

# EZ-FLO Fertilizing Systems

## Why is it Important to *Fertilize Responsibly*™?

Traditional methods of applying granular fertilizers and other chemicals (herbicides, pesticides etc.) leave much to be desired as compared to newer application techniques using fertigation.

The term “fertigation” is a commonly used term to describe a particular fertilizing method that has been used for decades in the agricultural sector. There is a significant body of published research available proving the efficacy of fertigation in commercial farming. Consequently, lessons learned from the agricultural sector can be brought to bear to improve fertilizing practices for residential and commercial landscapes.

Benefits of fertigation over traditional broadcast or drop fertilizing methods include:

- Increased nutrient absorption by turf and other plant materials
- Reduction in fertilizer and chemicals needed and,
- Reduction in water usage

The last two benefits listed have a profound environmental and societal impact that will be explored further in this white paper.

Until recently, most residential fertigation systems were adaptations of much more sophisticated and proven agricultural solutions. Although these solutions have a long history of working on larger scale properties, the sheer complexity of the mechanical and control systems, as well as the ongoing maintenance needed to operate these systems, is a significant barrier to adoption of fertigation to smaller properties.

EZ-FLO Fertilizing Systems manufactures products that automatically dispense fertilizers through an irrigation system. EZ-FLO has successfully adapted the key delivery aspects required for fertigation to the smaller sized landscape. We have incorporated fertigation’s proven benefits into easy to use, reliable and maintenance-free systems that owners of homes and small commercial properties can readily use. We are knowledgeable in fertilizing methods and procedures for residential and small commercial landscapes and we bring this expertise to bear in providing products that overcome significant barriers in adopting fertigation to this market.

This white paper will examine each of the benefits of fertigation to demonstrate why the application of fertilizers through fertigation is the most responsible way to fertilize in today’s environment. We also discuss why the EZ-FLO product approach captures the benefits provided by fertigation and provides a superior means of fertigation, without the attendant complexity of other competing product solutions.

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## BENEFITS OF FERTIGATION

### Increased Nutrient Absorption

#### *Fertilization – Dry Broadcast*

Under traditional drop or broadcast fertilizing methods, fertilizer is applied in concentrated granular form. Depending on the fertilizer brand, size ranges of the fertilizer granules can range from fine granular dust to pellet size. Once applied, water from natural sources (rain) or from artificial sources (irrigation systems including sprinkler, spray or drip) dissolves the fertilizer solids so that they can leach down to the plant root zone. This method of application results in uneven nutrient delivery due to uneven dissolving of the fertilizer granules. The concentration of fertilizer reaching the roots is dependent on the temperature and amount of water available to dissolve the fertilizer solids.

Traditional drop or broadcast fertilizing also increases the danger of burning plant leaves and root systems due to the uneven and uncontrolled release of fertilizer. In addition, especially in high heat conditions, dry fertilizers can volatilize meaning that these fertilizers can breakdown and release gases that damage or burn the nearby foliage. Dry fertilizers are typically applied in concentrated amounts every four to six weeks creating a “feast and famine” feeding schedule for the plant<sup>1</sup>. Delivering too much nitrogen to the plant in the “feast” portion of the cycle, increases the succulence of the grass, increases its demand for water, makes it more susceptible to heat damage<sup>2</sup> and inhibits its root growth<sup>3</sup>. It also weakens the plant, making it more susceptible to disease and insect infestation<sup>4</sup>.

#### *Fertilization - Liquid Fertigation*

With the advent of liquid fertilizers that were sprayed onto the plant material, fertilizing effectiveness jumped significantly. Liquid fertilizers have a significant advantage over granular applications in that liquid fertilizers can be absorbed through the above ground pores of the leaf/stalk/branch structures of plants as well as through their root systems. This above ground process is termed “foliar absorption”. In addition, the liquid fertilizer making its way to the root zone is more consistent since it is already dissolved and ready for the plant to absorb.

All above ground plant structures (available on all grass, flowers, trees, shrubs etc.) can absorb water and nutrients through tiny pores on the plant structure. Typically leaves have the densest pore structures on the plant and maximum nutrient uptake occurs there. For example, a 12 year old apple tree in Washington State has a leaf surface area of one-tenth of one acre even though the tree only occupies one-hundredth of an acre<sup>5</sup>. Making the nutrients available to both the leaves and roots greatly enhances the plant’s ability to absorb the nutrients.

