter. Beans prefer lighter soils. If you have heavy soil, amend it well with compost prior to planting. Break up large clods of soil and rake the area smooth prior to planting your pole bean seeds.

Spacing

Plant pole beans at 1"- 1½" deep at 3" apart within a row at the base of a trellis or netting or in a circle around a pole. If using a pole, plant at least 6 bean plants at its base. Space rows of trellis, poles, teepees, etc. at 4' apart.

Direct Seeding

Pole beans will continue to produce beans throughout a growing season until the frost kills them and as long as they harvested regularly. If you have a long growing season, 2 overlapping plantings of pole beans may be needed to provide a continuous supply of fresh beans. Gently press soil cover so that the beans have good contact with it.

Seeding For Transplants

Pole beans are not normally transplanted. If you want to give it a go, sow one bean seed per 1½" cell or soil block at 1" deep. If using a flat, sow at 1" deep, 2" apart, in row with 2"-3" between rows. Gently press the potting mix so that the beans have good contact with it. Start seeds 2-3 weeks before the last spring frost.

Germination

These seeds germinate best in soils around 75°F-80°F. Germination will take 14 days.

Transplanting Into the Garden

Transplant bean plants at 3-4 weeks.

Watering

Maintain a consistent moisture rate during germination. Deep watering once a week is recommended as long as the soil drains well. Saturated soil increases the risk of seed rot. Once plants have sprouted less frequent irrigation is required until just before bean plants are about to blossom. Just prior to and during the blossom stage, ensure the bean plants have consistent moisture and deep water once a week if there is no rainfall. Be sure to water the plants at their base and be careful not to knock off blossoms while watering.

Harvesting

Fresh Beans: Fresh (snap) beans are normally ready for harvest about 8-10 days after flowering. Pick beans when they are pencil thin, the fruit is bright green, the pod is fleshy and seeds are small and green. The bean pods should snap easily when bent - thus the name snap beans. Pinch or cut the beans off rather than pulling them as pulling the beans may pull up the plant.

Harvest the beans frequently - if not daily - to keep the plants producing. The bean plants will stop producing if bean pods are allowed to reach maturity.

Over-mature beans loose their bright green color and become pithy and tough.

Do not pick beans while the plants are wet if it can be avoided. Wet bean plants are ripe for the transmission of disease. Harvest and remove from the field any overly mature pods that may have been missed earlier.

Dry Beans: Leave the plants alone and let the bean pods dry right on the plant until late fall. If the climate has high humidity or your crop is in danger of being blanketed by snow, pull the plants and hang them upside down in a shed or other protected location with good air circulation.

Post-Harvest Handling

Fresh Beans: Snap beans are a moderately sensitive vegetable with a high-respiration rate. This means the beans must be cooled quickly after harvest to maintain their flavor, texture, color, and freshness. Pre-cooling to remove field heat prior to shipment is commonly practiced via forced air-cooling. Do not use ice or water, as the beans will become damaged. Significant post-harvest decay will occur if the beans remain wet after harvest.

Dry beans: Once the bean pods have completely dried, gather the bean plants on a large sheet or tarp and thresh to separate the beans from their pods. Winnow to separate the beans from the chaff and place in storage containers.

Storage

Fresh Beans: Snap beans are best stored at 41°F -46°F with 95% to 100% relative humidity. Snap beans can be stored for up to 8-12 days in these conditions.

Dry beans: Store dry beans in containers in a cool, dry, dark place. Dry beans stored in these conditions will be at their best for up to 4 years.

Diseases

Anthracnose, Bacterial Blight, Mosaic, Rust, Downy Mildew

Pests

Mexican Bean Beetles, Aphids, Cabbage Loopers, Corn Earworms, European Corn Borers, Japanese Beetles

Comments

Beans perforom much better with the use of inoculants. Inoculants are typically dry powders that contain symbiotic rhizobial bacteria. When the seeds of legumes like bush beans are treated with inoculant, the plants will form nitrogen nodules on their root systems as well as produce increased yields. The beans plants don't need the nitrogen fixed by the inoculant. Rather, when the bean plants are tilled under, the nitrogen in the nodules becomes available in the soil for the next crop of plants - preferably one that likes nitrogen like tomatoes.

To apply the inoculant, dust the bean seeds with a light amount of inoculant as you plant. Inoculant is an especially good idea if you haven't planted beans in the chosen area before.

Till bean plants under in the fall after they're done producing unless disease has struck. In the spring, plant a nitrogen feeder to take advantage of the nitrogen provided by the bean plants.

Beans are very prolific. A 100' row of bush beans can produce about 50 quarts of beans.

Beans are self-pollinating and therefore different cultivars can be grown side by side with little danger of cross-pollination.

Never weed or work among the beans while they are wet to prevent the spread of disease.

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Growing Potatoes

Family: *Solanaceae*
Genus and Species: *Solanum tuberosum*

Potatoes are native to the high Andes of South America. Potatoes are a cool season, high altitude crop. Many different varieties of potatoes have been cultivated for hundreds, maybe thousands of years. While grocery stores and food co-ops offer only a few varieties of potatoes, the truth is there are hundreds of different varieties of potatoes.

Climate

Potatoes are a cool weather crop. If you live in a cool climate, plant potatoes in early spring three weeks before the last frost. If you live in a warm to temperate region, plant your potatoes in late winter. In a truly hot climate, plant potatoes in the fall to grow over the winter.

Soil

Potatoes need fertile, well-drained soil. Potatoes need high amounts of nitrogen, potassium, and phosphorus. Mixing compost into your bed and making sure there is plenty of organic matter will help ensure good soil conditions for your potato crop. Make sure your soil is easy to dig around in, it will make harvesting the potatoes easier. Potatoes need soils at least 45° for sowing and 60°-65° for optimal growing. The ideal pH for potatoes is 5.0 - 5.5 to prevent scab.

Spacing

The common practice is to keep potatoes 6"-12" apart with row spacings of 30"-36".

Direct Seeding

Potatoes are not normally thinned so make sure you plant the potatoes at the proper spacing to begin with to avoid crowding. Plant seed potatoes 6"-12" apart in a shallow holes 3" deep. Use row spacings of 30"-36". Direct seeding is possible for some cultivars but planting seed potatoes is the much more common method of starting potatoes. Seed potatoes are actually nothing more than either a whole or sections of a whole potato. Plant the seed potatoes in early spring, about 3 weeks before the last frost.

An alternate method is to dig a trench 6"-12" deep and place the seed potatoes in the bottom of the trench 12" apart. Cover them with 3" of soil. The trench method allows you to add soil back into the trench as the potato plants continue to grow.

Seed potatoes need some preparation before planting. The practice of greening and pre-sprouting seed potatoes before planting encourages early growth and hastens the development of the potatoes.

