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## The Mathematics of Growth

Numbers that add up to success and beauty

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Vancouver Sun

*Friday, January 11, 2008*

It is common knowledge in gardening circles that things look better in threes. Nature seems to prefer odd numbers, for some reason. Three pots in a row or grouped together always looks better than four. And similarly, plants grouped in threes and fives always look better than groupings of two or four.

A solitary statue or pot can look wonderful against a flat green hedge or set amid shrubs.

There are exceptions, of course. A pair of urns or pots can look very natural flanking steps or an archway in their precise symmetry.

But, as you'll see, these are not really exceptions. They actually fit very neatly into an ancient series of numbers that makes me think there is indeed a lot more science and mathematics to the art of gardening and garden design than we perhaps realize.

The mystery of these numbers was recognized centuries ago by Leonardo of Pisa, the famous 13th century Italian mathematician who became known as Fibonacci.

Travelling with his father in North Africa (and probably the Middle East), Fibonacci learned about a numbering sequence that was unknown in the West until he popularized it in his book, *Liber Abaci* (Book of Calculations).

The pattern of numbers, now known as the Fibonacci Sequence, is as follows: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584 and so on to infinity.

The sequence is arrived at by adding the previous two numbers together: 5 plus 8 gives you 13; 8 plus 13 gives you 21, and so on.

When a number is divided by the previous number in the sequence you get a ratio of 1.6180339887. This was known long before Fibonacci to people like Plato and Euclid (the father of geometry) as the "golden ratio."

The Greeks use a more accurate method of calculation that arrives at the same number by adding one to the square root of five and dividing by two.

It is thought the numbers were first spotted in musical rhythms in India. The magical ratio is found time and time again in all sorts of works of art as well as architecture, such as the Pantheon, even in the dimensions of a Stradivarius violin.

### FLOWER COUNTS

Leonardo da Vinci was thought to be fascinated by Fibonacci numbers as well as by the esthetic harmony and beauty achieved by obeying the dimensions of the golden ratio.

His *The Vitruvian Man*, among other things, is a portrait of the amazing relations of numbers found in the proportions of the perfect human form. Many of these are Fibonacci numbers.

And the *Mona Lisa* and *The Last Supper* are thought to have become such enduring works of art because they contain the intrinsic and transcendent harmony of Fibonacci

numbers.

Yes, I know this all sounds like I have been reading too many Dan Brown novels, but no, Fibonacci's contribution to mathematics is no fiction and my interest is purely one of curiosity as to how numbers repeatedly show up in nature, especially in plants and flowers and other areas of the nature.

Moving on from the simple idea that things look better in threes and fives, we find other surprises.

Many flowers appear to obey this code. In fact, it is a rarity to find plants that do not contain Fibonacci numbers. If they are short a petal, it is probably that one has fallen off.

The lily and iris, for instance, have three petals (it may appear that they have six, but close examination shows they actually have three sepals and three petals).

The flowers of aquilegia, vinca, trillium, buttercup, dianthus and lupin have five petals while delphinium, coreopsis and bloodroot have eight. Ragwort and corn marigold have 13 while shasta daisy, rudbeckia and aster have 21.

Four is missing in most instances, but when this exception occurs, there is another explanation. The number falls into a slight variation on the Fibonacci sequence called the Lucas series, which builds up the same way, but starts with the number two -- 2, 1, 3, 4, 7, 11, 18, 29, 47, 76 and so on.

But the Fibonacci sequence gets more exciting when you use it to create spirals. These apparently are also duplicated throughout nature in everything from sea shells to pine cones to the spirals on a pineapple or cauliflower.

Gardeners will be fascinated to know that the Fibonacci spiral is evident in the cone of echinacea or in the centre of a sunflower, with 55 or 89 spirals going in opposite directions.

#### TRACKABLE GROWTH

Fibonacci started everyone talking about his numbers by speculating about how two rabbits would breed if left alone without any interference for a year.

