

PLANT POPULATIONS & PLANT SPACINGS

Plant population refers to the **NUMBER** of plants per unit area of land.

Example: 40 000 plants per hectare (e.g. cabbage) or
100 plants per square metre (e.g. carrot)

Plant spacing, on the other hand, refers to the **ARRANGEMENT** of plants on the area planted.

Example: Widely varying plant spacings such as 1 000 mm x 10 mm, 500 mm x 20 mm and 100 mm x 100 mm, all give a plant population of 100 plants per square metre.

Question: What is the optimum population or spacing for a specific vegetable crop?

There is no precise answer to this question. Factors such as climate, soil, cultivar, market requirements, managerial ability of the grower, and many others, all play a role. For this reason, one will often find that a range of spacings or populations is recommended. For example, a recommendation for cabbage may be a plant spacing of 350 mm to 500 mm in rows drawn 500 mm to 700 mm apart, and a plant population of 35 000 to 45 000 plants per hectare. At any specific plant population, individual plants are likely to perform best where a uniform spacing of plants, equidistant from one another in all directions, is adopted. However, it is usually more practical to plant fairly closely in rows, with the rows being spaced wider apart. This allows for easier access into the planting for inspections, weeding, pest and disease control and harvesting.

The size and shape of the root system of most plants are generally in proportion to the size and shape of their top growth. Thus we find that plants like lettuce, cabbage and cauliflower, with a fairly compact "rounded" top growth, generally have compact, rounded root-systems, but lettuce, being smaller, should be planted closer together than cabbage for optimum yields. Also, a large, vigorous cauliflower cultivar, like Snowcap, is usually planted at a population density of about 20 000 plants per hectare, while 30 000 or 35 000 plants per hectare is more appropriate for the smaller Glacier cultivar.

Small-growing (short), more upright growing crops, like onion or carrot, have relatively shallow roots, with limited lateral (sideways) spread.

Rambling crops, such as pumpkin, Hubbard squash or butternut, on the other hand, tend to have rather sparse, but spreading, root-systems, similar in size and spread to that of the top growth. Butternut, being less vigorous than the others mentioned, requires a closer spacing (a higher plant population) for optimum yields.

In cases where climate, soil and nutrient status are all favourable for growth, plants will grow larger and have better-developed root-systems and this could require a wider than normal spacing. A lower plant population is also justified when conditions such as limited soil moisture are a likely limitation to the crop.

With an understanding of a plant's growth behaviour, and the conditions under which it is to be grown, it is possible to make a good estimate of a suitable plant spacing for most vegetable crops.

Question: What would happen if the plant density of a vegetable crop was increased further after reaching a population which gives an acceptable economic yield?

Generally the total yield would at first still increase, eventually reaching a peak, and thereafter yield would decline as inter-plant competition became too severe.

However, the response to higher plant densities differs in several respects between fruiting crops, such as pea, bean, chilli, tomato and pumpkin, on the one hand, and non-fruiting crops, such as carrot, beetroot, potato, cabbage, spinach and sweet corn, on the other. The main differences in response to increasing plant densities, within the acceptable population ranges for these two groups of crops, are summarised below:

	Fruiting Crops	Non-Fruiting Crops
Range of acceptable populations	Wide (5 to 10 times)	Narrow (1 to 2 times)
Yield per hectare	Increase	Increases at expense of product size
Yield per plant	Reduced	Greatly reduced
Size of product	Little effect	Markedly reduced
Harvest period	Concentrated	Lengthened
Earliness of harvest	Earlier main crop	Main crop is delayed

In practice these differences in response can be effectively used to achieve certain aims. For example, high-density populations are utilised for once-over mechanical harvesting of processing tomatoes, green beans or green peas, where a concentrated crop maturity is essential for good yields. Also, where the market demand calls for smaller-sized products, such as "baby carrots" or mini-cauliflowers, density of the plantings is also increased, often to the point of reducing total yields in order to produce the required size (this may be a viable option provided premium prices are offered for such produce).

Where crops are grown under less favourable conditions, the plants tend to be smaller than normal, and increasing the population slightly would normally be advantageous, particularly for fruiting crops. Slightly denser plantings are, in any event preferred because they are more likely to allow for an acceptable final population density to be achieved, even when plant losses are slightly greater than expected. Bear in mind that, for most vegetable crops, the percentage loss in yield due to plant losses is usually half that of the percentage of plant loss, i.e. a 20% loss of plants results in about a 10% yield loss.