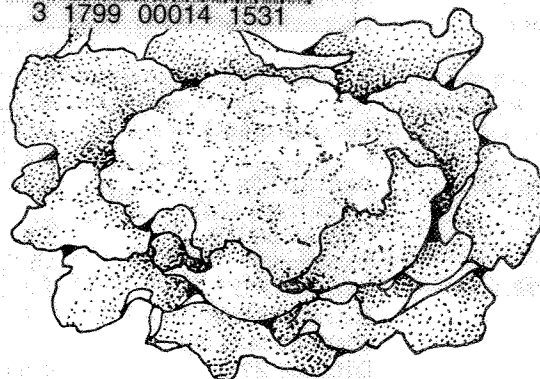




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Quick Facts

Hybrid cauliflower varieties have not found favor with Colorado growers.
Transplanting is more expensive than direct seeding and can only be justified when growing for an early market.
To obtain a successful crop by direct seeding, it is necessary to control weeds, crusting, insects and disease.
As soon as seedlings emerge they should be observed for flea beetle damage.

Cauliflower is a minor vegetable crop in Colorado with 450 A, although its acreage is rapidly increasing. The South Platte River Valley north of Denver accounts for half of this production, the San Luis Valley produces 125 A and the rest is scattered among the other growing areas of the state.

Varieties

Colorado produces cauliflower for summer-fall harvest and therefore does not use the winter varieties common in California. Among the summer-fall varieties there are a few hybrids, but they have not gained favor among growers. The most popular standard varieties are of the Snowball series: A, E, M, X and Y with Y being the most popular. Other standard varieties are Alert, Olympus, Snowflower, Snowcap, Dominant, Igloo and White Empress.

Transplanting

Transplanting can only be justified when growing for an early summer market since direct field seeding is more economical for late summer and fall markets.

The method chosen to produce transplants will depend upon the number of transplants needed

and whether transplant production is going to be a perennial operation.

For small operations it could prove most cost effective to contract out the plant production, allowing six weeks from seeding to field planting.

A protective structure will be required if transplants are to be grown in cold weather. Seed may be sown directly in ground beds, in cellular containers or in flats. The system used will dictate the seeding method used. When grown in ground beds the plants will go to the field as bare root transplants. When seeded in flats, they will be transplanted into pots or cells, then grown out for four weeks before going to the field.

It requires six weeks to produce a transplant. They should be germinated at 75° F, then grown at a night temperature of 55° for five weeks. The final week, the night temperature should be held to just above freezing in order to harden the plants. During the growing period they should be fertilized with 1 ounce of 10-52-17 fertilizer per gallon three times a week. If cold temperatures do not occur during the sixth week, water should be withheld to the point where they are slightly wilted most of the time.

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It is a good idea to pre-irrigate the field then supply each plant with 0.5 pint of water containing two pounds of 10-52-17 per 50 gallons. Transplanting should begin after 12 N to avoid excess wilting. Bare rooted plants should only be used in cool weather. Irrigation should follow as soon after transplanting as practical.

Field Preparation

A good seed bed is desirable for transplanting and absolutely necessary for direct field seeding. With clay dominated soils, good seed bed preparation means fall plowing, mulching and listing up beds before the soil freezes.

In spring, the rough beds should be formed with a bed shaper or otherwise smoothed to form a good seed bed, destroying all weeds in the process. If planting is delayed for more than three days after bedding, it should be re-worked to eliminate any weeds which might have germinated. Soil which has been formed with a bed shaper is subject to blowing almost as badly as floated ground.

Direct Field Seeding

To obtain a successful crop by direct seeding, it is necessary to control weeds, crusting, insects and diseases. It is best to use a field which has not been planted to cauliflower or related crops for four years. If nematodes or disease are known to be present, fumigation should be considered. Chemical weed control and seed protection are standard measures when direct seeding.

Seed should be planted $\frac{3}{4}$ -inch deep, 2 to 6 inches apart, in rows 30 inches apart, or in twin row beds 12 inches apart on 40-inch centers. The initial planting distance reflects the confidence of the grower in obtaining a stand. There is three times as much stand insurance at 2 inches than at 6 inches. At the first sign of a crust, seed beds should be rolled, or irrigated if emerging seedlings are caught in the crust.