Spread the potatoes to be used as seed potatoes in a open-top box, crate or flat. Place the potatoes in the container so that the side with the most 'eyes' (the little dimples) is face up. Do not stack the potatoes. Keep the flats of potatoes warm and in a spot where light levels are medium to intense. The warmth will stimulate

development of strong sprouts from the bud eye clusters and the light will keep the sprouts short and strong.

To get more potato plants from one seed potato cut the seed potato into chunks so that there at least three healthy sprouts per chunk. Make sure the potato chunks are at least 1½" across. Allow these to air dry for a day or two before planting.

Seeding For Transplants

Transplanting potatoes is not normally practiced.

Transplanting Into the Garden

Potatoes planted in a hill will dry out quicker so watch the soil moisture carefully. Keep potatoes evenly moist and water deeply during dry spells.

Watering

Potatoes planted in a hill will dry out quicker so watch the soil moisture carefully. Keep potatoes evenly moist and water deeply during dry spells.

Harvesting

Potatoes are mature when the leaves die back. New potatoes are immature potatoes picked several months after planting but before the potato plants reach maturity. New potatoes can often be found when the potato plants blossom.

Mature Potatoes: Once the leaves of the plants have died back, use a garden fork to gently loosen the potatoes from the ground. You will see why it is important to have well drained, light soil- it makes the harvest a lot easier.

New Potatoes: Carefully poke around in the potatoe hill (or under the mulch) by hand to see what's there. New potatoes are often harvested as small as a marble up to the size of a golf ball. If you find something worth taking, pluck it gently from the roots so as not to disturb the rest of the potato plant.

In either case, drier soils are an advantage to harvesting potatoes.

Post-Harvest Handling

Brush the soil from the potatoes but don't wash them. Potatoes need to cure several weeks before storage. Store them in a cool, dry, **dark** place during this time.

Storage

Potatoes can be stored for 5-10 months in temperatures from 40°-50° and 90% relative humidity for mature potatoes. New potatoes should be stored at 50°-60° and 90% relative humidity.

Mature potatoes are sensitive to ethylene gas so do not store them with fruits and vegetables that produce ethylene gas.

Diseases

Potato Blight, Speckle Leaf, Black Leg, Early Blight, Late Blight, and Ring Rot.

Pests

Colorado Potato Beetles and Pocket Gophers.

Comments

Hill Method: When the potato plants are 1' tall, use a hoe to "hill" the soil around the plant. Hill the potato plants with soil so that just the top few leaves are exposed. This helps prevent the potatoes from turning green and allows the plants to produce more potatoes.

Mulch Method: A good alternative to hilling, especially if your soil is shallow, rocky or compact, is to use mulch to bury the plants. The best mulch to use is loose, seed-free hay or straw. Leaves and dried grass clippings can also be used. Cover the potato plants at least a few times during the growing season.

Cage Method: Grow your potatoes in vertical boxes, cribs, barrels or wire cages. **Do not use old tires to grow your potatoes in!** Plant strong seed potatoes at the bottom of the container/cage and cover them with 3"-4" of loose soil. As the plants grow, add mellow compost, mulch or soil. Cover the potato plants at least a few times during the growing season. This method is known to produce 2-3 times the amount of potatoes. Watering requirements will be greater if using a wire cage because of the increased soil surface area exposed to air.

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Growing Pumpkins

Family: *Cucurbitaceae*
Genus and Species: *Cucurbita pepo*

Pumpkins are an old, nutritious vegetable grown for hundreds of years alongside corn and peppers. Pumpkins are beautiful and bountiful and their harvest is a sure sign of autumn. Pumpkins can be used in breads, pies, and stews. Pumkins are also delicious roasted on a grill. Pumpkin seeds can be roasted and are a delicious addition to salads.

Pumpkins date back many centuries. The name pumpkin originated from the Greek word for "large melon" which is "pepon." The French turned "pepon" into "pompon" and the English changed that into "pumpion." But it took the American colonists to finally change "pumpion" into "pumpkin."

Native Americans dried strips of pumpkin and wove them into mats. They also roasted long strips of pumpkin on the open fire and ate them. The origin of pumpkin pie occurred when the colonists sliced off the pumpkin top, removed the seeds, and filled the insides with milk, spices and honey. The pumpkin was then baked in hot ashes.

Climate

Pumpkins are a warm season crop that need good soil, a lot of sun, and plenty of room to grow. Pumpkins are frost sensitive, but fast growing so they do well even in short growing season areas.

Soil

Pumpkins need fertile, aerated soil that is warm enough for germination (70°-90°) and warm enough for growing (65°-75°). Mix compost or well-rotted manure into the bed to ensure plenty of nutrients. Pumpkins grow best in soils with a pH between 5.5 and 6.5. Pumpkins need moderate amounts of potassium and phosphorus and high amounts of nitrogen.

Spacing

Grow pumpkins in a corner of the garden and train the vines to grow outside of the garden. Pumpkin vines are huge and they can take up most of your garden if you are not careful. Space plants 12"-18" apart.

If growing pumpkins in a row, space the pumpkin plants at 18" in rows 6' apart.

Alternately you can grow pumpkins on a hill of soil, compost or manure. When pumpkins are grown in hills make sure there is approximately 50-100 square feet of space per hill for the pumpkin vines to grow. Pumpkin hills should be approx 3' by 3'. Planting pumpkins on hills of rich soil or organic matter helps ensure these heavy feeders get what they need.

Direct Seeding

Direct seeding pumpkins is not recommended in areas with short growing seasons. Pumpkins need at least three months of frost free, warm to hot weather. If you live in a cool climate, start pumpkins indoors.

In areas with longer growing seasons, direct seed pumpkins once the danger of frost is past and soil temperatures are between 70° and 90°. Use black plastic to warm the soil if needed. Sow 2-3 seeds, 1" deep every 12"-18" in rows 6' apart. Thin to one or two pumpkin plants.

Alternately sow 4 to 5 seeds per hill.

Seeding For Transplants

In cool climates start pumpkin seeds indoors one month before the last frost. Sow pumpkin seeds in peat pots as pumpkins do not really like being transplanted. Sow pumpkin seeds 3 per pot and then thin to one plant per pot once pumpkin seedlings are established.

Germination

These seeds germinate best in soils around 70°F and 95°F. Germination will take 6-10 days.

Transplanting Into the Garden

Transplant pumpkin starts when the soil is warm enough - approximately 70°-90°. Use black plastic to warm the soil. Put pumpkin seedlings with their peat pots into moist, warm soil and water thoroughly.

