

Growing and Ripening Go Hand in Hand

by Peter Kunz

*“What determines quality, however,
is always the ripening process.”*

Hardly anyone pays attention to this element in the landscape anymore: in autumn, cereal fields turn the grey-brown earth green, covering and protecting it over winter. In spring the green first darkens, then turns to blue-green and to grey-green. In high summer, during the ripening period, the straw turns first green-grey-yellow, but more and more often goes straight to a dull brown-grey and not infrequently to grey-black. This is where our bread comes from. The golden colours of cereals, as we know them from old paintings and from advertising, are becoming ever rarer.

Farming has changed completely with the use of mineral fertilizers, pesticides and short-straw varieties. Through breeding, all cereal species have been shortened over the last 100 years, while yields have increased. But the change in the plants' architecture and physiology has serious consequences: short, heavily fertilized plants provide a favourable environment for fungal diseases, which affected the ears and endanger the grains with highly toxic and carcinogenic toxins. Because the ears ripen closer to the ground and to the leaves, the ripening colours are missing, and the kernels also tends to taste more like grass. Healthy cereals need thorough maturation. It is important both for the health of the plant and for the healthiness of the products made from it.

With fruit, unlike cereals, ripening is obvious, because ripeness can be seen and tasted immediately: a hard and green apple changes its colour and becomes sweet, and a bouquet develops, an abundant diversity of characteristic, variety-specific aromas appears. Every fruit has its optimum eating ripeness, which can be recognized by a fresh, often slightly lightened colouring and an appealing aroma profile. After the peak of optimum ripeness come breakdown and spoilage. The structure dissolves, and taste and smell become one-sided and unpleasant. Also the colours then also move back towards the colour of the soil from which the vital, green plant originally starts growing.

Root – Leaves – Flower and Grain Formation

Cereal growth takes place in three developmental phases: root building – leaves – flower/grain.

A germinating plant first concentrates on root building in the decreasing part of the year, before winter. Only a few leaves are present above ground, but the root already reaches 30 to 50 centimetres deep, if ever the conditions allow it. For almost six months (in Central Europe), growth is directed downwards: the biggest part of the assimilates from the leaves are channelled downwards, and a large share of them is also exuded into the surroundings of the roots. By this way the plant feeds and steers the soil life around the roots. A large and diverse range of substances influences the solubility of minerals in the soil and shapes the growth and the activity of soil microorganisms.

In spring time, life awakens anew. New leaves are formed and tillers develop. A large leaf area is the prerequisite for assimilation and thus for growth. In the short shoots, the entire structure of leaves, stem and ear is pre-formed in miniature, invisible from outside, well before the plant straightens up and elongates. Although the cereal field still looks like a green meadow, the plants that will later stand more than a metre high are already fully pre-formed. Then the crop shoots up rapidly, the ears emerge from the stems, and with flowering, outward growth comes to an end. Only cereals show such developmental dynamics. By flowering, wheat plants have produced an enormous amount of biomass, but nothing yet edible for humans, only grass and straw for those animals that are able to digest roughage and fibres.

The green leaf and stem biomass is the basis for grain formation, which begins shortly after flowering. For this, the metabolism of the cereal plant is quite turned upside down. Now, the developing grains trigger the remobilization and translocation of assimilates, proteins and minerals from the leaves, the stems and even from the roots. In healthy plants this process is stable; that is, it proceeds slowly, in an orderly way and steadily. In weak plants it can become chaotic and break off prematurely; decomposing fungi then spread, because they find a favourable environment in the disintegrating tissues.

Ripening is visible

leaves lighten from the tip, first turning light green and then yellow before drying out. The stems, too, lighten from the bottom up, can become translucent, and may briefly flare up in colour. As with deciduous trees in autumn, shades of every nuance appear, from pale yellow to deep red. In their own way, the otherwise inconspicuous cereal plants show a process of flowering and ripening: it is the visible expression of successful, balanced fruit formation and ripening. This conversion and translocation process is partly responsible for which substances arrive in the grain and which can be newly formed there. Depending on environmental conditions, above all temperature and water availability, the gluten proteins and starch configu-

rations that matter for dough formation and baking are formed only in the grain, along with a diversity of secondary compounds that shape aroma and influence tolerability.

