

Gardening for Beginners: How Plants Grow

A Step by Step Gardening Guide

by

Martin Cole

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For Laura, Amelia and Luisa.

CHAPTER ONE

Why you need to know how plants grow



Unless you are going to create a Japanese Zen garden, like the famous Ryōan-ji garden in Kyoto, plants are going to be at the centre of your gardening efforts.

Plants give a garden a sense of purpose, structure and character.

They can provide shade, shelter or screening to turn a garden into a place of peace and quiet reflection. But with striking combinations of

form and colour, plants can also offer an ever-changing visual display that can shimmer with energy.

Plants attract birds, animals and insects to the garden. They also give us food to eat and juices to drink and can even give us some of the materials that we need to care for them, such as wooden stakes or garden compost.

But beyond what is intrinsic to plants themselves, it is the process of interacting with plants that makes gardening so captivating for so many.

Plants provide gardeners with something that is quite rare in human endeavours - the opportunity to be both imaginative and practical at the same time.

As we plan and develop our gardens, combining plants of various colours, shapes and size, we exercise a truly creative side of our nature that may otherwise be rarely seen.

Yet almost simultaneously, we are also engaged in tasks of the most practical kind - sizing up spaces, preparing ground, planting, pruning, feeding, watering, and generally working physically outdoors.

So, as gardeners, we owe almost everything that we get from gardening to plants and, for that reason, it pays to gain as much of an understanding about plants as we can, especially as we start out on our gardening life.

This book is aimed at helping you understand how plants grow, so that you can grow the plants that you want and grow those plants well.

Edible or ornamental, fruit or vegetable, tree, shrub, perennial or annual,

whatever you want to grow, the fundamentals are all the same.

If you come to understand what is in this book, you'll never look back as a gardener.

CHAPTER TWO

The challenges of plants

New gardeners are faced with two main challenges when it comes to plants.

First, we need to decide which plants we want to grow in our garden. Second, we need to know how to take care of the plants that we do select.

This means that we need to develop:

- our knowledge and understanding about the different plants that are available to us, and
- an appreciation of the conditions that we have in our garden, so that we can select plants that are suited to those conditions.

It also means that we need to know:

- how to get our plants safely into the ground in the first place, i.e. how to plant plants,
- what, if any, additional assistance those plants need from us, such as feeding and watering,

- how to prune plants, either to keep them within the space available to them or to change the way that they grow,
- how to identify when our plants have been attacked by pests and diseases, how to help plants recover from such attacks, and how to prevent pest and disease problems in the first place.

Although you can look at the challenges of plant selection and plant care separately, the truth is that in both cases all we are really concerned with is trying to provide our plants with the best conditions that we can, so as to enable them to flourish.

What you need to know

Of course, you can learn about the different needs and requirements of the various plants that you grow on a plant-by-plant basis. And you will almost certainly do this as you increase your familiarity with the various plants that you might want to use in your garden.

However, your overall gardening knowledge will be strengthened no end if it is underpinned by a basic understanding of how plants grow.

If you have that understanding you will often be able to make judgements about what you need to do in relation to a particular plant, without necessarily having to consult the books to find out more specifically what that plant's individual requirements are.

So, what you'll learn in this short book are the basic facts that you need to know about plants to help you garden successfully.

You should know that what you'll find here is nowhere near *all* there is to know about plants, but there is certainly more than *enough* of what

you need to know to get your started.

So, in the following pages, we'll answer these questions:

- What makes plants grow?
- What are the main parts of plants and what are their functions?
- How is this information relevant to day-to-day gardening tasks?

CHAPTER THREE

How plants grow

Just like us, plants are living things. We are able to grow and thrive because our bodies, remarkably, are able to take the energy from the food we eat and convert it into material can be used in the creation and renewal of the cells in our body.

Plants operate in a similar and equally remarkable way. Plants fuel their growth by combining sunlight, air, water and soil nutrients. Just think for a moment about that.

How can those ‘ingredients’, seemingly so lacking in weight or substance on their own, produce something as enormous, solid and long-lived as a mature oak or a California redwood? How can those very same ingredients produce something so delicate and transient as an apple blossom, or something so sweet and succulent as a melon?