Watering

Pumpkins need to be watered regularly throughout the growing season. Keep the pumpkins evenly moist and water deeply during dry spells. To prevent mildew, water pumpkin plants at their base, don't water the pumpkin foliage. Watering the pumpkins in the early morning also helps prevent mildew.

Harvesting

Pumpkins are mature when the stems connecting the pumpkin to the vine begin to shrivel. Pumpkins can be harvested whenever they are a deep, solid color (orange for most varieties) and the pumpkin rind is hard. If the pumpkin vines remain healthy, harvest in late September or early October, before heavy frosts.

Harvest pumpkins before the first hard frost. Cut pumpkins from the vines carefully, using pruning shears or a sharp knife and leave 3" to 4" of stem attached. Snapping the stems from the vines results in many broken or missing "handles." Pumpkins without stems usually do not keep well. Wear gloves when harvesting pumpkins because many varieties have sharp prickles on their stems.

Post-Harvest Handling

Wash and dry pumpkins thoroughly. Avoid cutting and bruising the pumpkins when handling them. Pumpkins that are not fully mature or that have been injured or subjected to heavy frost will not store very well.

Storage

Pumpkins can be stored for several weeks in a root cellar but they do not keep as well as other squash varieties. Pumpkins will keep for 2-3 months in temperatures from 50° to 55° and 50%-75% relative humidity. Cure the pumpkins for several days in sunlight before storing them. Bring the pumpkins in at night if there is a frost predicted.

Diseases

Anthracnose, Bacterial Wilt, and Downy Mildew.

Pests

Cucumber Beetles and Squash Vine Borers.

Comments

To grow giant pumpkins use one of the jumbo varieties. Plant the pumkins in early June and allow 150 square feet per hill. Thin the pumkin plants to one or two of the best plants. High fertility, proper insect control and shallow cultivation are essential. Remove the first two or three female flowers after the pumkin plants start to bloom so that the plants grow larger with more leaf surface before setting fruit. Allow a single pumpkin to develop and pick off all female flowers that develop after this pumpkin has set on the plant. Do not allow the vine to root down at the joints near this developing pumpkin because these varieties develop so quickly and so large that they may actually break away from the vine as they expand on a pumpkin vine anchored to the ground.

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Growing Radicchio

Family: *Asteraceae*
Genus and Species: *Cichorium intybus*

Radicchio has been a part of our diet since Roman times. Plinio the Old (23-79 A.C.) refers to Venetian lettuce in his Naturalis Historia, emphasising its purifying qualities. In ancient times radicchio was used for medicinal purposes and was particularly indicated for the treatment of insomnia.

Radicchio is a type of chicory with reddish purple leaves and cloud white veins. Radicchio adds a zesty flavor to salads and is often referred to as Italian chicory. There are two major groups of radicchio: head types leaf types.

Head types are harvested as an entire plant and leaf types are harvested leaf by leaf. Both are easy to grow in most garden soils.

Climate

Radicchio grows well during the cooler spring and summer months in many locations. If radicchio matures during the warmest months of summer, the leaves turn bitter. Radicchio grown in the autumn or over the winter retains its sweet flavor. In cold climates, grow radicchio in a cold frame for continual harvest throughout the cold months.

Soil

Radicchio grows well in most soils. Loose, fertile soils that have plenty of nutrients and good drainage are ideal for growing radicchio. Radicchio grows well in containers, pots, or raised beds. Grow radicchio interspersed between other plants in your garden. Radicchio's red leaves are very showy and it grows well under the leaves of other plants in partial shade. Radicchio grows best in soils with a pH of 5.5-6.8.

Spacing

Radicchio plants should be spaced 8" apart in all directions.

Direct Seeding

Direct seed radicchio outside in successive plantings for the most practical crop. Successive seedings of radicchio ensures a continual harvest rather than a huge harvest all at once. Sow radicchio seeds every two weeks from midsummer through autumn or direct seed radicchio into prepared beds as soon as the soil can be worked in the spring. Prepare the bed and rake it for a smooth finish, sow 1-2 radicchio seeds every 4", ¼" deep in rows 8" apart. Thin plants within a row to every 8" once they are established. Space beds at 12"-18" apart.

Seeding For Transplants

Radicchio can be started in open flats or in cell packs 8 weeks before the last frost. Sow radicchio seeds in moist growing mix and thin to 1 plant every 2" once seedlings have sprouted the first set of true leaves.

Germination

These seeds germinate best in soils around 60°F-65°F. Germination will take 5-7 days.

Transplanting Into the Garden

Transplant radicchio starts to the garden when they are 4" tall. Make sure the soil is moist and the radicchio seedlings do not dry out during transplanting. Water the radicchio seedlings well until they are firmly established.

Watering

Keep radicchio evenly moist for the most tender leaves. Radicchio leaves that are stressed due to water shortage will turn bitter and taste terrible.

Harvesting

Head Varieties: Radicchio heads are mature when the heads are firm and plump.

Leaf Varieties: Radicchio leaves can be harvested anytime after the leaves beging to open.

Head Varieties: Cut the whole radicchio head off the plant just above the soil line.

Leaf Varieties: Harvest the outer radicchio leaves as you want them. Harvest and disgard any older leaves as well.

Post-Harvest Handling

Clean the radicchio of dirt and cool using hydro cooling. Hydro cooling is the process of spraying or immersing vegetables in chilled water. Dry radicchio thoroughly before storage.

Storage

Radicchio is highly perishable and deteriorates rapidly with increasing temperature. Radicchio can be stored at 32° for 2 to 3 weeks at 98%-100%.

Radicchio is very sensitive to ethylene gas so do not store radicchio with vegetables and fruits that give off ethylene gas such as apples and pears.

Diseases

Radicchio is relatively disease free.

Pests

Radicchio is relatively pest free.

Comments

Older varieties of radicchio need to be cut back before the head forms.

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Growing Radishes

Family: *Brassicaceae*
Genus and Species: *Raphanus sativus*

Radishes have been seen as an appetite stimulant for thousands of years. Horace of Rome said radishes were a vegetable "to excite the languid stomach." Today, radish "festivals" are held in countries around the world and radishes are enjoyed in Russia, China, India, the Middle East as well as throughout Europe and North America.

Radishes are a spicy additions to salads and salsa. Radishes provide a refreshing taste that is cooling and invigorating. There are many different varieties of radish from red and pink to white and purple. In many Asian countries and increasingly in this country, daikon radishes are used fresh, pickled, or dried in many dishes.

Climate

Radishes grow best in the cool months of early spring and early summer or in the autumn and winter. If radishes are grown in too much heat with sporadic watering, they will become spicy and tough. Given the right climactic conditions: cool temperatures and moist soil, radishes will be a tender crop.