His calculations showed that a single pair would reproduce themselves and continue to reproduce at precisely the rate in his sequence, resulting in a population of 377 pairs at the end of the year.

This trackable growth pattern has also been found in the plant world, with plants first producing a single stem, then breaking into two stems, then three, then five, then eight, then 13 and so on. This same sequence has also been observed in the development of leaves on a plant. And the 1: 1.6 golden ratio has also been found to apply to the spacing of seed within a flower head.

It is easy, of course, to become over-zealous and look for the vague coincidences in nature. I have not taken time to study leaf patterns but Fibonacci supporters see the sequence at work in the leaves of elm, linden, oak, cherry, apple, holly, plum, poplar, willow, blackberry and even grass.

Fibonacci numbers can also be found in the chambers, sections or seeds of a pepper, lemon, apple or tomato.

So, what does it all mean? Well, certainly it shows that growth is connected in a specific way to what went before. And you could argue that productive, successful growth appears also to be connected to our perception of beauty, balance and harmony.

What I do know is that three pots do look better than four in an arrangement. And planting in threes and fives creates a better look than if you plant in twos and fours.

But the next time I look at a passion flower with its three carpels on top of five stamens, and three sepals underneath two layers of five petals, I will understand why many people regard the Fibonacci sequence as the "law of nature."

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#### QUESTIONS & ANSWERS

Q: I volunteer at the Stanley Park Lawn Bowling club and have an 80-foot garden to look after. We have an area to plant veggies and I would like to grow some garlic. How should I do it?

SW: Well, you're a wee bit late. Garlic is best planted in the fall, around the same time that you plant tulips and daffodils.

But you could still plant some cloves this month, provided the ground isn't frozen or too sodden. You will end up harvesting a week or two later than if you had planted in the fall, but that's not a big deal.

There are two basic kinds to consider growing: hardneck and softneck (ones that can be braided using their soft stems) Hardneck garlic is best suited for cold climates; softneck varieties are mostly recommended for warmer climates.

Top softneck cultivars are 'Silverskin', 'Russian (soft)' and 'Yugoslavian (soft)'. These are usually harvested two to three weeks ahead of hardnecks.

For coastal gardens, the hardneck varieties, although they are slower to mature than softnecks, are still your best bet.

'Music' is highly rated for Lower Mainland gardens, being a hardneck porcelain-type with a strong flavour, medium strength and large, easy-to-peel cloves.

'Yugoslavian' is another quality porcelain garlic with a strong flavour and a reliable growing habit. Other names to look for include 'Leningrad', 'Zemo' and 'Italian Porcelain'.

Garlic thrives in well-drained, loamy, fertile soil in a sunny location. Do some soil preparation before planting. Fork over the ground and work in well-rotted organic matter.

Break the individual cloves from the bulb and plant each one vertically (roots down) about 5 cm (2 inches) deep and 15 cm (6 inches) apart. Space rows about 30 cm (12 inches) apart.

Ideally, garlic requires a cold spell with temperatures under 10 C (50 F) for a month. If cloves don't get the chill they like, they tend to just bulk up into large cloves instead of developing into the traditional-shaped bulb comprising individual cloves. For more information, check out *Growing Great Garlic: The Definitive Guide for Organic Gardeners and Small Farmers* by Ron Engeland.

Q: My birch tree once had a beautiful white trunk. Now it is all yucky with algae and splashed-up dirt. What's the solution?

SW: Believe it or not, gardeners at Royal Horticultural Society gardens in England wash the trunk of trees once a year to keep them looking pristine. They hose down the pure white bark of *Betula utilis* var. *jacquemontii* as well as the patchwork trunks of *Eucalyptus gunnii* and *E. pauciflora* subsp. *niphophila*. They even scrub (albeit gently) the bark of *Acer grosseri* to show off its white marbled bark. Well, you did ask.

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