The Vita Landscape System

at

The Mesa Arizona Temple

29 June 2015

Prepared by Growing Season, Inc.

Cover photo by Bloomer Aerial Photography

Table of Contents

Executive Summary

The Vita Landscape System is a comprehensive method of maximizing plant health and increasing the visual appeal of intensely managed landscape systems. Intensely managed landscape systems face challenges related to the vigor and sustainability of non-native vegetation that is universally judged against the demanding standard of perfect visual appearance, perpetually. Most of the challenges are related to the regional, abiotic stresses that non-native plants are not genetically prepared to adapt to. The visual enhancement of an important edifice by a properly presented landscape is undeniable and, subsequently, significant effort and resources are committed to overcoming the difficulties associated with high-level landscapes across the world.

At the Mesa Arizona LDS Temple, the primary landscape challenges include localized landscape destruction during the Easter Pageant and Christmas Light events, sub-standard overall turf quality, non-sustainable ornamental garden plots, poorly presented citrus trees, and a correspondingly high cost of operation. To address the aforementioned challenges, the Vita Landscape System was integrated into the management of multiple project areas at the Mesa Arizona Temple beginning in November 2014. At the end of a six-month project period, *every project area subjected to the Vita Landscape System demonstrated significant improvement in sustainability and visual appeal.*

This report documents the findings and benefits of the Vita Landscape System at the Mesa Arizona Temple with the express purpose of initiating further applications of the Vita Landscape System on additional, highly significant properties of the Church of Jesus Christ of Latter-day Saints.

Introduction

The Vita Landscape System (Vita; **vahy**-*tuh*) is a comprehensive method for maximizing plant health by applying proprietary amendments in conjunction with site-specific irrigation and fertility practices. Vita is comprised of multiple product lines with tailored application strategies designed to address a broad spectrum of landscape, agricultural, and sports environments, ranging from rescue applications on acute and chronic stress areas to maintenance applications to enhance beauty and production while reducing water consumption and pest damage. This report is constructed to introduce personnel within The Church of Jesus Christ of Latter-day Saints' (Church) Temple Department, Architecture, Engineering, and Construction (AEC) Department, and The Corporation of the Presiding Bishop to the Vita Landscape System and to demonstrate the successes that Vita has had on multiple Church facilities in Arizona, principally the Mesa Arizona Temple (Mesa Temple).

The Church of Jesus Christ of Latter-day Saints Facilities

The Church of Jesus Christ of Latter-day Saints is a highly visible entity with a commitment to influence the world through good works; *Therefore let your light so shine before this people, that they may see your good works and glorify your Father who is in Heaven (3 Nephi 12:16).* In part of fulfilling this commitment, the Church has developed and maintains thousands of facilities worldwide to provide various ecclesiastical and community functions, the purpose best explained in the Overview of the 2011 publication *Facilities Management Guidelines for Meetinghouses and Other Church Property:*

> "*God has blessed us with wonderful facilities in which to teach the living truth. We now have meetinghouses scattered across the continents. Let us use them to nurture our people with 'the good word of God'* [Jacob 6:7]" (Gordon B. Hinckley, in Conference Report, Apr. 1997,91; or Ensign, May 1997,67).

To members of the Church, the facilities provide a familiar, comforting place of worship and sociality. To many others, the facilities of the Church are the first and/or only contact with the Church. In those instances, the facility exterior and grounds serve as a symbol of the goodness of the doctrines, people, and practices of the Church, the literal outward expression of an inward commitment. Because of the value of the facilities, considerable effort and resources are allocated for their maintenance, all provided by contributions from the Church membership.

In addition to facilities within public view, the Church is committed to worldwide humanitarian and preparation efforts that include many diverse agricultural production systems in order *to clothe the naked, and to feed the hungry, and to liberate the captive, and administer relief to the sick and afflicted* (Jacob 2:19).

Based on the Church's worldwide influence, high volume of aesthetic landscape and agricultural production systems, and humanitarian philosophy aligned with the founders of Vita, it is believed that Vita can measurably improve the results and economics of the Church's landscape and agricultural holdings on a macro scale, promoting an improved reach of the efforts previously stated.

The Vita Landscape System

Plants are biological, living organisms created with the specific purposes of beautifying the Earth and providing necessary substance for the inhabitants. Their core biological process includes harnessing energy from the sun and organizing elements from the earth into useful platforms. Further, plants are genetically coded to be perpetual, creating and securing progeny for future generations, continually filling their role in the Earth's life cycle. Indeed, plants are a vital foundational component of life on Earth.

The Vita Landscape System (Vita) is a comprehensive method developed by Vita Products, Inc. and Growing Season, Inc. to support the aforementioned plant systems through the application of proprietary amendments in conjunction with site-specific irrigation and fertility practices. Vita is comprised of multiple product lines of amendments with targeted application strategies designed to address a broad spectrum of landscape, agricultural, and sports environments, ranging from rescue applications on acute and chronic stress areas to maintenance applications to enhance beauty and production while reducing water consumption and pest damage.

The Vita Landscape System is based on the unique requirements of a plant's biological nature. The fundamental approach of Vita is to promote ideal synthesis of minerals and nutrients into the plant's system. It is the Vita philosophy that a healthy plant system is the most efficient, cost effective plant system, especially in a highly maintained environment such as an ornamental, landscape, agricultural, or sports facility. Vita takes a pro-active, healthy management approach, providing a plant the vital background materials requisite for photosynthesis, respiration, and transpiration.