As soon as seedlings emerge, they should be observed for flea beetle damage and protected. Then, as soon as the tractor operator can see the rows, seedlings may be cultivated. The first cultivation usually uses a disk on either side of the row. The disks cut the crust and trash, and thereby prevent seedlings from being uprooted by any shifting of the crust during cultivation. Disks are followed by knives and the knives by duck feet so that all weeds between the rows are eliminated. Ditchers then follow along to re-form the furrows.

The disks are removed after the first cultivation and knives are moved further apart with each subsequent cultivation to prevent damage to the cauliflower.

As soon as plants begin to crowd, they should be hoed and thinned, leaving a plant every 6 inches. When they begin to crowd at this spacing, they are thinned to the final stand which may be 12 to 15 inches depending on variety.

The advantages of direct field seeding is that the cost of the transplanting operation is eliminated and heading is likely to occur in cooler weather when heads hold longer.

Herbicides

Treflan (trifluralin), Dacthal (DCPA) and Devrinol (napropamide) are recommended for cauliflower. Treflan, which is currently the most popular, and Devrinol are applied preplant and incorporated before seeding. Dacthal is applied preemergence at seeding. The labels should be consulted in regard to rates of application and soil type as cole crops have shown marginal tolerance to Treflan at recommended rates.

Insect Control

Flea beetles may infest and seriously damage the crop during seedling stages. Vigorously growing plants can often outgrow flea beetle injury but severe infestations need control. Applications of insecticides rarely persist longer than five to seven days on growing foliage. Edges of fields bordering permanent vegetation are usually most seriously damaged.

Later, protection against cabbage looper, imported cabbage worm and diamond-back moth will be required. Damage done by these insects prior to head formation has little effect on yield. After head formation, control is very important to prevent product contamination by insects.

Use of a wetting agent is often desirable when making applications to improve coverage of waxy leaves.

Diseases

Alternaria leaf spot (caused by *Alternaria brassicae*) causes yellow, concentric spots on foliage which may yellow and die.

Black rot (caused by *Xanthomonas campestris* pv. *campestris*) produces yellow, angular spots which progress inward from the leaf margin. Leaf veins become dark brown to black, and heads may be deformed.

Club root (caused by *Plasmodiophora brassicae*) causes plant yellowing and wilting, with large spindle-shaped galls on roots.

Damping off and seedling blight (caused by *Pythium*, *Rhizoctonia* and *Fusarium* species) causes a pre- or postemergence wilting and death of seedlings. Roots and hypocotyls are discolored, watersoaked and/or rotted.

Downy mildew (caused by *Peronospora parasitica*) produces yellow spots on the upper surface with bluish to white fungal growth on the lower surface of leaves.

Nematodes cause poor root development, root galls, root cysts, and/or stunted and yellowed plants.

Wirestem (caused by *Rhizoctonia solani*) produces a darkened and girdled stem at the soil line.

Plants are stunted and a leaf rot is often present near the soil.

Disease management recommendations rely upon crop rotation, pesticides, clean seed and transplants, good seedbed preparation, and other production guidelines that reduce plant stress.

Tying

Cauliflower must be white to be marketable. It can only be white if it is protected from the sun. Heads produced by late fall and winter crops escape the direct rays of the sun because the sun is low in the southern sky and leaves effectively block the sun from this angle. However, summer grown cauliflower must be tied since the sun passes directly overhead.

Tying is accomplished by gathering the leaves when the white button is first visible, raising them over the top of the plant and tying them. This is generally done by hand, although tying machines

are being used experimentally. The leaves are gathered and held with the left hand, while a rubber band is transferred from one hand to the gathered leaves, forming a canopy which protects the head from the sun.

Since a field may be tied more than once, it is a good idea to use different colored bands, so that a given color may be harvested at each cutting.