Soil

Grow radishes in cool moist soil. Above all, radishes like consistency - don't let the soil dry out during the growing season. Loose, fertile soil that retains water but isn't soggy is perfect. Mix in organic matter like leaves or compost for an extra boost. Loosen the soil to a depth of 10" before sowing radish seeds. Radishes will grow best in soil temperatures between 60° and 65°. Soil pH should be 6.5 or higher. Soil pH over 6.8 will help manage club root.

Spacing

Radishes grow quickly, most radish varieties mature in 25-35 days. This makes radishes perfect for marking the rows of slower germinating crops like carrots or parsnips. Sow radish seeds in loosened soil about ½" deep. Keep them 1-2" apart for small varieties and up to 6" apart for larger varieties. Grow several rows of radishes in a bed but keep your beds at least 2' apart.

Direct Seeding

Direct seed radishes in prepared beds ½" deep in loosened, moist soil in early spring and fall in cool climates. In warm climates, sow radishes in late fall to grow through the winter.

Seeding For Transplants

Transplanting radishes is not normally practiced.

Germination

These seeds germinate best in soils around 45°F-90°F. Germination will take 4-12 days.

Watering

Radishes need consistent moisture. If the soil dries out during their growth, radishes will become bitter and mealy. Keep radishes evenly moist throughout the growing season. Use a straw mulch to help retain soil moisture.

Harvesting

Radishes are mature for a short time, if left in the ground too long radishes will become pithy and mealy. Most radishes take 25-35 days to mature, so watch them during this time and pick a radish every so often to determine their maturity.

Harvest radishes by gently grasping the top and pulling the radish plant from the ground. Use a hand shovel to loosen soil of necessary.

Post-Harvest Handling

Wash and dry radishes thoroughly. Radishes benefit from pre-cooling such as hydro cooling. Hydro cooling is the process of spraying or immersing vegetables in chilled water. Dry radishes thoroughly before storage. Washing radishes in chlorinated water will reduce instances of black spot.

Storage

Store radishes at 32° and 95% - 100% relative humidity. Radishes will last 1-2 weeks in ideal conditions.

Diseases

Radishes are relatively disease free.

Pests

Aphids, Flea Beetles, and Cabbage Maggots.

Comments

Radishes can be grown interspersed with other crops.

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Growing Rutabaga

Family: *Brassicaceae*
Genus and Species: *Brassica napus*

The rutabaga is a relative newcomer. Rutabagas are thought to have evolved from a cross between a wild cabbage and a turnip. The earliest records of rutabagas are from the 17th century in Southern Europe where rutabagas were first eaten as well as used for animal fodder.

Because rutabagas thrive cooler climates, they became popular in Scandinavia, but especially in Sweden where the rutabaga is known as a 'swede.' In America, rutabagas were first cultivated in the northern parts of the country in the early 1800s. Today, Canada and the northern states are the prime producers of the rutabaga.

Climate

Rutabagas can be grown as summer or fall crops in cool regions or as winter crops in warmer locales. Rutabagas need cool temperatures, even frosts, to finish perfecting their hearty flavor. Rutabagas do best in full sun although they will tolerate light shade.

Soil

Rutabagas need consistent nutrients throughout the growing season. Mix compost into the soil during the growing season or fertilize with a complete organic fertilizer like seaweed or fish emulsion to obtain the best results. Rutabagas like loam or sandy loam soils. You will like these soils too when you harvest the big vegetables in autumn or spring. Digging rutabagas out of a soil that is compacted is frustrating and difficult. Loam soils are lighter and easier to dig in which makes harvesting a cinch. Rutabagas grow best in soil temperatures between 60° and 65° with a soil pH of 6.3 to 6.5.

Spacing

Space rutabagas 3"-4" apart within rows 16"-20" apart. Plant several rows of rutabaga per bed. Space beds 18"-24" apart.

Direct Seeding

Direct seed rutabagas as soon as the soil warms to 60°-65°. Do not tamp the soil. Use black plastic to warm the soil. Plant rutabaga seeds ½" deep in moist, warm soil. Thin rutabaga plants to 3"-4" as soon as the rutabaga seedlings are established.

Seeding For Transplants

Transplanting rutabaga is not normally practiced.

Germination

These seeds germinate best in soils around 60°F-85°F. Germination will take 3-5 days.

Watering

Keep rutabagas evenly moist throughout the growing season. If your soil drains very well, more frequent waterings may be necessary.

Harvesting

Rutabagas are mature when the roots or tops are large enough to use. Harvest fall crops after the first frost, which can sweeten the flavor of the roots.

To harvest rutabagas, gently dig the plant up and cut the leaves off 1" from the top of the root.

Post-Harvest Handling

Wash and dry rutabaga thoroughly.

Storage

Store rutabaga at 32° and 98% - 100% relative humidity. Rutabaga will last 120-180 days in ideal conditions.

Diseases

Club Root, Black Rot, Black Leg, Wirestem, Alternaria Leafspot, and Downy Mildew

Pests

Aphids, Cabbage Loopers, Imported Cabbageworm, Cutworms, Flea Beetles, and Diamond Back Moth.

Comments

Use floating row covers for the first couple of weeks to protect the rutabaga seedlings from early spring insects.

Mulch the your rutabaga heavily and continue to harvest your rutabaga crop after the first fall frost up until the ground freezes.

Rutabaga leaves are also edible - especially when young.

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Growing Scallions

Family: *Liliaceae*
Genus and Species: *Allium fistulosum*

Green bunching onions are known by several names depending on where you live. Scallions, green onions, and spring onions are just some of the names you'll find. All of these names can be used for immature onions. The true bunching onions are a different species from that of the immature bulb onion. They are, in fact a perennial and will multiply into bunches of onions - thus their name. For the record, this primer is about true bunching onions - or scallions *Allium fistulosum*.

Scallions can be grown in the same way as onions by direct seeding or transplanting. Scallions are tender and delicious and are easy to grow in containers, raised beds, patio gardens, even window boxes.

Climate

Scallions will grow in many climates. The most important factor for growing scallions is the amount of daylight they receive.

Soil

Next to daylight, soil is the key to growing good scallions. Deep, loose, fertile, friable soil works well for growing scallions. Mix in compost or rotted manure to your bed before you plant. Scallions will grow best in soils with a pH of 5.3 to 6.0.

Spacing

Spacing is for convenience sake with scallions. Choose a spacing that suits your needs.

Direct Seeding

Direct seeding scallions provides the least amount of disturbance to the growing cycle. Scallions grown by direct seeding are more resistant to disease. Direct seeded scallions take longer to reach maturity so it is not always the best option in northern climates. Sow scallion seeds in a prepared bed after the soil has warmed to 50°. Sow scallion seeds in rows about ¼" to ½" deep. Thinning is not necessary.

