

# Ferns for NJ Gardens

Everyone loves ferns! Their delicate texture and wonderful ability to grow in a multitude of shady sites makes them a natural choice for the woodland garden. What most gardeners fail to understand or perhaps even consider is the historical age of ferns or the seemingly complicated processes of fern reproduction. Ferns date back well over 300 million years and along with the mosses, liverworts and horsetails, they represent some of the original plants to colonize the earth. Unlike some of their ancient cousins, ferns are vascular plants, with the appropriate plumbing to move water and nutrients throughout the plant.

Although ferns originally started to develop around 360 MYA during the early Carboniferous period, the ferns we recognize today did not start to appear until around 250 MYA with the advent of Osmundales (the Royal and Cinnamon Ferns order) with many such as the Lady Fern or *Athyrium* not appearing until after 145MYA! In other words, ferns did not appear and simply stop developing; they continued to change and speciate as the continents drifted and the climates changed. Ferns absorb nutrients and water through a fibrous root system which is very similar in structure to the more advanced seed plants. Although ferns appear to be lacking a stem, they are actually rhizomatous (a rhizome is a horizontal stem) with the stems spreading either under or above ground in a fashion similar to the stems of Bearded Iris. In the Tree Ferns, such as the Australian Tree Fern (*Cyathea cooperi*) the rhizome actually assumes the form of a vertical trunk!

Fern leaves, often called fronds, have a network of veins throughout the leaf and they are several cells thick, giving them the technical designation as a megaphyll, as opposed to the single-cell thick microphyll of a moss leaf! The leaf initially appears as tightly curled fiddle head, bearing a strong resemblance to a bishop's crozier and it proceeds to unfurl in a manner called circinate vernation. Ferns have two types of leaves or fronds:

- Trophophyll – a leafy frond whose function is to conduct photosynthesis and produce sugars.
- Sporophyll – a leaf that produces spores. This leaf can assume the shape of a normal frond and conduct photosynthesis or it can appear uniquely different – typically smaller and narrower – and may only function to produce spores!

Spores are somewhat similar to seeds, in that they can travel about by wind or by some form of mechanical means and, depending upon the plant, can remain dormant for extended periods of time. Spores differ from seeds since they are produced through meiotic cell division while seeds are produced through the sexual union of the male and female gametophyte. Spores are also predominantly haploid while seeds are diploid. A diploid organism has two sets of chromosomes while haploid organisms have merely one set. Similar to mosses and other primitive plants, fertilization is dependent upon water. What is unique to the reproductive cycle of ferns is the gametophytic stage in which the male gametophyte (the sperm) and the female gametophyte (the ovum or eggs) are created. Unlike most other plants and animals, this stage is marked by the appearance of a totally independent life form called a prothallus. The majority of a fern's life span is spent in the sporophytic stage, with the trophophylls and sporophylls providing what we gardeners accept as a 'fern'! Depending upon the fern species, spores are shed at varying times of the year, and when conditions are proper, they will absorb water and germinate into small, leafy structures called a Prothallus. The prothallus is typically ¼" wide, heart shaped and green. The outer wings of the structure are only one-celled thick while the central midrib is several cells thick. The prothallus produces rhizoids on its lower surface to

anchor it to substrates and to absorb nutrients and water. Along with the rhizoids, the Prothallus also produces reproductive structures on its lower surface; on the outer wings tiny ball-shaped antheridia appear, which produce the sperm, while long the mid-rib, chimney-like archegonia appear, which produce the ovum or eggs. In the presence of water, the multiflagellated sperm (some with more than 100 flagella) swim to the ovum, apparently attracted by Malic Acid or other chemicals. Once one ovum is fertilized, the remaining archegonia are rendered inactive, allowing only one fern to be produced from each Prothallus! The enlarging embryo initially receives its nutrition from the Prothallus and an initial, 'boot-like' root that is the first growth to appear – much like the radicle or root is during seed germination. However, as soon as the stem and the first leaf develop, the 'fern' begins functioning as an independent plant and the prothallus rapidly degrades and vanishes. Interestingly, very few insects or animals eat ferns, but many eat the prothallus, which in part, explains why they are not seen more readily in the wild!

There are currently 33 families of ferns currently existing in the world. The majority of the ferns and their families that we use today in the garden are relatively young, only dating back around 140 million years or less! The youngest family of ferns is polypodiaceae, which includes Christmas Fern, *Polystichum acrostichoides*. The oldest family is the Osmundaceae which developed during the Triassic Period (250-200 MYA). Osmundaceae contains two of my favorite types of ferns for moist sites: the Cinnamon Fern or *Osmunda cinnamomea* and the Royal Fern, *Osmunda regalis*.



The origins of the genus name *Osmunda* is a bit of a mystery, but common belief is that it came from the Saxon god Osmunder, who was more or less the equivalent of the Scandinavian god of thunder, Thor. In order to protect his family, Osmunder hid them in a tall group of ferns, which were called *Osmunda*! My infatuation with *Osmunda cinnamomea* also started with my family, but not so much as to hide within but to display and enjoy! The slowly spreading rhizomes produces large masses of dark brown colored roots that ultimately develop into a small, 4-6" tall and wide mounds, from which the fiddle heads appear come spring. During the winter landscape, their appearance was somewhat of a fascination to me, as they dotted themselves about the swampy, frozen ground. I moved them to a moist site closer to the house for us to enjoy and today, nearly 50 years later, they are still thriving in that same site! In spring, the croziers of the leafy trophophylls appear first, followed by the fertile sporophyll fronds. The sporophylls are initially green, but once the spores are shed, these leaves take on an attractive cinnamon brown coloration, extending

upwards of 24" tall by mid-June before collapsing in mid-summer. It is the tan coloration of the sprorophylls that gives rise to the common name of Cinnamon Fern, as well as its other common name of Flowering Fern. The stems of the fronds are also covered with downy orange hairs as they unfurl and they remain for a short period thereafter. Interestingly, these hairs are used by Hummingbirds to line their nests! When grown in wet or very moist sites in an acidic pH, the feather shaped sterile fronds are very tolerant of full sun and can reach heights of nearly 5'. In

drier or higher pH soils, the plants vigor is reduced and a more modest height of 3' can be expected.

If I had been exposed to Royal Fern as a young lad, there is no doubt that I would have been equally as infatuated with this plant. A very regal and stately fern, the species epithet is very fitting! Like its cousin, it too produces mounds of wiry, dark brown roots and prefers acidic, moist locations. What is different is the shape of the foliage. Fossils of Royal Fern first appeared in southern Gondwana (what is now roughly South America, Africa and India), and through tests on fossils found in Sweden in 2014 it was revealed that the genetic identity or genome has not changed significantly



in over 180 Million Years! The large and elegant trophophylls have a twice cut or compound leaf, reaching upwards of 5' tall and over 1' wide. The sporophylls are typically shorter and have foliage similar to the trophophylls at the base, with the cinnamon brown spore releasing portion at the tip. Unlike the Cinnamon Fern, the Trophophylls remain throughout the growing season.

Hardy from zones 2 to 10, *Osmunda cinnamomea* and *Osmunda regalis* are two imposing, stately ferns for the Garden that – should the need arise – can be used to hide your family! Ferns are clearly a plant that can fetch everyone's fancy, whether you are a boy of 10, a seasoned gardener of 90 or person that enjoys providing habitat for your local hummingbirds!