

4. What is the difference between open-pollinated varieties and hybrid varieties?

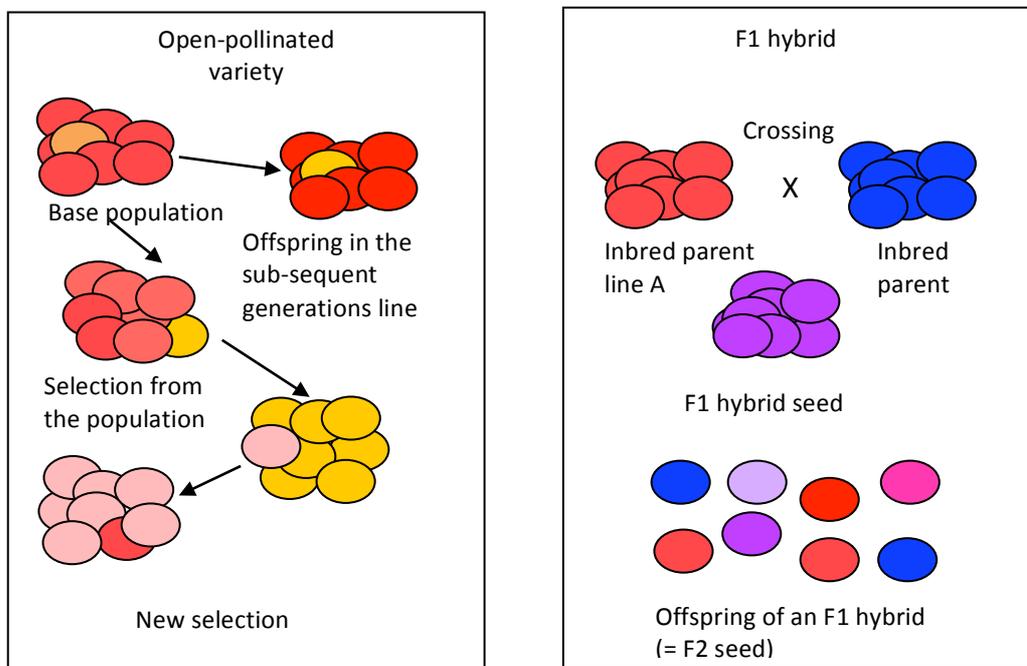
The question that is often asked in the organic sector is: 'What is the difference between a hybrid and an open-pollinated variety, and what are the advantages and disadvantages? And what fits in best with organic farming?'

What is a 'open-pollinated' variety?

An open-pollinated variety is produced using the traditional method of crossing and then selection of offspring in several generations (base population), see Figure 1.

After a few years (usually after 5 - 6 generations) of systematic selection the variety becomes stable and the characteristics hardly ever segregate out again. This means that all the offspring are virtually the same, which is why the term 'open-pollinated' is used. So plants come from seeds of open-pollinated varieties with virtually the same characteristics as the variety purchased.

Figure 1. Diagram of the breeding of an open-pollinated variety (left) and an F1 hybrid variety (right) (courtesy to M. Haring)



What is a (F1) hybrid variety?

F1 hybrid means literally 'first offspring after a crossing'. In the case of F1 hybrids the breeding process is divided into two phases: inbreeding and combinations of crossings. So the process is more complicated and requires more intervention by breeders than in the case of an open-pollinated variety.

The first step is to develop parent lines. These parent lines (the mother and the father) should each be as uniform as possible; and the parent lines for a crossing should also be very different. Uniform parent lines are produced by inbreeding. In the case of self-pollinators (tomatoes, peppers) this is fairly simple: self-pollinators are natural inbreeders. But in the case of cross-pollinators (such as chicory and cabbage) all

sorts of techniques are needed to carry out (manual) inbreeding. The second step is to test which combination of inbred lines will produce a good F1 hybrid on crossing.