Seeding For Transplants

Scallions can be started indoors on heat mats and underneath growing lights 8-10 weeks before the last frost. Sow 2-5 scallion seeds per cell in a cell tray. Cover seeds with about ½" of light potting mix and mist to moisten the mix. Thin seedlings no more than 3 per cell after the first true leaves appear.

Transplanting Into the Garden

Scallions grow best when the early part of their growth cycle is cool. Plant scallions in early spring in cool climates. In mild winter areas, plant scallions in the fall to grow through the winter. Plant scallion starts in a moist, prepared bed. While spacing is not that important, aim for 2"-3" between plugs.

Watering

Scallions do not need to be constantly moist, but their shallow root systems makes them sensitive to drought. Do not let the soil dry out to the level of the scallion roots. Use straw mulch to help retain moisture and keep out weeds.

Harvesting

Scallions are ready when they reach the thickness of a No.2 pencil.

Harvest scallions by gently pulling on the green tops. Use a garden fork to carefully loosen soil around the scallions if needed.

Post-Harvest Handling

Scallions benefit from cooling immediately after harvest. Clean the scallions of dirt and cool using hydro cooling. Hydro cooling is the process of spraying or immersing vegetables in chilled water.

Storage

Scallions should be stored at 32° and 95% to 100% relative humidity. Scallions are quite perishable and are normally marketed or eaten promptly. Scallions can be stored 7-10 days at 32° if moisture loss is prevented.

Diseases

Botrytis Leaf Blight, Purple Blotch, Pink Root, Downy Mildew, Damping Off, White Rot, and Nematodes

Pests

Onion Thrips and Maggots

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Growing Spinach

Family: *Chenopodiaceae*
Genus and Species: *Spinacia oleracea*

Spinach is an easy and nutritious plant to grow. Spinach has the highest amount of vitamins A & B2 of any common crop and is packed with iron, calcium, and protein. Choose slow bolting spinach varieties for growing in warmer weather.

Climate

Spinach is a cool season crop that likes damp conditions. Spinach is one of the first greens up in the spring. Sow spinach seed in a sunny spot in the fall or spring for a spring harvest. Spinach prefers partial to full sun. But can't tolerate hot weather.

Soil

Spinach loves an organically rich soil and well drained beds. Prepare the bed by amending the soil with compost or well-rotted compost. Muck soils are best as they provide spinach with the necessary organic matter and high, uniform, moisture content. A pH of 6.2 to 6.9 is optimum. Spinach has a deep taproot so cultivate the soil to at least 12" prior to planing spinach seed.

Spacing

Spinach plants should be 3" apart in rows 12" to 18" apart in beds at least 2' wide. Spinach is an easy plant to grow and spacing can be adapted to suit your needs. If you plan to sow spinach seeds often for an ongoing harvest, use a tighter spacing of 1" between spinach plants.

Direct Seeding

Spinach seed can be direct sown into the garden in fall or in the spring as soon as the soil can be worked. Rake the soil and plant spinach seeds ½" deep. Thin spinach to one seedling every 3" or so.

Seeding For Transplants

Sow spinach seeds indoors 3-4 weeks before the last frost. Plant spinach seeds ½" deep in flats or cell trays (1-2 spinach seeds per cell). Once spinach seedlings have 2 pairs of true leaves, thin to one spinach plant per cell or inch.

Germination

These seeds germinate best in soils around 65°F-70°F. Germination will take 7-14 days.

Transplanting Into the Garden

Transplant spinach starts as soon as soon as soil can be worked. While spacing is not that important, aim for 2"-3" between plugs.

Watering

Spinach needs to be evenly moist throughout its growing season. Use of a straw mulch on the spinach beds will help retain soil moisture.

Harvesting

Spinach is ready to harvest when the spinach leaves are big enough to pick.

Harvest spinach by either cutting the leaves away from the spinach plant or by pulling the whole spinach plant out.

Post-Harvest Handling

Spinach leaves benefit from cooling immediately after harvest. Wash the spinach leaves in chilled water (hydro cooling).

Storage

Spinach leaves should be stored at 32° and 95% to 100% relative humidity. Spinach leaves are quite perishable and are normally marketed or eaten promptly. Spinach leaves can be stored 10-14 days.

Spinach is sensitive to ethylene gases so do not store it with fruits and vegetables that produce ethylene gas.

Diseases

Anthracnose, Spinach Blight, Damping Off, and Downy Mildew.

Pests

Flea Beetles, Crown Maggots, Leafhoppers, Loopers, Army Worms, Aphids, Leaf Miners, and Slugs

Comments

Use a sharp pair of scissors to thin spinach seedlings so as not to disturb the remainins spinach plants.

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Growing Summer Squash

Family: *Cucurbitaceae*
Genus and Species: *Cucurbita pepo*

Summer squash is thought to be native to the Americas. Summer squash has been found in Central America and Mexico as far back as 7000 BC. Summer squash spread throughout North America from Central America. The name squash is apparently derived from the Algonquin "askoot asquash", meaning "eaten green". Summer squash found its way to Europe when the early explorers returned home.

There are four basic categories of summer squash: straightneck, crookneck, scallop (aka patty pan squash), and zucchini (aka cozelle). Each summer squash variety has its own delicate flavor that can be incorporated into salads, pastas, pasta salads, bean salads, roasted vegetables, or pizza topping. On top of that, summer squash flowers are edible too and are even considered a delicacy in Italy and the United States.

Climate

Summer squash is extremely frost sensitive. Summer squash needs 3 months of warm, frost free conditions to produce fruit.

Soil

Summer squash needs fertile, aerated soil that is warm enough for germination (70°-90°) and warm enough for growing (65°-75°). Summer squash takes well to soil amended with compost or well-rotted manure. Summer squash grows best in soils with a pH between 5.5 and 6.5. Summer sqash needs moderate amounts of potassium and phosphorus and high amounts of nitrogen.

Spacing

Grow summer squash in a corner of the garden and train the vines to grow outside of the garden. Give summer squash about 2' apart in rows that are 2' apart.

Summer squash can also be grown in soil hills. To plant summer squash in hills, set one plant per hill and space the hills 4'-5' apart. Make the hills by mounding topsoil, compost, and well-rotted manure. Summer squash is a heavy feeder and when grown in these hills are more likely to get what they need.

Direct Seeding

Direct seed summer squash once the danger of frost is past and soil temperatures are between 70° and 90°. Use black plastic to warm the soil if needed.

Seeding For Transplants

Summer squash seeds can be started indoors one month before the last frost. Sow summer squash seeds in peat pots or cell trays ½" deep. Place the pot or cell trays under grow lights. Sow summer squash seeds 3 per pot/cell then thin to one squash plant once squash seedlings are established.