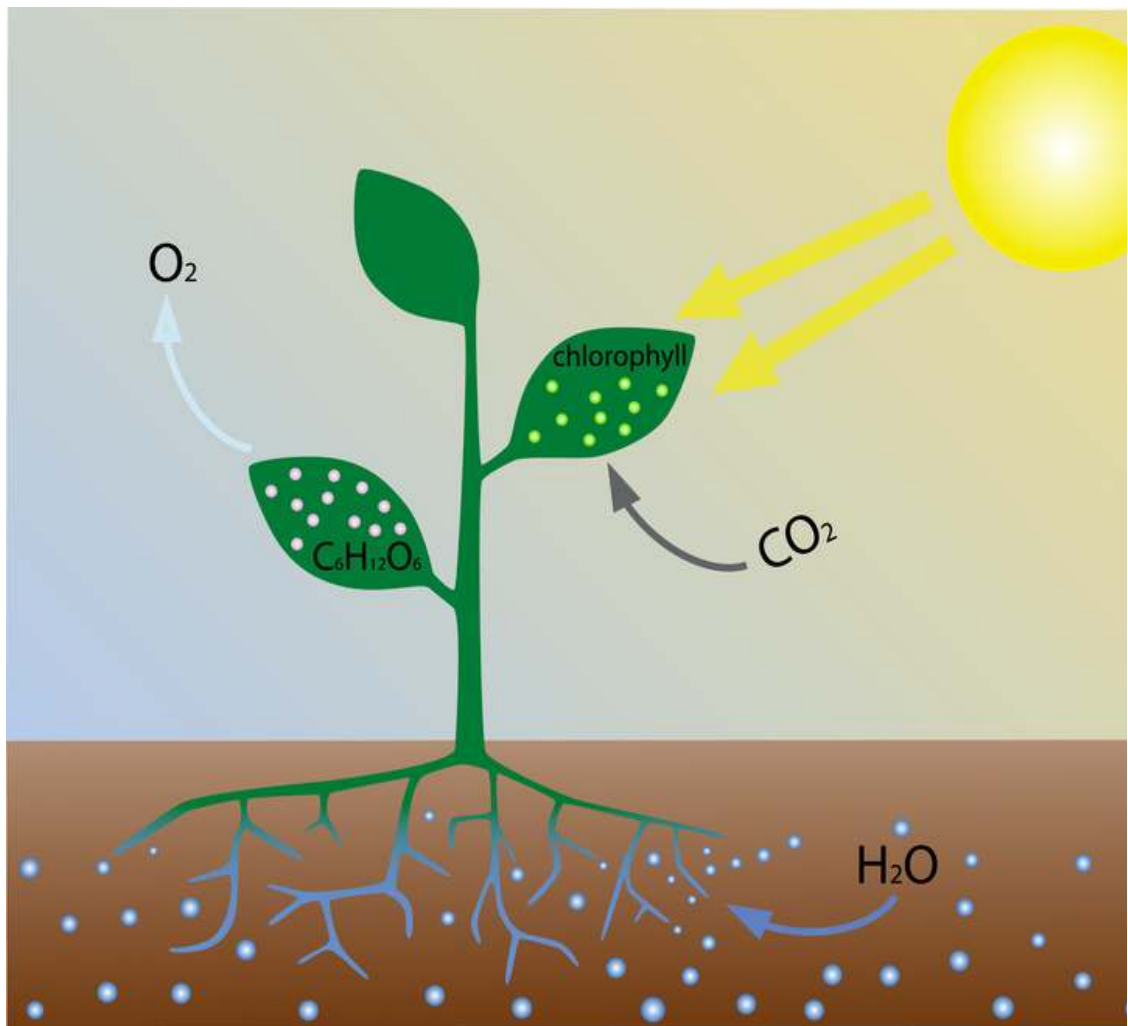
The answer is that plants achieve this magic by a process called photosynthesis. Photosynthesis is unique to plants and is so specialised that science has never even been able to replicate it.

Put simply, it involves the conversion of energy from the sun into the building blocks of plant life.

The actual process itself is quite complex but once we take into account a few simple scientific facts, we can easily gain an understanding of how it

works. This is what we need to know:

- First, we need to appreciate that the air around us contains carbon dioxide gas (CO_2).
- Second, we need to know that water (H_2O) is comprised of molecules of hydrogen and oxygen.
- Third, we need to know that the individual cells in the green parts of plants, such as the leaves, contain structures called chloroplasts.
- Finally, we need to know that each chloroplast is filled with a substance called chlorophyll. Chlorophyll is what makes leaves green and it is chlorophyll that takes the central role in the photosynthesis process.



Photosynthesis in five steps

So, with that knowledge, let's look at how photosynthesis takes place. For the sake of a simple explanation, the process can be broken down into 5 steps.