Harvesting

Harvesting is done selectively by hand if the field was tied more than once. If the field was not tied or tied only once, the field may be unselectively harvested by machine. When hand harvesting, only the heads tied with a common color are harvested. This is done by severing the plant below the head and loading them out of the field to the packing shed where the heads are trimmed, packed, iced and shipped.

Table 1: Insecticide recommendations.

Insect	Insecticide	Rate (lb actual/A)	Days to harvest	Remarks
Flea-Beetle	carbaryl (Sevin, Savit, Sevimol, etc.)	1.0	3	
	endosulfan (Thiodan, Tiovel)	0.75-1.0	7	
	Methoxychlor	1.0-2.0	14	
	Disyston	As labelled	42	Restricted use. Planting treatments do not allow granules to contact seed.
Cabbage Looper, Imported Cabbage-worm, Diamond-back Moth and other worms	<i>Bacillus thuringiensis</i> (Dipel, Javelin, Thuricide)	As labelled	0	Microbial insecticide, stops feeding within hours, dies in 2-3 days
	permethrin (Ambush, Pounce)	0.05-0.2	1	Restricted
	mevinphos (Phosdrin)	0.25-1.0	1-3	Restricted
	Pydrin	0.05-0.2	3	Restricted
	methomyl (Lannate, Nudrin)	0.25-1.0	3	Restricted
	endosulfan (Thiodan, Tiovel)	0.75-1.0	7	
	Guthion	0.5-0.35	21	Restricted
	Monitor	0.5-1.0	35	Restricted
	mevinphos (Phosdrin)	0.25-1.0	1-3	Restricted
	malathion	0.4-0.8	3	
Aphid	diazinon	0.25-0.5	7	
	endosulfan (Thiodan, Tiovel)	0.75-1.0	7	
	dimethoate (Cygon)	0.25-0.5	7	
	Metasystox-R	0.75-1.0	7	
	Guthion	0.5-0.75	21	Restricted
	Monitor	0.5-1.0	14-21	Restricted

Table 2: Disease control recommendations.

Disease	Pesticide	Application Rate (acre)	Application frequency (days)	Days to Harvest
Alternaria	Bravo 500	2.25 pt	7-10	
	Dithane FZ	1.2 qt	7-10	
	Dithane M22 Sp	2.25 lb	3-10	7
	Kocide Maneb	1.2 qt	7-10	
	Dithane Z78	4-6 lb	7-14	7
Black Rot Club Root	Kocide, 101, 606	2.6 pt, 2 lb	7-10	
	Terraclor 75	2-6 lb/100 gal with ½-¾ pt/plant, 30 lb/13,100 ft, 40 lb/A	Transplant Solution In Row Broadcast	
	Terraclor 10G	200 lb/13,000 300 lb/A	In Row Broadcast	
		5.3 oz/100 lb	Seed Treatment	
Damping Off	Arasan 70s (Thiram 42s)		Seed Treatment	
	Captan 30 DD	1.2 fl oz/100 lb	Seed Treatment	
	Captan 50	15 lb	Preplant, Broadcast	
Downy Mildew	Dithane FZ	1.2 qt	7-10	
	Kocide Maneb	1.2 qt	7-10	
	Dithane M22 Sp	2.25 lb	3-10	7
	Dithane Z78	4-6 lb	7-14	7
	Kocide 101	0.5-1 lb	7	
	Kocide 606	0.6-1.3 pt	7	
	Top Cop + S	2 qt	7-10	
	Bravo 500	2.25 pt	7-10	
	Bravo W75	1.5 lb	7-10	
Nematodes	Vapam	40-100 gal	Preplant, aerate 7	
	Telone II	9-15 gal	Preplant, aerate 7-14	
	Telone C-17	10-17 gal	Preplant, aerate 7-14	
	Vorlex	7-15 gal	Preplant, aerate 14	
			Preplant, aerate 14	
Wirestem	Terraclor 75	15-20 lb in 50 gal 10-15 lb in 35 gal per 10,900 ft	Broadcast Row Drench At seeding	
	Terraclor 10G	110-115 lb per 10,900 ft	Row application prior to seeding.	