Germination

These seeds germinate best in soils around 70°F-90°F. Germination will take 6-10 days.

Transplanting Into the Garden

Transplant summer squash starts when the soil is 70°-90°. Use black plastic to warm the soil. If using peat pots, slit the pots and place them into moist, warm soil. Water thoroughly.

Watering

Summer squash need to be watered throughout the growing season. Keep summer squash evenly moist and water deeply during dry spells. Water the bases of the summer squash plants to prevent mildew. Don't water the foliage. Watering summer squash in the early morning also helps prevent mildew. Summer squash also needs a lot of nutrients. Summer squash plants benefit from a monthly application of a complete organic fertilizer like fish emulsion or seaweed.

Harvesting

Summer squash are mature when they turn their mature color. Straightneck, crookneck, and zucchini summer squash are ideal when they reach 1½"-2" in diameter. Scallop summer squash are ideal at 3"-4" in diameter.

Harvest summer squash often. To avoid damaging the squash plant it is best to cut the summer squash from the vine rather than snapping it free.

Post-Harvest Handling

Wash and dry summer squash thoroughly. Avoid cuts and bruises when handling.

Storage

Summer squash held at 41°-50° and 90-95% relative humidity will last for 7-14 days.

Summer squash are sensitive to ethylene gas so do not store them with fruits and vegetables that produce ethylene gas.

Diseases

Anthracnose, Bacterial Wilt and Downy Mildew.

Pests

Squash Vine Borer, Squash Bugs and Cucumber Beetles.

Comments

Squash plants are very prolific. Plant only one or two plants for home use or you'll be swamped in squash.

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Growing Sweet Corn

Family: *Gramineae*
Genus and Species: *Zea mays*

Corn first originated in tropical America more than 4000 years ago. Corn traveled from the South American Andes up to Canada through the trades of Indian tribes. Corn was given as a gift to the first white settlers and in fact, enabled them to survive that first year. Today, corn is grown on more acres in the United States than any other crop.

Sweet corns come in two classes. The first are the open pollinated varieties, which have been around for many, many years. Their flavors are milder than the hybrid super sweet varieties you find in most markets and farm stands. The hybrid super sweet varieties are the result of selective breeding, which emphasize desirable corn characteristics like sweet taste and increased length to the harvest period.

Sweet corn kernels come in only a few colors: yellow, white, or a mixture of both (bicolor).

Climate

Sweet corn is a warm season crop that requires a minimum soil temperature of 50°F for soil germination. For maximum growth and yield plant sweet corn in full sun.

Soil

Sweet corn thrives best in a sandy loam soil with a pH of 6.0 to 6.8. As a general guide, plant early corn in light soil (sand or loam) and late corn in heavier soil (silt, clay) when there is an option. Light soils warm up faster than heavy soils, so seed germinates more readily. Under hot, dry midsummer conditions, heavier soils have the advantage of holding much more moisture than light soil.

Sweet corn requires rich soil with ample nitrogen and moisture. Amend the soil well-aged manure or compost. Plant corn in an area that had healthy beans or peas the previous year is helpful because these legumes contribute more nitrogen to the soil especially if an inoculant was used.

Corn should be planted where the soil has been prepared to about 6"-8" deep. Make sure clumps are broken up and debris such as rocks and twigs removed.

Spacing

Corn is a tall plant susceptible to wind and therefore benefits from blocks of at least 4 rows of corn plants for support and pollination. Corn should be spaced at 8"-10" for early cultivars and 9"-12" for late cultivars, within rows spaced 30"-36" apart.

If planting more than one cultivar, space the corn stands at least 250' apart to prevent cross-pollination. An alternate method to prevent cross-pollination of different corn cultivars is to stagger planting dates of the different cultivars by a minimum of 14 days.

Direct Seeding

Sow corn seed 1" deep, 2-3 seeds per 6"-8" within rows spaced 30"-36" apart. Thin corn seedlings to 1 seedling per 6"-8". Gently tamp and rake soil smooth after planting seed.

An alternate method for planting corn is to use hills. Sow 5-6 seeds per hill. Space hills at 36" apart. Thin to 3 healthy corn seedlings per hill.

Sow corn seed no earlier than 10-14 days after the last spring frost date.

For a steady supply of sweet corn throughout the season, include early, mid-season, and late cultivars in your initial planting. 2-3 successive plantings of each corn cultivar, every 2 weeks, will extend the harvest season.

Seeding For Transplants

Corn is not normally transplanted.

Germination

These seeds germinate best in soils around 80°F-95°F. Germination will take 7-10 days.

Watering

It is important to maintain an adequate level of soil moisture during critical periods of corn development. Corn water consumption will rise dramatically as it approaches tassel formation and silking.

A properly spaced stand of corn uses water most efficiently. Corn that is poorly spaced will experience excessive water loss from bare soil.

Harvesting

Corn is fully mature when the stalks are anywhere from 5'-7' tall or more and have at least one or two ears. Corn silk should actually start to turn brown and the kernels should be full to the touch and produce a milky white fluid when broken.

To harvest, pull down quickly on the ear of corn and turn it at the same time.

Post-Harvest Handling

Corn will quickly begin to convert sugars into starch after harvest so it is very important to quickly cool the ears after harvest. The rate of conversion of sugars to starch in the corn kernels increases with the rise of temperature.

Storage

Corn should be stored at 32°F and relative humidity of 98%-100%. In ideal conditions corn may last up to 4-6 days.

Diseases

Smut and Stewart's Disease (bacterial wilt)

Pests

Corn Borer, Corn Earworm, Flea Beetle, and Cutworm

Comments

"Normal" sweet corn (su) is corn with kernels that contain moderate but varying levels of sugar, depending on variety. Sugars convert to starches rapidly after harvest. All of the open-pollinated heirloom varieties are normal sweet corn.

"Sugar-enhanced" (se, se+, or EH) is corn with a gene that increases tenderness and sweetness. Additionally, conversion of sugar to starch is slowed.

"Super-sweet" or "Xtra-sweet" (sh2) is corn that greatly increases sweetness and slows the conversion of sugars to starch. The dry kernels (seeds) of this type are smaller and shriveled.

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Growing Tomatillos

Family: *Solanaceae*
Genus and Species: *Physalis ixocarpa*

Tomatillos are native to Mexico where they are known as tomate verde and tomate de fresadilla. Tomatillos are referred to as husk tomatoes, jamberberries, strawberry tomatoes, and Mexican green tomatoes.

The tomatillo is a member of the tomato family and even similar in appearance to a green tomato. The tomatillo, however, grows a thin husk that must be peeled prior to using the fruit. Tomatilloes are easy to grow. Tomatillos are an important ingredient in salsa verde and are used in many Mexican dishes. Tomatillos are grown in much the same way as tomatoes but they are hardier and less prone to diseases. Once tomatillos are established in your garden, they re-seed themselves.