The plant draws in water (H_2O) through its roots and carbon dioxide (CO_2) from the atmosphere and combines these in its chloroplasts.

The plant absorbs light from the sun, which leads to a reaction in the chlorophyll causing it to split the water molecules into their constituent parts of hydrogen and oxygen.

As a result of this reaction, the chlorophyll converts some of the energy absorbed from the sun into a simple form of sugar ($C_6H_{12}O_6$ in the illustration above). Meanwhile, the oxygen that has been liberated from the water finds its way out of the plant's leaves back into the atmosphere.

The simple sugar molecules then combine with the hydrogen molecules that came from the water and together these create more complex forms of sugar, which are capable of being used to build the cells that form the plant's structure.

These complex sugars then combine with water and nutrients that the plant takes up from the soil to form the various parts of the plant such as its roots, stems or flowers.

And that is pretty much it. Combine sunlight, air, water and soil with the magic of chlorophyll and you have something that can provide you with shelter, beauty, warmth and food.

If we now turn to look at the main individual parts of the plant, we can gain an even better understanding of how plants grow and what we need to do as gardeners to help plants grow in the way that we want them to.

CHAPTER FOUR

Roots



Roots are the underground parts of a plant. They have three main functions.

Firstly, roots anchor the plant in the soil. They do this either by sending down long, sparse tap-roots deep into the soil or by spreading a complex

network of fibrous roots in the soil near the surface around the plant. Most plants use one or other of these tactics, but some use both.

Secondly, roots take in nutrients and water from the soil around them. These, as we have seen, are essential for photosynthesis and for the continuing growth of the plant.

Thirdly, roots store food and energy.

Root vegetables, such as carrots are good examples of the storage capacity of roots. Bite into a fresh carrot, which is basically a swollen tap-root, and you can taste the sweetness of the stored sugars.

This stored energy is also what allows perennial plants that die back in winter to regenerate each spring.

Roots and the gardener

Where roots are concerned, the gardener's job is to take care of the soil they are planted in, both at the time of planting and as the plant is in growth.

Roots need open (not compacted) soil, so that they can grow out and down and so that they do not become trapped in a waterlogged environment.

They need soil with an adequate supply of nutrients and they need enough, but not too much, water.

Soil cultivation is in fact one of the most important gardening tasks. If your plants' roots are anchored in good, healthy soil everything else you

do in the garden is likely to be a whole lot easier.

CHAPTER FIVE

Stems



A plant's stems form the framework from which it grows other parts that are essential for its continued life, both as an individual specimen (its leaves) and as a species (its flowers).

The framework on most plants usually consists of main stems and

branches.

At the tip of each stem is the growing point - the apical meristem. This is the part that produces new leaves, buds and stem sections (or nodes) as the plant grows.

At the junction of each node you will usually find leaves and, between the base of the leaf stalk and the main stem, buds.

These buds are called axillary buds and it is from these that branches grow. Not all axillary buds will grow into branches. Most remain dormant, available for growth if the apical meristem is damaged or removed by pruning.

Apart from their structural function, stems also contain the tubes (called phloem and xylem) that transport water, sugars and nutrients around the plant.

Stems and the gardener

A gardener needs to understand these facts about plant stems in order to be able to bring some control to the plant by pruning it.

Pruning involves removing parts of the plant's framework to achieve a desired outcome.

So, we may prune to encourage leafy growth, which is achieved by removing the growing points from each stem, so as to induce the dormant axillary buds to grow. This, for example, is what we do with hedges.

We may also prune to maximise flowers or fruit. In this case we remove

side shoots, so that all the plant's energy can go into the remaining flowering (and fruiting) stems. This is what we do with tomatoes.

In all cases, bearing in mind the role of stems in carrying essential fluids around the plant, we should always cut back to just above a bud, so that there is less risk of the plant being damaged by infection entering the open wound.

CHAPTER SIX

Leaves



Leaves were the evolutionary development that enabled plants to come to dominate the earth.

They represent a scientific and aesthetic wonder. Just consider how incredible it is, both as a matter of botany and beauty, to see a huge tree completely transformed in spring by its new green foliage.

Leaves are where photosynthesis takes place and this process is driven by light.

Leaves, therefore, have evolved to carry out the function of light collection. This is why individually and/or collectively they present a large surface area to the sun and also why they are thin enough to let light penetrate into their cell's interiors.

