

# PLANT SCIENCES

SEED AND VEGETABLE SCIENCES (GENEVA) • 1

NEW YORK STATE AGRICULTURAL EXPERIMENT STATION, GENEVA, A DIVISION OF THE NEW YORK STATE COLLEGE OF AGRICULTURE AND LIFE SCIENCES, A STATUTORY COLLEGE OF THE STATE UNIVERSITY, CORNELL UNIVERSITY, ITHACA

## Vegetable Crop Fertilization

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Plants are living integrators of all soil and environmental factors from planting to final harvest. High yield potential due to correct soil pH, organic matter, drainage, and structure; use of quality seeds of responsive varieties; even and proper distribution of plant population; pest control; avoidance of phytotoxic substances in the soil and atmosphere; and proper crop rotation will increase yield response due to fertilizers.

Fertilization for vegetable crops depends on soil tests and crops. Soil tests measure the levels of available nutrients and pH. A sample should be taken from each field or area within a field that differs in productive characteristics from the surrounding areas. Fertilizer elements should be applied as needed to supply adequate nutrients for the crop in each different area as determined by soil tests. If the same fertilizer is applied uniformly to areas that differ in soil tests, the rates should be adjusted to meet the minimum requirements for the desired economic level of production in the areas with lowest soil tests.

Broadcast application of fertilizer before plowing or planting is an effective method for providing the crops with large amounts of nutrients. Broadcasting too long a time in advance of planting may result in loss of some elements.

Band placement of fertilizer 2 inches below and 2 inches to the side of seeds at planting time is most efficient for low to moderate rates of complete balanced fertilizers. Closer placement may injure germinating seeds and seedlings, while farther away will delay response. Each granule should contain a balance of all elements, or blends should be evenly metered to the band without segregation of ingredients or particle sizes.

### NITROGEN

Nitrogen (N) during the seedling and early stages of growth and development promotes vigorous top structures and root growth. Generally, 40 to 60 pounds of N per acre applied in a band is sufficient for early growth of direct-seeded crops. One or two applications of sidedressed N are needed during the growing season, depending on the amount of N that becomes available and losses in the soil, the kind of crop, and the time of harvest. Fertilizer N applied before planting is usually less effective than the same amount in a band plus sidedress. A gradual depletion of available N in the soil as the plants approach harvest time ensures efficient use of N.

Ammonia, urea, and diammonium phosphate are good sources of N for broadcast. Excessive rates and/or improper and close placement in a band may cause injury to seed and seedlings, especially when the soil pH is above 6.5 or 6.8 or under dry soil conditions.

### PHOSPHORUS

Phosphorus (P) is most available at soil pH 5.6 to 7.0. Uptake of P is slow during the seedling stage, then increases during rapid growth. More available P is needed in the rooting zone of plants than is taken up. Phosphorus, with a balance of other nutrients, especially N and K, in the rooting zone of seedlings stimulates uniform vigorous growth and development.

# GROWTH, DEVELOPMENT, AND MATURATION OF VEGETABLES

## SEEDLING

### (Vigorous and uniform)

1. Vigorous and uniform growth of seedlings during the first one-third of the growing season leads to a reliable, uniform quality and yield with once-over mechanical harvesting.
2. Uptake of nutrients is slow and limited to the small rooting zone of the seedlings.
3. Application of fertilizer elements in a band at planting time is essential to supply adequate and proper balance of nutrients within the rooting zone of the seedlings. Germinating seeds and seedlings are injured by excessive fertilizer salts, imbalances, and toxic substances.