Applying fertilizers in a water stream works in harmony with a plant’s natural nutrient absorption and growth processes. A plant’s stomates typically open at dawn in response to sunlight to expose a dense network of pores and the process of photosynthesis begins. Plants require water for photosynthesis to occur, and water is typically drawn into the plant through roots as well as the leaves. Using fertigation, the water taken in by the plant leaves and roots can also include fertilizer nutrients.

As the temperatures rise during the day plants may begin to lose water through evaporation. This occurs naturally without much significance unless the root systems cannot keep supplying the plants' above ground structures with moisture. If the plant senses it is losing water that cannot be replaced through capillary action from the roots, its pores close to prevent further evaporation and to conserve the available water. When pores close because of a water deficit, the process of photosynthesis stops and the plant begins to wilt. Pores will subsequently reopen when the plant senses its water levels have recovered and adequate water is available in the areas where photosynthesis occurs<sup>6</sup>.

Howard Walters of American Rose Society notes that "fertilizer in liquid form allow[s] roses to absorb nutrients immediately through the leaves and roots" instead of waiting on nature or later watering to activate the fertilizer<sup>7</sup>. Fertigation applies the nutrients in a form that is ready to absorb immediately. This not only lessens the amount of time that fertilizer is sitting atop the turf or plant in an inactive, precarious position but also gives the landscaper or gardener more control over the application. According to a Congressional study conducted by the Research and Development Subcommittee of the Joint Committee on Atomic Energy, Washington, D.C., it was reported that fertilizers when applied in liquid forms that as much as 95 percent of what is applied may be used by the plant. If a similar amount is applied to the soil, only about 10 percent of it is used<sup>8</sup>.

One of the key elements in optimizing the beneficial effects from foliar absorption is the ability to regulate the proportion of fertilizer to a given amount of water. If the concentration ratio of fertilizer to water is too high, then the plant material (roots and leaves) may actually become damaged (termed "fertilizer burn"). Therefore when using fertigation it is important that the water soluble or liquid fertilizer being used is accurately proportioned into the irrigation water stream to keep from damaging the plant while still providing the optimum uptake that the plant can accept. Studies have confirmed that nutrient uptake is improved by supplying the nutrient more frequently in the smallest amounts<sup>9</sup>.

In addition to increased effectiveness from foliar absorption, applying small amounts of fertilizer through irrigation water also improves the healthiness of the plant root structure and the absorption of nutrients through the plant root structure<sup>9</sup>. This is especially important in drip applications where foliar absorption does not play a significant role in getting nutrients into the plant. Root health and mass are critical to the overall health of the plant, more so when using drip systems alone. The functions of a plant's roots are to provide the plant with water and nutrition. Increasing the root's mass gives the root more surface area in the soil which increases its ability to absorb water and nutrients<sup>10</sup>.

### *EZ-FLO Fertigation*

EZ-FLO Fertilizing Systems optimize the benefits of fertigation. EZ-FLO fertigation eliminates the "feast or famine" feeding cycle caused through the application of granular fertilizers by delivering consistent, small quantities of nutrients. In addition, lesser concentrations of fertilizers reduce possible leaf and root damage. EZ-FLO has patented certain fluid flow processes that ensure that fertilizer concentrate is accurately proportioned into a water stream on a consistent basis regardless of pressure or flow levels. Through these flow mechanics (which are achieved without the need for any moving parts and using existing water pressures within the irrigation lines) an EZ-FLO fertigation unit provides consistent, small doses of nutrient-rich water into the irrigation system.

EZ-FLO also has perfected the process of “micro-dosing”, which means to deliver minute amounts of nutrients at traces levels in the water systems. Micro-dosing allows you to fertilize every time you water for maximum nutrient uptake while keeping the application amounts very low. Most fertilizer dispensing units achieve proportioning levels of 75 to 200 to one. EZ-FLO can achieve proportioning levels of 15,000 parts water to one part fertilizer. This is equivalent to 1/20 of a teaspoon of fertilizer for every gallon of water dispensed.