Leaves have veins and midribs that carry water from the plant's stem to the leaf cells and also carry sugars away from the cells for storage. They also have microscopic openings, usually on their undersides, called stomata that allow for the entry of carbon dioxide.

These stomata also allow water, in the form of water vapour, to escape from the leaves in a process called transpiration.

As water exits the plant through the leaves, the pressure in the plant's xylem causes more water to be drawn through the system from the roots to replace the water that has been lost. This is how the plant transports the nutrients that are drawn in at the roots to those parts of the plant where they are needed for growth.

If, on a hot day, you've ever felt how much cooler it is to stand in the shade of a tree rather than under man-made structure, then you have felt the power of transpiration and the cooling effect of the water vapour surrounding the tree's leaves.

Leaves and the gardener

Leaves are very often what we cultivate the plant for, whether it be the edible properties of leafy vegetables, the aromatic properties of certain

shrubs or the screening properties of hedging plants.

Leaves are like plant barometers. They can tell a gardener a lot about a plant. If they drop or become discoloured, we know that there may be something wrong with the plant's growing conditions. So, for example, a yellowing of leaves, will often tell us that the plant is in need of nitrogen (which we must add to the soil).

Leaves can also tell us something about a plant's character and preferences.

Plants with silvery, shiny or succulent leaves, or leaves covered in small hairs, are often well suited to hot, dry conditions. Those leaf characteristics are the way that the plant has adapted to be able to thrive in those conditions.

Softer (and therefore thinner) leaves or leaves of dark green (which attain that colour because of a greater concentration of chlorophyll) are often found on plants that prefer shade. Those adaptations enable the plant to photosynthesise, even in low light conditions.

CHAPTER SEVEN

Flowers



Flowers are the means by which a plant engages in sexual reproduction. This is what plants have evolved to do. We, as gardeners, take advantage of this evolutionary urge when we grow plants for their flowers.

Plants contain male parts – the anthers and filaments (together, the stamen) and female parts – the stigma, style and ovary (together, the pistil). The anther (orange in the picture) produces pollen, which is transported from one flower to another by means of insects, birds or

wind.

When the pollen lands on the 'sticky landing pad' part of the pistil, called the stigma (light green in the picture), it is transported down to the base of the pistil to the ovary where it fertilises the undeveloped seed (or ovule).

Fertilisation causes the flower to lose its petals as their job in attracting pollinators is done.

Seeds can develop in several ways, but one we are all familiar with involves the expansion of the ovary to produce the fruit that houses the fertilised seed. When the fruit drops it may be eaten by an animal but the seed will usually stay intact.

Once the animal digests the fruit, the seed is emitted within the animal's droppings. In this way, the plant's seed is spread to new locations and deposited with a helpful starter pack of nutrients in the form of the animal's manure.

Flowers and the gardener

Oddly enough, flowers can be precisely what the gardener tries to induce a plant to do or the very thing that the gardener wants to prevent.

We welcome the rose or the lily bud but look to prevent our leafy vegetables from flowering because once they do, the taste we grow them for is lost.

So, whether we grow plants for flowers or wish to prevent flowering, we often adopt a specific feeding and pruning regime to encourage

whichever outcome we seek.

But, taking the case of ornamental plants for the moment, it is very often the flower colour, size and shape that dictates whether and where we include a plant in our garden.

Part of the great creative art of gardening lies in combining plants with complementary colours that flower at the same time or planning the succession of flowering plants, so that a garden might be full of colour for a whole growing season.

Finally, flowers provide gardeners with the wonderful gift of seeds. If you have the patience, it is hard to beat the satisfaction of looking at a well-grown mature plant that started its life as a seed in your own hand.

CHAPTER EIGHT

Final thoughts

These basic facts about how plants grow and about the functions of the various main parts of plants are the foundational knowledge for almost everything else in gardening that is connected with raising plants.

From here you can expand your horticultural knowledge as far as you want, perhaps to discover more about particular plant types or species that interest you. Indeed, if you are new to gardening, you will certainly want to know more about the practicalities of such things as planting, pruning, soil cultivation and so on.

It is to be hoped that what you've learned from this short book will help you as you expand your horticultural knowledge and in a productive and creative gardening life to come.

If you've found this book to be useful, please consider leaving a review at Amazon.com.

For more gardening tips and advice, especially for beginner and improving gardeners, please visit my website at www.gardeningsstepbystep.com.

About the Author

Martin Cole is a writer and avid gardener with a flair for teaching. He is an Englishman and former BBC Gardener of the Year finalist and currently lives in Australia with his wife and two young daughters.

