



IRRIGATION

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1. Tips for watering the home garden.

- Watering of a garden may have some recreational or therapeutic value to the homeowner but too much watering ends up just being a waste, especially in our dry South African conditions. There is no reason why existing landscapes can't be altered as time goes by to incorporate water saving ideas. Landscaping to use less water must become a culture within South Africa in order for the effects to be of lasting value. Whether you are starting a new garden/landscape from scratch or have an existing garden you should constantly look at your options for saving water and where possible improve on old non water saving techniques.

- All gardens need to be watered at some time or another, whether it is to initially plant or establish plants or to maintain plant growth on an ongoing basis. It is therefore important that the individual applying the water be aware of these water saving ideas. Irrigation systems have a reputation of wasting water but through correct design and application different combinations of irrigation systems within a garden will actually assist in saving water.
- Don't start watering programs too early in the spring. Plants will normally only flourish after the first good rains. Rather spend time improving soil and top dressings.
- Switch off irrigation before puddling starts.
- Water dry spots individually, avoid wasting water by watering a large area with the sprinkler if the intention is just to water a single rose or a small section of grass.
- Where to water - (a) if the soil in the root zone feels dry and crumbly, if it looks as though the plant is starting to wilt. (b) Late evening, early morning is best. (c) Avoid mid-day irrigation which usually results in loss of water through evaporation. (d) Lawns are best watered in the mornings to help prevent disease.
- Sprinklers with coarse, low spray are best. Fine high pressure systems loose water when the droplets atomize into the atmosphere. This is often caused by too high water pressure in the line. Make sure your selection of irrigation nozzle suits your pressure.
- Water trees individually giving them a deep drink but less often.
- Water slowly to prevent runoff but long enough to penetrate the root zone. By over watering, water penetrates beyond the reach of the roots, and excess water will run off and be wasted. Experiment to see how far water penetrates within a given period. Then take a slither of soil from the watered area and check the soil moisture or use a moisture meter (tensio meter).
- Drip irrigation is very effective when used on vegetables, fruit trees and specimen trees.
- Automatic watering systems should be altered according to season, time of day and amount of rain received unless it is connected to an automated tensio meter and or rain check. Never waste water by allowing the automatic system to water when not

necessary. This is especially important for office blocks.

- Check all water connections for leaks.
- When planting a tree place a water pipe from the base of the tree roots to just above the soil surface. Watering into this pipe will take the water directly to the tree roots and prevent water wastage.
- Flowers and vegetables need short, frequent watering, while shrubs and trees need deeper but less frequent watering.
- In cool seasons plants need less water; in hot weather and when windy, all plants use more water.
- Where possible water trees separately and consider digging a shallow trench around the tree to catch and hold water.

2. Nursery watering

Tips for saving water:

- Never water paving. Use a broom to sweep hard surfaces, not a hose.
- Water at correct time of the day.
- Different soil mixes require varied amounts of water.
- Different size containers need varied amounts of watering.
- Avoid over-watering.
- Avoid using high pressure sprinklers on seedlings as they damage the young plants and waste water. Water directly into bags rather than generally watering the whole block of plants.

Hose pipe

- On/Off fittings, in the form of ball valves or trigger connections, save water.
- Maintenance and installation of the fitting must be done correctly.
- Use a lance for reaching hanging baskets and the back of beds.
- Misters are useful for watering fern leaves.

Watering can

- Seedlings.
- Turning the rose upwards for soft water application.
- Window boxes.

- Using the point to get to each plant individually. Don't use the rose as this wastes water.

Container watering

- Sump watering - sumps can be installed at the base of containers. They act as reservoirs for water to be used later by the plant.
- The use of drip trays are recommended to encourage collection of excess water.
- Mixed planters - water plants separately and according to their water requirement.