Another important aspect of EZ-FLO proportioning is the ability to achieve uniform levels of fertilizer proportioning over the entire fill cycle of a fertigation unit. Many fertigation units start out fertilizing with high concentrations of dissolved fertilizers and, as the tank contents empty, the proportion of fertilizer falls as a percentage of the water applied. Independent flow testing of an EZ-FLO fertigation unit by the J. R. Peters Laboratory, a Scotts Fertilizer Company affiliate, demonstrates that delivery of the main elements of almost all fertilizers N P and K (i.e. nitrogen phosphorus and potassium) remains very consistent over the duration of the fertilizing cycle regardless of fertilizer tank capacity. EZ-FLO’s patented fluid flow technology creates a separation of fertilizer and water in the fertigation tank which effectively prevents dilution and creates consistent metering, from start to finish.

## **Reduction in Fertilizer and Chemicals Needed**

As noted previously, increased fertilizer absorption rates promote the health of the landscape as well as the health of the surrounding environment. The objective of fertilizing is to get as much fertilizer into the plant as possible so that runoff is minimized. According to an article from the Scripps Howard News Service, “when lawns get more nitrogen than they can absorb, excess nitrogen migrates into the watershed, stimulating algae growth in local ponds and bays that suffocates fish and aquatic life.<sup>11</sup>” An application resulting in low absorption of nitrogen and other elements present in fertilizer can leave the product sitting atop the lawn, prone to rain and other factors that can leach it into the surrounding environment.

A study conducted by a Stanford University research group confirmed that a 223 square mile algae bloom in the Gulf of California was the result of fertilizer runoff resulting from fertilization of wheat fields in Mexico. Excess algae growth sucks oxygen from the water creating dead zones where few organisms can live. “Scientists believe fertilizer runoff from the Mississippi River help explain a 5,700 square mile dead zone that appears every summer in the Gulf of Mexico off the coasts of Louisiana and Texas. The Natural Resources Defense Council said the Stanford study should prompt changes that could lead to less pollution flowing into the gulf. ‘We need to do a better job of promoting more sustainable practices.... It’s hard to change old habits. We need more leadership from our universities, government agencies and agricultural industry organizations to help producer understand there are better ways out there.’<sup>33</sup>

The spread of chemicals into neighboring and unintended environments is beginning to be recognized by local and state governments as an environmental hazard. In 2000, New York State passed the Neighborhood Pesticide Notification Law to protect the health and safety’ of the community. Currently seven of New York’s counties have opted-in to the requirements of the law and an eighth is in the process of joining them. This could very well be the beginning of a movement across localities to recognize the danger inherent in the spread of chemicals to unintended surroundings. A greater initial absorption rate of chemicals (fertilizer as well as pesticides and herbicides) would limit the amount susceptible to run-off.

Not only is an increased efficiency of absorption beneficial to the surrounding environment but this can also drastically reduce the amount of fertilizer needed to maintain a landscape. The International Atomic Energy Agency, a department of the United Nations, tested fertigation in the dry climates of the Middle East. A test in Jordan showed that “maximum garlic yields could be obtained with 80 kilograms of nitrogen per hectare when applied by fertigation as compared to 120 kg N/ha when applied by conventional methods.<sup>12</sup>” Experimentation in Syria and Lebanon produced similar results. Final conclusions through several different experiments showed a 42% increase<sup>13</sup> in yield when fertigation was used compared to traditional methods using the same amount of fertilizer.

In addition, it takes significant energy to produce fertilizers. Therefore any savings in fertilizer use can reduce energy costs. According to experts “There are significant energy requirements in the manufacture of nitrogen fertilizer (24,600 BTU per pound of nitrogen).<sup>14</sup>” A reduction of 50% in fertilizer usage thus would save the United States approximately \$2.9M annually based on a cost of \$9.10 per million BTU and based on usage of 13,000 tons of nitrogen based fertilizer<sup>15</sup>.