## FRAME

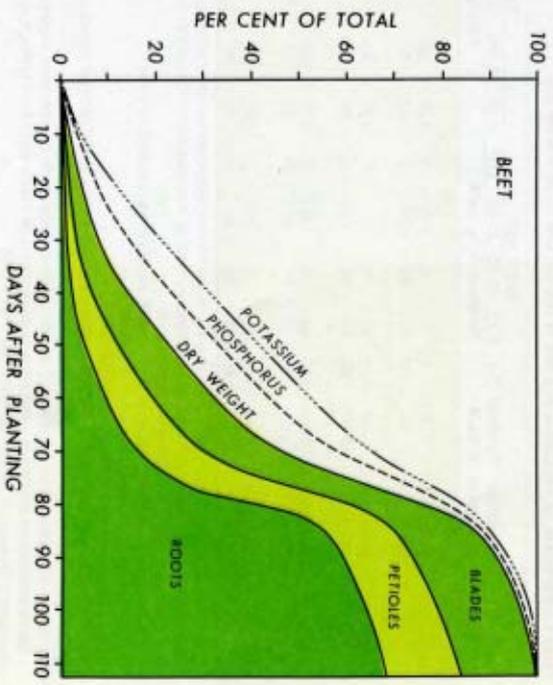
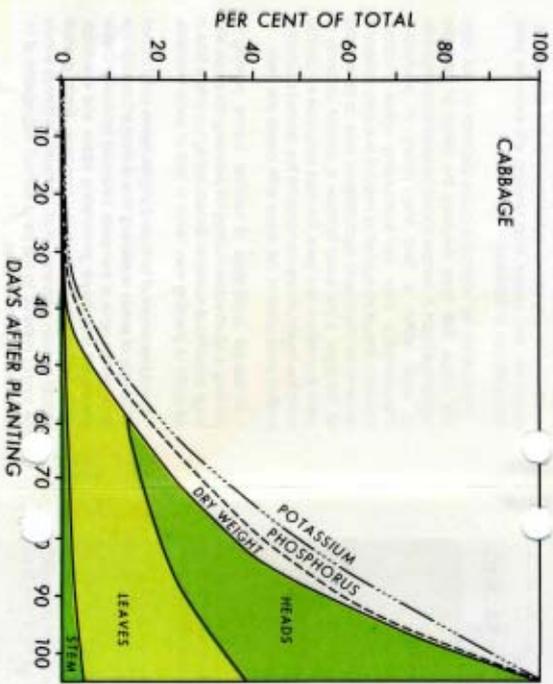
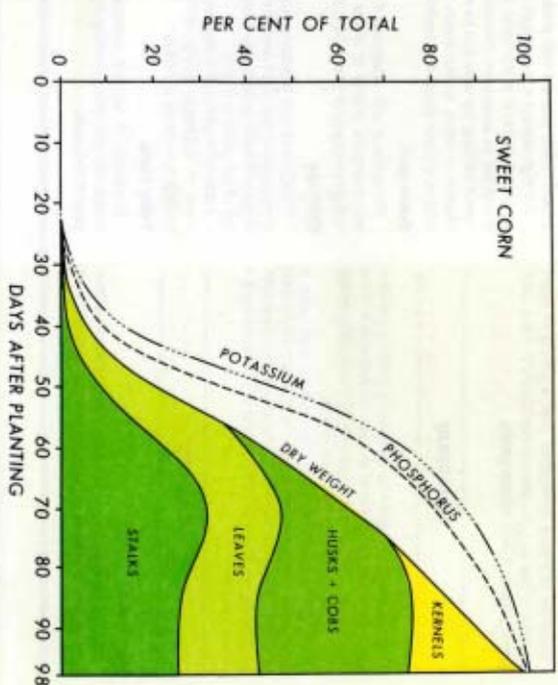
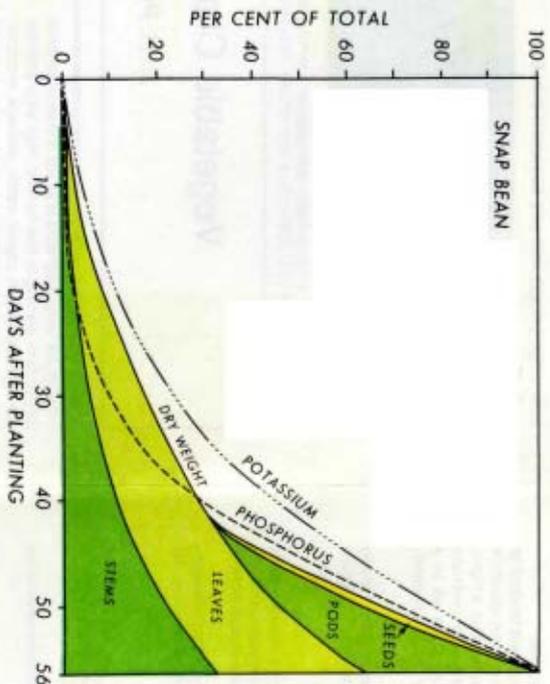
### (Determinate and sturdy)

1. Rapid growth and development of determinate, sturdy frames, plus expansion of the rooting systems into the entire soil profile during the middle one-third of the growing season are needed for full harvests.
2. Uptake of nutrients is rapid from the entire rooting zone in the soil.
3. Broadcast fertilizer before planting supplements available soil nutrients to supply the large amounts of nutrients removed from the soil. Fertile soil promotes deep rooting systems. Early sidedress applications of N during the growing season maintains rapid growth.