3. Light and the impact it has on water utilisation by the plant

- Light, water and food are the most basic needs a plant requires to live. Plants will photosynthesise food by using light energy in direct proportion to the amount of light they receive, provided the light does not cause damage to the leaves through heat. Light is also required to produce essential hormones for growth and flowering.
- If moderate amounts of light are available, plants may not grow but will maintain a healthy, good looking, condition. Other plants merely survive as the light levels deplete. At even lower levels of light intensity the plant will begin to die.
- Watering should be reduced as the light intensity drops and the plant starts to grow slower. It is easy to over water plants in low light causing more stress to the plants. Common symptoms of over watering are root and stem rot.
- Low light particularly in doors will cause the plant to become etiolated (leggy). These plants are not strong and are very susceptible to disease and pests. To combat this, interior plantscapers keep plants very dry. This regulates the plant growth. Keep in mind that water should be gradually reduced.

4. Humidity and pot plants

- Air conditioners often dry out the air making it difficult for plants to grow well. The amount of moisture in the air is referred to as Humidity. This is the percentage of maximum amount of water vapour the air can hold at a given temperature. As air

warms it is able to hold more water. When cold air is heated it dries out.

- Plants are grown at about 80% humidity compared to the average building which ranges from 35 to 65%, these plant leaves become brittle and develop brown edges. This will be aggravated if:
 - The soil is allowed to dry out.
 - There is air movement over the surface of the leaf.
 - Direct sunlight through a window shines on the leaves. (This will cook the plant.)
 - Use a wet bulb and a dry bulb thermometer to calculate your humidity. Refer to the table for the calculation.

SEE TABLE A BELOW

5. Water temperatures and pot plants

- The temperature of water could have a negative effect on a plant. Hot water will boil the plant causing softening of the leaves and later drying out. This often looks very similar to frost damage.
- The seriousness of the damage depends on the coverage over the plant. The plant could recover if only a small proportion of the plant becomes damaged.
- Cold water is also harmful to plants. This is because the indoor environment is often very stable with regards to temperature and sudden changes in temperature reduce the water and nutrient absorption of the roots in the short term.
- The plant responds as it would in a "drought" situation by dropping its leaves. Two examples of plants and their responses to water temperatures are tabled below.

Plant Species	Number of leaves dropped at different irrigation water temperature			
	2°C	10°C	20°C	30°C
<i>Ficus benjamina</i>	404	282	305	320
<i>Dracaena marginata</i>	132	134	96	67

6. Effects of watering on plant growth and development.

- For optimal growth, optimal watering is required. Too much or too little will reduce growth.
- **Over watering;** Plants roots require oxygen as they are living and respire. Long periods of saturated soil will suffocate the roots. Secondary infections caused by bacteria are quick to move in and further damage the roots.
- **Symptoms of over watering include:**
 - Wilting foliage.
 - Leaves turn pale and new growth is weak.
 - Stem base is soft and spongy.
 - Strong pungent odor.
 - Excessive leaf loss.
 - Brown tips with yellow stripe on leaves.
 - Young shoots appear shriveled and blackened.
 - Roots appear dark and mushy.
 - Few or no flowers.
 - Flowers buds develop brown spots.
 - Plants are easily uprooted.
 - The presence of fungal growth and fungus gnats or sciarid flies.
- **Symptoms of under-watering include**
 - Leaf edges turn brown.
 - Flowers fall off.
 - Stems show signs of wrinkles.
 - Leaves lose their shine and take on a blueish luster.
 - The growing medium shrinks away from the side of the container.
 - Leaves become yellow or crispy and suddenly.

7. Innovative alternatives to watering trees and large shrubs

Most common watering practices include:

- Irrigation systems.
- Hand watering.
- Use of basins and mulches.

The problems most commonly experienced are:

- Soil compaction does not allow water penetration and results in restricted root growth and smaller trees.
- Erratic watering of trees also restricts root and tree growth.

Innovative methods to try - for special trees needing extra attention:

- Use a deep root irrigating lance that is pushed into the soil and waters deep down.
- Inserting pipes into the base of the tree hole before soil is put back. This allows for water to be applied directly to the roots.
- Drill holes into the compacted soil all around the tree drip line. Wetting granules and water retention granules can also be included into these holes.
- Use soaker hose or leaky pipe for slow even watering. It should be well hidden under the mulch. They can be coiled around the tree.
- Harvest water using swales to direct water to the tree. Trees planted in these hollows should have good drainage. (Could drown the tree if very frequent rain is expected.)
- Drip grey water onto the tree - as in a forest garden.