Once you have various inbred parent lines, you can quickly make new combinations (varieties). This has been one of the motivations for breeders to move from 'open-pollinated' varieties to 'hybrid' varieties. After all, the breeding of a new variety can take ten years. So breeders have always looked for faster ways of breeding. Hybridisation has been an important step in this.

Advantages of open-pollinated varieties

The first advantage of open-pollinated varieties is that there is always some form of genetic variation between the plants in the field and so diseases spread less fast than in the case of genetically identical plants of a hybrid variety.

Another advantage is that growers can propagate these varieties themselves, i.e. they can repeatedly obtain seed and sow it again, see Figure 2. The seed production cycle can therefore be continued indefinitely, from generation to generation. As there is always a little undetected variation in an open-pollinated variety, you have to apply some selection in this seed production in order not to obtain too much non-desirable variation. A variety can otherwise 'degenerate' and deviate too much from the characteristics desired originally.

Figure 2. An organic grower in a cabbage field herself selecting cabbages from an open-pollinated variety (left) and obtaining seeds from them (right)



Disadvantage of open-pollinated varieties

The farm saved seed of open-pollinated varieties obtained by growers is a disadvantage for breeders. They miss out on income to fund their breeding of new varieties. If the organic sector wants to encourage the breeding of new open-pollinated varieties, the costs of breeding need to be invested differently. Read about this in Section 10.

Advantages of an F1 hybrid variety

The first advantage of hybrid seeds for growers is the high degree of uniformity: all the plants are, for example, ready for harvesting at the same time and are therefore suitable for a one-off, mechanical harvest. They look alike and they provide a uniform sorting. A second advantage is that in some cases there is additional growth vigour ('heterosis'), as a result of which the plant grows more vigorous or produces a higher yield.

Disadvantages of an F1 hybrid variety

The disadvantage for growers is the fact that their own farm-saved seed does not produce usable seed. Hybrid varieties can in principle produce seed but in the F2 the characteristics segregate out again and a variation is produced that is not wanted by the market. In this way seed companies protect themselves against farm saving seeds. This makes growers dependent on the seed companies, who have to constantly cross the inbred parent lines to be able to bring new F1 seed onto the market. Partly for this reason F1 seed is more expensive than of an open-pollinated variety. But for some growers the advantages compensate for the disadvantages. In organic farming hybrid varieties are permitted and are used in certain crops.

Why is inbreeding necessary in the case of a hybrid variety?

Inbreeding of parent lines means that desired variety characteristics are 'fixed' faster, as a result of which the parent lines each become very homogenous. Then two distinctive parent lines are crossed, which produces the so-called F1 hybrid seed. The plants from F1 seed offspring have the characteristics of the two parent lines combined and all the plants are identical and thus produce a uniform field. In the case of an open-pollinated variety more deviations are possible.

Are hybrid varieties permitted in organic farming?



As long as the seed is produced under organic growing conditions, hybrid varieties are permitted in organic farming. There are several hybrid varieties whose parent lines have been too weakened by inbreeding and that can produce good seed only with the use of pesticides; these varieties are therefore not desirable in the organic sector.

Figure 3. Breeding for a hybrid variety for cabbage: manually inbreeding and crossing (Photo: J. Myers, Oregon State University)

Bio-dynamic farming and hybrid varieties

Bio-dynamic (BD) farming is a specific way of farming within organic agricultural movement that has its own vision and has additional rules in addition to those of organic farming. For bio-dynamic farming the development of an open-pollinated variety is the most natural way of breeding. No artifices are used, such as inbreeding in the case of plant types that are naturally cross-pollinators. From a specific BD point of view the propagation of one's own seed fits in with the development of one's 'own' farm individuality. After all, by repeatedly producing seed growers can adapt a variety to suit their own business. They do this by constantly selecting certain plant types in the offspring of the seed that fit in best with the farm and the local conditions. The fact that an open-pollinated variety is constantly able to produce a vital subsequent generation is in keeping with the BD vision. Hybrid varieties therefore fit in less well with the BD farming perspective.