Ripening thus means orderly breakdown in the lower, green part of the plant and, at the same time, the building up of the fruit and of the food substance at the next higher level, in the grain. From the perfection of grain development, a trained eye can tell how well this transformation has succeeded. Through the trained eye of the biodynamic breeder, these considerations become effective in practice. In this way, varieties are developed that exploit the potential of the site without lapsing into imbalance and becoming diseased. Almost always they also show intensive leaf and biomass formation, which is why they do not depend on mineral nitrogen fertilization. The stems are longer overall, the ears ripen at a greater distance above the leaves and therefore stay healthier. This health-promoting architecture favours the ripening process. It leads not only to refined grain quality but also to very stable, good yields, which makes biodynamically bred cereal varieties ever more popular. The high reliability of these varieties in extreme years, such as the rainy summers of 2016 and 2024 and the hot summers of recent years, confirms the great importance of architecture, growth dynamics and ripening processes for resilience.

Bread from Grain

Fully matured grain has dormancy and can be stored for a very long time without losing its nutritional value. When water is added to flour during dough making, conversion processes begin that are very closely related to the germination of the seeds. Because the cereal grain is an extremely concentrated food, it needs sufficient time after milling and wetting for the breakdown processes to occur. Whereas the seedling carries the developmental direction towards a new plant within itself and steers it on its own, in dough making the process can be guided from outside through temperature and the addition of sourdough or yeast. Without sourdough or yeast, a chaotic development easily sets in, which can end in butyric or acetic acid fermentation and, as a result, in an unappetizing loaf.

Bakers, too, speak of a ripening process which, like that of the cereal plant in the field, involves breakdown and new formation and takes its time. The grain not only releases sweetness from the starch but also forms a wide range of new aromas; substances that inhibit germination and digestive enzymes are broken down or inactivated; and protein degradation also gets under way, which is associated with improved tolerability and an increase in valuable amino acids. If the process is run too fast, in a one-sided way or incompletely, not only taste and smell suffer, but also digestibility. When ripening succeeds, the result is a well-structured bread that holds its shape and stands up well, rich in aroma and easy to digest.

The importance of ripening is being rediscovered by bakers and by many consumers. Industrial processing, too, tries to take it into account at least in part, but this always involves higher investment and, above all, more time. And time is money! This is why the opposite trend also has its followers: ever faster processes, combined with processing aids and added flavourings, produce results that are hard to tell apart on the shop shelf.

Yet what determines quality is always the ripening processes that bread goes through, from breeding through cultivation and processing in the bakery to the moment of enjoyment. And consumers hold the power themselves: with their purchasing decisions they steer how food is produced. It is not enough to judge quality conclusively on first sensory impression.

Sensory Aspects of Digestion

Appealing experiences of colour, smell, taste and touch prepare and influence the digestive processes. In germination, the seedling steers the breakdown and the new formation of structure; in grain formation and ripening in the ear, it is the developing grain that initiates and guides the change in metabolism and the breakdown in the green plant. In humans, the same role falls to sensory impressions and the experience of enjoyment. The stronger and more differentiated the stimulation of the senses before and during eating, the calmer and more complete digestion will be. Digestibility and tolerability are also linked to this, despite individual preferences and sensitivities. This teaches us to pay close attention to bread and all foods before we enjoy and digest them.

The senses eat with us, so if we use them carefully and attentively, they enrich our experience and deepen our understanding of, and responsibility for, the origin and significance of our food as the basis of life. This learning process, too, can be described as ripening.

Plant architecture means the appearance, structure and form of the plant, together with the functions of its organs.

Assimilation is the plant's anabolic metabolism, meaning that it takes up substances from outside (carbon dioxide, minerals, etc.) and integrates them into its organism. The best-known example is photosynthesis, in which carbon dioxide is taken up and oxygen is released.