Other good ideas for water efficiency:

- Where possible water trees separately and consider digging a shallow trench filled with mulch around the tree as wide as the drip line to catch and hold water.
- Cut down on high nitrogen based fertilizers, rather use fertilizers with high ratios of potassium (K) and phosphorus (P). This will encourage plant cell walls to thicken enabling them to cope better in drought conditions.
- Light pruning helps plants cope during water restrictions because of reduced transpiration from aerial parts.
- Erect tanks around the house to collect rainwater from roofs.
- Apply mulches to soils and garden beds in order to reduce water loss.
- Aim to contain rainwater, rather than allowing it to run off site. This can be done by, altering the slope of the land, using retaining walls, making berms and gabions or

by draining water into depressions where it can slowly seep back into the landscape.

- Avoid transplanting plants as this will induce unnecessary stress.



- Established shrubs and hedges will rarely need to be given additional water. In the majority of years their roots will be extensive enough to enable them to obtain all the moisture they require from the soil. When they are first planted, however, a shortage of moisture can easily lead to stunted growth, or even death.
- The amount of water these plants require will depend upon the soil type, weed competition and the weather conditions. Applying water for 15 to 20 minutes as fast as the soil can absorb it will be adequate for most situations. Ideally you should aim at moistening the soil to a depth of about 150 mm.

8. When and how long to water

- Fully established trees should be able to survive without any extra water in normal rain cycles. In extended dry periods good long watering will need to be considered.
- Watering will depend on the soil type. Sandy soils don't hold water well and dry out quickly, whereas clay soils hold water well and need watering less frequently - they can in fact hold too much water and become water logged. Loam soils are ideal as they have the right balance of water retention and drainage.
- For more information refer to SOIL (2).
- The type of sprinkler used will affect the time that it takes to water a tree. Slow delivering drippers could take hours to water a section while a high pressure hose could fill a trees water basin in seconds.
- Fruit trees require watering to help fruit set and form. Once they are well formed over

watering will cause the fruit to be lacking in flavour and cause them to split.

- Deciduous fruit trees should not be watered in the winter to prevent early development and frost damage, but as soon as the blossoms start they need good watering to lengthen the pollination period because this keeps the blossoms on the tree as long as possible. The longer the blossoming period the more chance there will be for pollination to occur. The tree will require large amounts of initial water to moisten the soil profile all the way down so don't be hasty in watering.
- Remember to water well after fertilising so as to soak the fertiliser into the soil and to lessen the effect of fertiliser burns that may accrue.
- During early spring watch new growth as the fresh leaves are very sensitive to wind and heat wave damage. During these periods extra water will be needed. Remember to water at night as day time watering contributes to the loss of large amounts of water due to evaporation.

9. Watering plants immediately after planting

- When plants are placed in their growing positions it will be beneficial to water them in. You should aim to thoroughly wet the soil around the roots, and moisten the leaves with a fine spray. Applying water in this way will ensure that the plants have the correct conditions for rapid establishment, and will reduce the time they remain wilted. Water should not be spared when planting as this first watering is the most important one.
- If you plant shrubs or hedges during late autumn or winter the soil will need extra water on the highveld because of the lack of rain. If you find that the soil begins to dry out immediately after planting you should irrigate the site. But don't overwater.
- When transplanting large trees use a product like Kalpak which contains cytokinin, a hormone to stimulate root growth. The product is mixed with water and sprayed on to the leaves and watered in the roots.
- Remember to seal any wounds or tears occurred during planting.

10. Plants in clay containers

- Plants in clay containers can be checked for water by lightly tapping the side of the container with a solid object, such as a cotton bobbin on a stick. A light ringing noise will tell you that the growing medium is dry, whereas a dull noise will tell you that there is moisture present. This method works best for loam based growing mediums.
- Lifting the containers up will also give you an indication of their moisture content. Light containers will contain less moisture than heavy ones.
- The third way of telling if these plants need watering is to push your finger lightly into the soil. If your finger feels moist and the compost sticks to your finger, the soil probably contains sufficient moisture. But be aware, frequent light watering may wet the top portion of the pot, but leave the bottom portion dry. When you water, therefore apply enough to ensure that surplus water runs out of the drainage holes. This ensures that the entire root ball has received water.