## MATURATION

### (Quality and yield)

1. Most processing vegetables change rapidly from the vegetative to the maturation stage during the last one-third of the growing season and are harvested as an immature stage. Reliable yields are needed to ensure a continuous supply of produce during the entire processing season.
2. Uptake of nutrients by the expanded rooting system continues throughout the entire rooting zone.
3. Adequate nutrients from fertilizers plus available elements from the soil are needed. The roots gradually deplete nutrients from the soil as the crops approach harvest time.



Because of heavy fertilization over a period of years, available P has accumulated to high levels in many soils. High P without K will reduce yields.

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## POTASSIUM

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Potassium (K) is taken up by actively growing plants in amounts nearly proportional to levels of available K in the rooting zone. Uptake of K is slow during the seedling stage, then increases during the rapid growth.

Available K has accumulated to medium-high levels in some soils. Coarse-textured soils need about 50 per cent more fertilizer K than fine-textured soils with the same soil K tests to supply K in the rooting zone of plants during the growing season.

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## CROPS

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### Snap beans

A balanced fertilizer in a band is needed at all row widths. Excessive N stimulates vegetative growth and results in an

indeterminate pod set with present varieties.

For high rates of K, potassium sulfate should be used for all or part of the K in the band, or part of the K should be broadcast as potassium chloride. In narrow rows, a higher rate of fertilizer per acre can be applied in a band with less chance of injury to the seeds because there will be a relatively lower amount of fertilizer per 100 feet of band.

### Sweet corn

Phosphorus with adequate K promotes early maturity and maintains quality of sweet corn kernels. Potassium reduces lodging of sweet corn plants.

### Cabbage

Phosphorus with adequate N and K in a band promotes early vigorous growth of direct-seeded cabbage plants. Excessive P without adequate K may cause internal darkening of the veins in heads.

Potassium stimulates vegetative growth and development of cabbage plants which increases yield but promotes bursting of heads.

### Table beets

Excessive P without adequate K will reduce yield. Potassium promotes seedling vigor plus early growth and yield of the roots.

**Table 1.—Fertilizers for vegetables adjusted to soil test and crops in loam soil.**

Crop	Fertilizer placement	Fertilizer N lbs/A <sup>1</sup>	Soil P test <sup>5</sup>					Soil K test <sup>5</sup>				
			1-5	6-10	11-20	21-40	41+ <sup>2</sup>	1-50	51-100	101-200	201-300	300+ <sup>3</sup>
			Fertilizer P <sub>2</sub> O <sub>5</sub> lbs/A					Fertilizer K <sub>2</sub> O lbs/A				
Snap bean wide rows <sup>4</sup>	Broadcast	0	0	0	0	0	0	120	80	0	0	0
	Band	40	100	80	60	40	0	40	40	40	40	0
Sweet corn	Broadcast	0-80	120	80	0	0	0	120	80	0	0	0
	Band	40-60	80	80	80	40	0	60	40	40	40	0
Cabbage	Broadcast	0-80	120	80	0	0	0	160	120	80	0	0
	Band	40-60	80	80	80	40	0	60	60	60	40	0
Table beet	Broadcast	0-80	120	80	0	0	0	320	240	160	80	0
	Band	40-60	80	80	80	40	0	80	80	60	40	0

<sup>1</sup> One or two sidedress applications of 40-60 lbs N/A are needed, especially for corn, cabbage, and beets, depending on available N in soil and weather during growing season. Fertilizer N applied broadcast before planting is less effective than N in band plus one or two sidedress applications.

<sup>2</sup> Soil P test over 40: Unlikely response to fertilizer P, except in band in cold wet soil.

<sup>3</sup> Soil K test over 300: Unlikely response to fertilizer K.

<sup>4</sup> Apply 50 per cent more fertilizer for narrow rows.

<sup>5</sup> Soil tests measure the pounds of available elements in acre furrow of soil (Morgan extraction solution).

*Note: For detailed information on research results of plant response to concentrated superphosphate and potassium chloride fertilizers on snap bean, sweet corn, cabbage, and table beet, write to: Mailing Room, Jordan Hall, New York State Agricultural Experiment Station, Geneva, New York 14456.*