Climate

Tomatillos are a hot weather crop. Tomatillos need good soil, water, and heat to do well.

Soil

Tomatillos need light, fertile soil with lots of organic matter. Soil temperature should be at least 80° for good tomatillo seed germination. Tomatillos like deep loose soil - at least 12". Mix in compost or chopped leaves to enhance the soil. Tomatillos do best in soils with a pH of 6.0 to 7.0. Tomatillos need low amounts of nitrogen, phosphorus, and potassium.

Spacing

Space tomatillos 30" apart within rows 2' apart.

Direct Seeding

Direct seed tomatillos in warm climates with long growing seasons in prepared moist beds. Plant seeds ½" deep in rows 2' apart. Thin tomatillo seedlings to 30" after seedlings are established. Keep tomatilloes evenly moist during this time.

Seeding For Transplants

Sow tomatillo seeds ¼" deep in cell trays in late winter. Keep tomatillo seeds evenly moist. Place cell trays under grow lights if available. Transplant tomatillos to larger pots when the seedlings are 3"-5" tall. When transplanting, bury the tomatillo seedlings with soil so 1" of the seedling is visible.

Germination

These seeds germinate best in soils around 80°F-90°F. Germination will take 7-14 days.

Transplanting Into the Garden

Harden-off tomatillo seedlings two weeks before planting time. Choose a planting date when the soil has warmed to 80°. Bury the tomatillo plants so that only 4" of the starts are visible. Water the tomatillo transplants well and mulch them with straw.

Watering

Tomatillos thrive on even moisture. Use straw mulch on the tomatillo beds to help retain soil moisture. Water tomatillos deeply during dry spells. Water the base of the tomatillo plant, not the foliage. Watering the foliage when tomatillo fruit is maturing can cause the fruit to crack.

Harvesting

Tomatillos are ready for harvest when the fruit fills in the husk. The freshness and greenness of the tomatillo husk is a quality criteria. The tomatillo fruit should be firm and bright green as the green color and acidic flavor are the main culinary contributions of tomatillos.

Harvest tomatillos often and remove all over-ripe tomatillos from the plant. Use a field knife to cut the tomatillos off.

Post-Harvest Handling

Wash and dry tomatilloes thoroughly. Use forced-air cooling for tomatillos going to market. Cooling of tomatillos is primarily done to maintain a fresh green look to the tomatillo husk.

Storage

Tomatillos stored at room temperature will last about 1 week. For longer storage life, keep tomatillos at 41° to 50°F with a relative humidity of 80% to 90%.

Tomatillos are very sensitive to ethylene gas so do not store tomatillos with vegetables and fruits that give off ethylene gas such as apples and pears.

Diseases

Verticillium Wilt, Fusarium Wilt and Tobacco Mosaic.

Pests

Tomato Hornworm, Aphids, Flea Beetles, Cutworms, Spider Mites and Nematodes.

Comments

Tomatillos are heavy feeders and respond to environmental conditions much the same as tomatoes. Occassionaly fertilize tomatillos with fish emulsion.

References

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Growing Tomatoes

Family: *Solanaceae*
Genus and Species: *Lycopericon lycopersicum*

Tomatoes are one of the most widely grown vegetables in the world. Americans consume over 12 million tons of tomatoes annually; that's an average of 18 pounds of fresh tomatoes and 70 pounds of processed tomatoes per person. Tomatoes are loaded with vitamin C and E and minerals that are very good for you.

Tomatoes are planted by an estimated 85% of home gardeners each year. Tomatoes are so popular because they are relatively easy to grow and can be grown anywhere. Fresh tomatoes have a delicious flavor and can be easily preserved for out-of-season use.

Tomatoes are actually a tropical fruit (botanically speaking). Tomatoes are thought to have originated in South America, in what is now Peru, Bolivia, northern Chile and Ecuador. Wild tomatoes can still be found in this area, including eight different species of tomatoes in Peru.

Tomatoes were first used in North America as a medicine. By the mid-18th century, tomatoes were cultivated from seed in the Carolinas, and by the late 1700s the migrating farmers took tomato seeds north and west. Thomas Jefferson introduced tomatoes to his table in 1781. By the early 19th century tomato seeds were planted widely and tomatoes were common in cooking.

Climate

Tomatoes are a hot weather crop. Tomatoes came from the tropics so it stands to reason that tomatoes like heat and humidity.

Soil

Tomatoes need light, fertile soil with a lot of organic matter. Too much nitrogen can reduce tomato yields. Make sure the soil is deep (at least 12") and loose. Tomatoes are heavy feeders so mix in compost or chopped leaves to enhance the soil. Tomatoes do well in soils with a pH of 5.8 to 7.0. Tomatoes need high amounts of nitrogen, phosphorus, and potassium.

Spacing

Tomato plants have two distinct growing habits - determinate or indeterminate.

Determinate tomato plants require staking or cages to help hold the the tomato plant up so spacing should include room for the stakes or cages. In general, space the tomato plants 12"-24" apart. You should allow for some air circulation between your tomato plants.

Indeterminate tomato plants will spread out on the ground or climb a trellis if offered one. Space indeterminate tomato plants 24"-36" apart if unsupported. If you trellis your indeterminate tomatoes space them at 14"-20" inches apart.

Keep at least 2' between the rows of tomatoes.

Direct Seeding

Tomato seeds are not normally sown directly into beds. But if you want to give it a go, plant tomato seeds directly into moist prepared beds after the soil has reached 80°. Sow tomato seeds ½" deep, 6"-8" apart in rows 2' apart. Thin tomato plants to proper spacing after the seedlings are established. Water the tomato seeds evenly.

Seeding For Transplants

Sow tomato seeds indoors ¼" deep in cell trays. Keep tomato seeds evenly moist and place the trays under grow lights if available. Transplant tomato seedlings to larger, peat pots when they reach 3"-5" tall. Bury the tomato seedlings with soil so only 1" of the tomato plant is above the soil line.

Germination

These seeds germinate best in soils around 80°F-90°F. Germination will take 6-8 days.

Transplanting Into the Garden

Harden-off tomato seedlings two weeks before planting time. Choose a planting date when the soil has warmed to 80°. Bury the tomato plants so that only 4" of the starts are visible. Water the tomato transplants well and mulch them with straw.

Watering

Tomatoes thrive on even moisture. Use straw mulch on the tomato beds to help retain soil moisture. Water tomatoes deeply during dry spells. Water the base of the tomato plant, not the foliage. Watering the foliage when tomatoes are maturing can cause the fruits to crack.