11. Plants in plastic containers

- It is very difficult to judge the moisture content of growing mediums in plastic containers. You cannot use the 'tapping' method as no distinct ringing noise is made, and it is also difficult to judge the moisture by lifting the containers. With this type of container the best method of checking the moisture content is to press your finger into the compost.
- When you first start to water plants in pots or other containers you may tend to either under, or over water them. With a little experience you will soon learn whether your plants need watering or not. In practice it is better to slightly under water than to allow the soil to become waterlogged.
- Never leave a plant standing in deep saucers for a prolonged time as this will cause the roots of the plants to die because of the lack of oxygen in the growing media.
- Should you be going away and cannot do your regular watering, use this as a very short term solution and don't make the basin deeper than on tenth of the height of the container.

- You may use watering sticks to gently water the soil during periods of leave. They are made of porous clay and water seeps through to the plant.
- Many pots have a built in sump under the pot. A sump is a collection area for water under the container this allows for extended periods between watering. Always inspect the pipe into the sump with a dip stick to check that you do not over water the plant. Over watering will cause the water in the sump to rot and will cause bad smells, this is because the roots start to die due to the lack of oxygen. Water will move back into the soil medium when the soil dries. It is not uncommon for some plants to adapt their roots and dangle them into the water, provided there is still air available for the respiration of the roots.

12. Watering hanging baskets

- Hanging baskets can produce excellent displays during the season, but their management is difficult because the limited amount of growing medium available in the smaller area means that they dry out quickly in hot weather. The correct watering of these containers is critical if healthy growth is to be obtained.
- The use of soil moisture granules help to increase the water holding capacity of the soil and are very valuable in these instances.
- During the early stages of establishment, hanging baskets can be dipped into containers of clean water, and allowed to soak until all the soil is wet. However, as growth proceeds and they are hung in their final positions, this often becomes impracticable, and watering using cans or other special equipment becomes necessary.
- You will need to water hanging baskets at least once per week during the season, and in hot periods this may be increased. You should never allow the soil to dry out, as the plants can rapidly deteriorate, and may die.

Tips

- Fit a lance to the hose pipe for easy access into the basket.
- Put a pot plant under the basket to utilise any dripping water.

13. Window boxes

- Window boxes are similar to hanging baskets in the sense that they have a relatively small amount of growing medium for the plants to grow in. They tend to dry out quickly during hot weather, and need to be watered as often as twice a week. In extreme conditions daily watering is required.
- Always ensure that the soil is completely watered. It is best to use a watering can with a rose fitted, when the plants are first established, but the rose can be removed, once establishment is complete.
- Watering well in the evening, enables the plants to absorb a good store of water overnight, light watering during the day could also be necessary for cooling, but the sun may evaporate much water before the plants can utilise it.

Tips

- You should use a lance at the end of the hose pipe with an on and off trigger for controlling the water. A rose will be necessary with young delicate plants.
- Remove the rose from your watering can once the plants are well grown so that the stem of the can allows easier aiming of the water into the container.
- Always water each plant individually. You must water the whole area.

Watering bedding plants

- Bedding plants are often grown in individual containers, or massed in seed trays or directly from seed.
- Plants grown in individual containers should not normally have their roots damaged during planting, but those grown in trays can sometimes suffer from accidental root loss. Root loss will require extra watering to prevent damage to the plant.
- Immediately following planting you should make sure that all the plants are watered thoroughly, so as to reduce the risk of wilting - this is especially important for any plants with damaged roots. Watering should be continued every day until the plants are established.
- Bedding plants grown from seed need more sensitive watering techniques. A watering

can fitted with an upward facing rose, is used with a continuous swinging movement. At no time may puddles occur as this will cause the seed to float away and be displaced. Dribbles as the water starts and finishes will also disrupt the seed bed so start and finish the swinging movement off the side of the seed bed. Should the seed at any time dry out the plants will die so three hourly checks will need to be made in hot weather.