Another aspect of reducing fertilizer needed relates to the behavior of the consumers when applying fertilizers through dry broadcasting methods. The largest consumer fertilizer companies bombard the public with advertising directed toward making the consumers’ lawns and landscapes as beautiful as the ones shown in the ads. According to a recent study by lawn care experts “roughly half of homeowners admit they don’t read or follow directions when applying pesticides and synthetic fertilizers to lawns, often using significantly more than the recommended amount.<sup>16</sup>”

EZ-FLO accomplishes the goal of reducing fertilizer needed based on the increased efficiencies from foliar absorption, the improved efficiencies of root absorption by creating a larger root mass and delivering the nutrients in micro-amounts in liquid form during the watering cycle so they are more readily absorbed by leaves and roots. By limiting the concentration of fertilizers applied, there is a reduced chance that the fertilizers applied will find their way back into streams, lakes and rivers.

The dry fertilizer absorption rate of 10% compared with the fertigation absorption rate of 95%, means that nearly 10 times the amount of dry fertilizer would need to be applied to accomplish the same results as realized with fertigation. This suggests that 90% of the dry fertilizer applied either remains in the soil in the form of nitrate salts or could become future runoff into streams, lakes, rivers and ground waters<sup>5</sup>.

The reduction in fertilizer needed (termed “fertilizer bulk”) and the increase in nutrition absorption is also advantageous in that it virtually eliminates exposure to fertilizer concentrates. In comparison, one pound of fertilizer applied through fertigation with an EZ-FLO system is applied evenly over a four to six week period, at rates less than 10 PPM nitrogen or .008 ounces of fertilizer per gallon of water and is absorbed immediately by the plant. This rate is below the Clean Water Act’s permissible level of nitrogen in potable water<sup>17</sup>. The equivalent amount applied in dry form would be ten pounds applied in one application. The dry application then sits on the ground until it is watered in by rain or irrigation. This single application of dry fertilizer is 454 times more concentrated than that of each fertigation application. This is the nutritional equivalent of a person eating one meal every six weeks. The dry application represents a high exposure to hazardous chemicals while the fertigation application virtually eliminates this hazardous exposure.

Multiple low doses of fertilizer and its inherent elements through fertigation allow for an initial absorption rate greatly superior to that of traditional granular applications. Dr. Max Brown, PhD is the Director of Agronomics Research and Development with The Toro Company. His studies have shown with fertigation “smaller amounts of nutrients [are] leached into ground water [where they] erod[e] into environmentally sensitive areas.<sup>18</sup>” A greater absorption rate leaves fewer chemicals exposed and subject to the effects of wind and rain. Yields have been greatly improved in agricultural crops by increasing the fertigation frequency and lowering the fertilization dose per frequency. EZ-FLO technology provides the maximum advantage by providing micro-dosing capability with each watering.

By improving plant health, fertigation reduces the need for pesticides and fungicides. “Stressed or unhealthy plants act as magnets to pest populations.<sup>19</sup>” “Failure to maintain optimal nutrient levels during early summer result in substantially more disease<sup>20</sup>.” The “feast or famine” feeding cycle of dry fertilizer application can promote conditions in the soil and plant that make plants more susceptible to disease and insect infestation and thereby increase the requirement for pesticides and fungicides. Insects reproduce more rapidly on plants with high nitrogen levels<sup>21</sup> which can be caused by feast and famine feeding cycle.

EZ-FLO fertigation delivers the nutrients in small, metered amounts so the plant receives the optimal amount of nutrients and the feeding of the plant is very efficient and effective while at the same time reducing the amount of fertilizer bulk.

## **Reduced Water Usage**

Water conservation is a major challenge that the landscape industry cannot afford ignore any longer. The Department of the Interior released a study in 2001 that predicts every major metropolitan area in the western United States has significant potential for conflict over water supply as early as 2025<sup>22</sup>. This study highlighted the potential of water shortages in such places as the San Joaquin Valley of California, Las Vegas, NV, Salt Lake City, UT, Denver, CO and Houston, TX. Tom Spofford, the Irrigation Association’s 2001 Person of the Year, believes that “irrigation is...a critical means of...using water resources efficiently and effectively<sup>23</sup>,” putting the responsibility of water conservation squarely on the shoulders of the irrigation and landscape industry. As an increasing population stresses our finite resources, water conservation is becoming a prominent issue in our industry.

Government agencies are attacking water conservation in varying ways. The California Urban Water Conservation Council is seeking grant money to fund a statewide turf buyback program similar to one implemented in Las Vegas, Nevada. The goal of Nevada’s program is to buy back 1.2 million square feet of turf which they estimate would result in 141,370 gallons of water saved per day<sup>24</sup>. Although the savings may be real, there are other drawbacks to this single-minded approach to solving the water shortage problem.

