COMMENTARY

If you stand still can you still be efficient?

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IN TODAY'S world, it is all about being efficient. Many companies and the industrial sector have devoted much time and money to researching how to make activities more efficient.

For instance, the fewer motions a person or a machine physically takes to manufacture an item, the less energy is being used, that means that the amount of energy being used is also decreasing, and less money on manufacturing the item is spent so a bigger profit can be made.

Also, for repetitive tasks, if it can be done using five motions compared to 12 motions to make an item, then they are able to produce more items at the end of the work day, which in turn again translates into more profit for the company making the items.

But is nature this efficient? Do plants and animals give any thought to efficiency to begin with? In the following paragraphs I will attempt to explain how stationary organisms like plants efficiently utilise the sun's energy including some strategies and physical adaptations they have developed.

Plants are the beginning of food webs in ecosystems so it is important that they be efficient as the energy they capture is enough to be passed along the food web to the rest of organisms. With plants, efficiency of energy use explained as the efficiency at which it transforms energy from the sun into glucose via photosynthesis. Out of 35% of the energy that comes from the sun that is usable for photosynthesis, mature plants utilise 2% of the energy from the sun while rapidly growing young plants utilise 8% of the maximum 35%. So where does the 27 to 33% of the usable energy go?

Well during the first weeks of the plant's life when it has germinated but is still under the ground, much of the usable energy hits the bare ground. Most of the sunlight continues to hit bare ground around the seedling as the plant continues to grow. Energy is lost because half of the energy that atmosphere is not of the correct wave length, as only the visible part of the solar spectrum is usable in photosynthesis. However, plants have adapted to this by having green pigments that absorb the light in this put of the spectrum. Therefore, to account for this ability, biochemists multiply the ecological efficiency by two; therefore plants are 4% efficient.

Now that we have accounted for how the energy is lost during the plants' lifetime, let us look at some adaptations plants have to maximise their collection of this solar energy. The green leaves of plants can be thought of as nature's solar panels. If you look at a tree from the side, you would notice that it is comprised of overlapping layers of leaves. This arrangement has the effect of increasing the surface area exposed to sunlight. This is because what light escapes; the top layer will be captured by the leaves in the lower layers. Another light gathering strategy employed by plants is to incline their leaves at an angle. This is because when light hits a surface at an angle it spreads out, also the intensity of the light will diffuse. This strategy is quite apparent if you were to look at the arrangement of the long thin blades of grasses.

Efficiency is not only important to terrestrial plants but also aquatic plants. Benthic marine plants, that is, plants that grow on the sea bottom and are anchored on the sea bottom are more efficient than floating aquatic plants.

The reason for this statement is that carbon dioxide is soluble in water so that benthic plants receive carbon dioxide needed for photosynthesis in a dissolved form from the water around them, while floating plants receive a lower concentration of dissolved nutrients.

Therefore one can see that in order to survive, all organisms must manage their energy efficiently and plants although stationary are no exception.

However, efficient use of energy does not take place during all life stages, and the most efficient energy use occurs past the seedling stage until maturity. Plants also have developed certain strategies with the placement of their leaves for optimum energy collection.