Harvesting

Tomatoes are mature when they reach their mature color. Keep a close eye on the unripe tomatoes once the first ripe tomato has been seen on a tomato plant. The rest will follow soon after.

As the end of the season approaches, pick the remaining tomato flowers to encourage maturation of the existing tomatoes before the killing frosts arrive.

Many people in northern climates have learned to like green tomatoes which can be harvested when the tomatoes reach their mature size but haven't changed color.

Harvest tomatoes often and remove all over ripe tomatoes from the bed. Harvest by clipping the tomatoes from their vines.

Harvest all your tomatoes the night before the first hard frost. Place unripened tomatoes on newspaper in cool, dark room. Some gardeners harvest the entire tomato plant before the first frost and hang it upside down in a cool dark room. The tomatoes will continue to mature.

Post-Harvest Handling

Wash and dry tomatoes thoroughly. Use forced-air cooling for tomatoes going to market.

Storage

Ripe tomatoes stored at room temperature will last 4-7 days. For longer storage life, keep tomatoes at 62° to 68°F with a relative humidity of 90% to 95%.

Do not store tomatoes in a refrigerator as the cold will alter the tomato flavor.

Tomatoes are very sensitive to ethylene gas so do not store tomatoes with vegetables and fruits that give off ethylene gas such as apples and pears.

Diseases

Verticillium Wilt, Fusarium Wilt and Tobacco Mosaic.

Pests

Tomato Hornworm, Aphids, Flea Beetles, Cutworms, Spider Mites and Nematodes.

Comments

Training Tomato Vines

Indeterminate tomatoes need support. Tomato fruits mature more evenly when the tomato plants are trellised. Place your trellis or other supports for the tomatoes before you transplant your tomatoes into their beds. Use siskal twine liberally to tie the tomato plant to the support, don't let the branches of the tomato plant bend or they might snap from the weight of the tomatoes. Tomato plants need to be reinforced throughout the growing season so check them often and add additional support as needed.

Pruning Tomato Vines

Most tomato plants will need pruning. Pruning reduces the amount of space your tomato plants will take up. Pruning your tomato plant will encourage higher yields of tomatoes. But pruning does take more work.

Pruning involves snapping off the branch that grows in the middle of two others - often referred to as a sucker. Snap the suckers off your tomato plants as they appear. If the sucker has flowers on it - leave it. Leave a few suckers toward the top of the plant to protect the tomatoes from the sun with their leaves. But keep an eye on them and prune them as needed to keep them from growing new branches.

If unpruned, you tomato vines will become unwieldy and your tomato harvest will be less. Studies have shown that a pruned tomato plant will produce tomatoes up to 2 weeks earlier than unpruned.

Tomatoes are heavy feeders. Occassionaly fertilize tomatoes with fish emulsion.

Share your thoughts on tomatoes with others in the **Farm & Garden Forums**

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Growing Winter Squash

Family: *Cucurbitaceae*
Genus and Species: *Cucurbita pepo*

Winter squash is thought to be native to the Americas. Winter squash has been found in Central America and Mexico as far back as 7000 BC. Winter squash spread throughout North America from Central America. The name squash is apparently derived from the Algonquin "askoot asquash", meaning "eaten green". Winter squash found its way to Europe when the early explorers returned home.

There are six basic categories of winter squash: acorn, buttercup, butternut, spaghetti, delicata (aka sweet dumpling squash), and hubbard. Each winter squash variety has its own delicate flavor. Winter squash flowers are edible and are considered a delicacy in Italy and the United States.

Climate

Winter squash needs 3 months of warm, frost free conditions to produce fruit. Winter squash plants are frost sensitive. Winter squash fruits will tolerate a light frost.

Soil

Winter squash needs fertile, aerated soil that is warm enough for germination (70°-90°) and warm enough for growing (65°-75°). Winter squash takes well to soil amended with compost or well-rotted manure. Winter squash grows best in soils with a pH between 5.5 and 6.5. Winter sqash needs moderate amounts of potassium and phosphorus and high amounts of nitrogen.

Spacing

Grow winter squash in a corner of the garden and train the vines to grow outside of the garden. Give winter squash about 2' apart in rows that are 2' apart.

Winter squash can also be grown in soil hills. To plant winter squash in hills, set one plant per hill and space the hills 4'-5' apart. Make the hills by mounding topsoil, compost, and well-rotted manure. Winter squash is a heavy feeder and when grown in these hills are more likely to get what they need.

Direct Seeding

Direct seed winter squash once the danger of frost is past and soil temperatures are between 70° and 90°. Use black plastic to warm the soil if needed.

Seeding For Transplants

Winter squash seeds can be started indoors one month before the last frost. Sow winter squash seeds in peat pots or cell trays ½" deep. Place the pot or cell trays under grow lights. Sow winter squash seeds 3 per pot/cell then thin to one squash plant once squash seedlings are established.

Germination

These seeds germinate best in soils around 70°F-90°F. Germination will take 6-10 days.

Transplanting Into the Garden

Transplant winter squash starts when the soil is 70°-90°. Use black plastic to warm the soil. If using peat pots, slit the pots and place them into moist, warm soil. Water thoroughly.

Watering

Winter squash need to be watered throughout the growing season. Keep winter squash evenly moist and water deeply during dry spells. Water the bases of the winter squash plants to prevent mildew. Don't water the foliage. Watering winter squash in the early morning also helps prevent mildew. Winter squash also needs a lot of nutrients. Winter squash plants benefit from a monthly application of a complete organic fertilizer like fish emulsion or seaweed.

Harvesting

Winter squash are mature when the stems connecting the fruit to the vine begin to shrivel.

Cut the winter squash from the vine rather than snapping it free. Cut winter squash from the vines carefully, leaving two inches of stem attached if possible.

Post-Harvest Handling

Wash and dry winter squash thoroughly. Avoid cuts and bruises when handling. To ensure long storage life for winter squash the fruit must be cured and stored properly. Immature fruit are poor quality and cannot be successfully stored. Proper curing and storage slows the rate of respiration of the winter squash fruit and will prolong the storage life.

After harvesting, cure the winter squash (except for the acorn types) at a temperature of 80° to 85° and a relative humidity of 80% to 85%. Curing helps to harden winter squash skins and heal any cuts and scratches.

Do not cure acorn squash. The high temperature and relative humidity during the curing process actually reduce the quality and storage life of acorn squash.

Storage

Winter squash fully cured and held at 50°-55° and 50%-70% relative humidity will last for 84-150 days.

Diseases

Anthracnose, Bacterial Wilt and Downy Mildew.

Pests

Squash Vine Borer, Squash Bugs and Cucumber Beetles.

Comments

After 1 or 2 fruits have set on a single vine, the vine should be cut back to within a foot of the last fruit to encourage production of the winter squash fruit.

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