The City of San Diego, California cites the positive impact landscaping has on the environment. “Plants provide an environmental value that nothing else matches... a lawn 50’ x 50’ absorbs carbon dioxide and releases enough oxygen into the atmosphere to meet the needs of a family of four. Studies conducted by the EPA indicate the average oxygen content of our air is 20 percent, but it has been measured as low as 12-15 percent in larger, more polluted cities. Plants and turf not only absorb carbon dioxide and release oxygen into the atmosphere, but the plant system – leaves, root, and soil – combine to remove toxins from the air.<sup>25</sup>” Studies show that lawns are up to 30 degrees cooler than paved areas and 14 degrees cooler than bare soil,

reducing the energy required to cool a home<sup>26</sup>. The Sacramento Municipal Utility District reports that “fully grown, properly placed trees can cut your home cooling costs by up to 40 percent.”<sup>34</sup> Landscaping prevents runoff of top soil, can function as a fire retardant around your home, absorbs noise and according to the Nursery and Landscape Association, adds 7% to 15% value to a residential property<sup>27</sup>.

Fertigation is an easy method of making a difference in our struggle to do more with less. From its test in the Middle East, the IAEA concluded that a 79% increase can be gained in water efficiency through fertigation<sup>28</sup>. Similarly Jeff Prink, the maintenance supervisor for the city of Aurora, CO installed fertigation systems in the city’s public area. The result in Aurora was a 20% reduction in the city’s overall water costs<sup>29</sup>. Turf Feeding Systems tested fertigation in Santa Fe, New Mexico and saw water usage reduced by up to 48%<sup>30</sup>. These results prove that fertigation is proving itself as an easy way to conserve water when applied to watering landscapes which accounts for 50% of the water consumed residentially<sup>31</sup>.

The estimated cost to meet the clean water needs in the United States over the next 20 years range from \$200B according to EPA estimates to \$330B according to United States city estimates<sup>32</sup>. Fertigation can be a key resource in reducing this consumption as well as the contaminants in the source water used to create clean water, which would greatly reduce the future cost of clean water.

Through the drastically increased absorption rates with fertigation, landscapers, cities and even countries around the globe are seeing healthier crops, plants and turf while using less fertilizer and water. Fertigation is proving itself to be the next logical step in irrigation technology and can have a major impact on the world’s future environment and our quality of life.

## Conclusions

### Fertigation Efficiencies

- Gained water efficiency – yield achieved from water used +79%
- Water use reductions -25% to -48%
- Fertilizer and chemical use reduction -70% to -90%

As has been discussed in this white paper, fertigation virtually eliminates harmful environmental hazards and exposure to hazardous chemicals as it conserves valuable water resources and produces far superior horticultural results.

Fertigation has been proven to increase fertilizer absorption and reduce fertilizer run-off. It is also likely that because the landscape is healthier, there is a reduced need for fungicides and pesticides. When combined with documented water usage reductions, fertigation is clearly the way to *Fertilize Responsibly*<sup>TM</sup>.

EZ-FLO’s patented technology not only provides all the benefits of fertigation to residential and small commercial landscapes, but also has the unique ability to use fully concentrated fertilizers and apply them in consistent quantities, every time you water. Studies have shown that this is the optimum way to deliver nutrients to plant material. Nutrient uptake and yields are maximized as chemical runoff is virtually eliminated. This unique ability provides superior results along with the convenience of a smaller storage tank having the capacity to feed an entire landscape for 4 to 6 weeks before it needs to be refilled. Other fertigation technologies for small landscape

fertigation cannot achieve the proportioning rates or consistency of application that EZ-FLO can achieve.

EZ-FLO, through its patented automatic fertilizing systems, delivers non-hazardous water soluble or liquid fertilizers through a hose, in-ground sprinkler or drip system every time you water. These systems as compared to other fertigation offerings, are superior based on their proven reliability, ease of installation while essentially being maintenance free.

EZ-FLO's unique micro-dosing capability provides the maximum benefit available from fertigation - creating the most beautiful results – all while being environmentally responsible.

## References

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