- Bedding plants are shallow rooted, which means that they can dry out rapidly in hot weather. If the maximum floral display is required you should water them during any dry or hot periods.
- Always be on the lookout for drooping plants which will be the sign that you should water. Mulching around the annuals is a great water saver as the evaporation from the surface is cut down. Be careful not to swamp the annuals with mulch as this will result in them rotting or make them vulnerable to fungal attack. On small beds watering can be carried out using watering cans, or hose pipes fitted with a rose.

14. Valuable plants during drought?

- Try and rank the order of importance of the plants in the garden that need water so that you do not lose the garden totally in the drought: Trees, ferns, shrubs, perennials, lawn, annuals and containers. Answers: A rule of thumb is leave the lawn and annuals till last save the prized older plants which are not easily replaced. During a drought only a small amount of water will be available. It is therefore important to use your available water in accordance with the use zones, created in your garden.
- Plants growing in shallow soil or exposed to strong winds or bright sunlight, have to compete for water with the roots of other plants, and this needs to be remembered during dry times.
- The following landscape plants (ones most usually watered) suffer most without irrigation. Learn the symptoms of drought stress so you are able to recognise plants that might be in trouble.
- *Azaleas*, evergreen - established landscape plants, use a wetting agent to aid water penetration. If new foliage droops, irrigate fast.

- *Camellias* - Young ones will need some water. Watch for wilting new growth.
- Citrus - Mature trees are surprisingly tough, they can survive on half their normal water requirements. Try spacing watering four to six weeks apart. Watch for wilting, discoloration and leaf drop - in that order - as symptoms of trouble. Apply water slowly to the root zone with a soaker hose or in a basin until the soil is wet to a depth of about two feet deep. Trimming on citrus is to be beneficial it does not stimulate fast growth.
- English Holly (*Ilex aquifolium*) - Probably the most sensitive of the hollies, it will need monthly watering.
- What are the most common symptoms of water stress in plants? When do these symptoms become fatal?
- Ferns - Most low growing types respond to drought by browning, then going dormant. They come back with water. Tree ferns need more help. Try watering severely stressed ones with just two litres of water per plant, poured directly onto the crown. (Water runs down the trunk's sides and gets into the plant's system because the trunk is an aerial root).
- *Fuchsias* - In mild climates, older plants with woody trunks can go a summer without wilting. Even if they lose their leaves and go dormant, they often come back. Young fuchsias with succulent stems need water.
- *Gardenias* - Big flowered types, such as 'Mystery' need water regularly. Fertilise only if you can water as usual.
- *Hydrangeas* - Leaves may wilt and drop, but stems should stay green and recover when watered. If some of the stems dry and shrivel, the plant needs water.
- Japanese maple (*Acer palmatum*) - Prolonged drought can stress even large unnamed seedling types. If you have the water, give them one deep watering in late spring. Smaller grafted varieties (usually the ones with finely cut foliage) are much more susceptible to drought damage. They may need monthly watering.
- *Podocarpus* - When drought stressed, it first loses leaves, then twiglets and finally branches. When you see stress, water just enough to prevent worsening.
- *Rhododendrons* - When they need water, their leaves hang and new growth wilts.

Foliage will perk up if you give roots adequate water soon enough.

- Roses - Young stems will need water. Less water will mean fewer blooms. Leave seed heads on to slow growth. Remove suckers, but don't otherwise prune until winter.
- Star Jasmine As a ground cover, this is inexpensive to replace if it dries. Prune large vines to reduce leaf surface, water when you can.

TABLE A

Relative Humidity At Given Dry Bulb Temperatures and Given Wet Bulb Temperatures (Referenced from IPSA training Manual)

Dry bulb temperatures in top row (°C) Wet bulb temperatures in all lower rows (°C)

16	18	21	24	27	Relative Humidity
15	7	9	10	12	10
7	8	9.5	12	13	20
8	10	12	13	16	30
9	11	13	15	17	40
11	13	15	17	19.5	50
12	14	16	18	21	60
13	15	17	20	22	70
14	16	19	21	24	80
14.5	17	20	23	26	90
16	18	21	24	27	100