Vita products are applied via water drench and foliar methods to utilize a plant's preferential means of nutrient uptake, through water uptake. Plants are somewhat passive in nutrient uptake in that they rely on the plant available nutrients in a water solution near the root zone. As water moves into and through the plants via transpiration, nutrients move into the plant. Plants regulate water flow into the plant by opening and closing stomata based on physiological indicators within the plant. These indicators include plant water content, plant temperature, nutrient levels, stress levels, etc. Vita products are formulated to work at the water and nutrient interface to promote improved mineral uptake and help regulate a plant's water consumption by more efficiently satisfying the plant's nutrient levels. Vibrant, healthy plants require significant water movement to locate nutrients throughout the plant, but nutrient dense water helps reduce non-effective water consumption. In an ideal management scenario, a maintenance dose of Vita Agri / VPX Booster would be automatically applied through the irrigation system during each irrigation event to promote consistent nutrient availability in the soil water solution.

Following the idiom that "an ounce of prevention is worth a pound of cure", Vita promotes that sustained management of plant systems yields more reliable, cost effective results. In recent applications, however, Vita has also proven valuable as cure. Two notable examples come from applications of Vita products on Church facilities in Northeast Arizona, specifically the Vernon LDS Meetinghouse and the Snowflake Arizona Temple.

Vernon Chapel Pine Bark Beetle

A very severe issue in the pine tree region of Northeast Arizona is the recent infestation of pine bark beetles (*Ips* sp. or *Dendroctonus* sp.). Bark beetles feed on and bore into the tree's inner bark, separating the bark from the tree and eliminating the path for carbohydrates to flow from the leaves to the non-photosynthetic part of the tree. Beetles can also induce a blue stain fungus that grows into the wood portion of the tree, preventing the upward movement of water and nutrients. These effects combine to completely starve the tree. A tree's primary defense against the bark beetle is strong sap production to purge the beetle and heal the wound locations. Typically, infected trees completely succumb to the pest pressure and die.

Figure 1: Damage from Pine Bark Beetle Infestation at the Vernon Arizona LDS Chapel. The pictures illustrate pine sap flowing from injury locations after Vita treatments. Notice the purged bark beetles.

The current infestation of pine bark beetles is onset by drought conditions and dense forest populations that further ration the water per tree. As trees become susceptible, beetles feed on the trees that no-longer have the capacity for strong sap production. At the Vernon Arizona LDS Chapel, multiple trees began showing signs of pine bark beetle damage and Facilities Maintenance personnel approached Growing Season, Inc. about possible solutions. Basal and foliar applications of Vita products were applied to 23 affected pine and spruce trees in July of 2013. In August 2013 substantial healing was realized through returned sap production and new growth in dead and/or dying areas, with 15 trees fully recovering. At an estimated removal cost of $1,000 per mature tree, the Vita application provided an economic benefit of approximately $10,500. In terms of $5,000 per mature tree replacement value, the Vita application provided an economic benefit greater than $85,000. At the time of this report, all of the rescued trees are thriving at the Vernon Chapel.

Figure 2: Green regrowth on a treated pine tree at the Vernon Arizona LDS Chapel.

Snowflake Arizona Temple

At the Snowflake Arizona Temple (Snowflake Temple), a project to resurface the parking was performed in mid-June 2013. The nature of the resurfacing project required that the turf irrigation schedule to be suspended for approximately 4 days. In Snowflake, late June is the most demanding period of the year for water stresses on plants due to altitude, maximum day length, high winds, and intense heat. The result of the halted irrigation schedule was severe damage to certain areas of the turf. Investigation revealed that the areas with critical damage coincided exactly with the placement of mortar mixers during Temple construction in 2001-2002, creating compromised soil depth and mineral composition that was not sufficient to support turf through the short stress period.

Growing Season, Inc. was approached by Snowflake Temple personnel to replace the turf with sod at an estimated cost greater than $20,000. To mitigate this large expense, an inexpensive attempt was made using Vita products (primarily Vita VPX Booster and VPX Plus). At a project cost of $160 per 10,000 square feet, the application of the Vita products combined with proper irrigation and fertility management contributed to the damaged area's rapid recovery to Temple Standard levels within a 5 week period. Since this initial success with Vita products at the Snowflake Temple, the methodology was instituted as standard protocol and developed into a long-term management strategy referred to as the Vita Landscape System. It has subsequently demonstrated far-reaching landscape benefits at the Snowflake Temple. An economic review indicates that the Vita Landscape System provides an annual estimated cost savings of $14,400 from improved plant health, reductions in irrigation, fertilizer, and pesticide inputs, and reductions in labor. Unanticipated benefits of the Vita Landscape System include a dramatic reduction in cottontail rabbit pressure and very early greening of turf (February 2015, see following pictures). The cost of implementing the Vita Landscape System at the Snowflake Temple is $45 per 10,000 square feet per month, or approximately $6,000 per year for the entire property.

Figure 3: Damaged turf at the Snowflake Temple – 26 June 2013.

Figure 4: Damaged turf at the Snowflake Temple – 8 July 2013. This photo was taken approximately two weeks following the treatment with Vita Products. Notice the visible recovery.

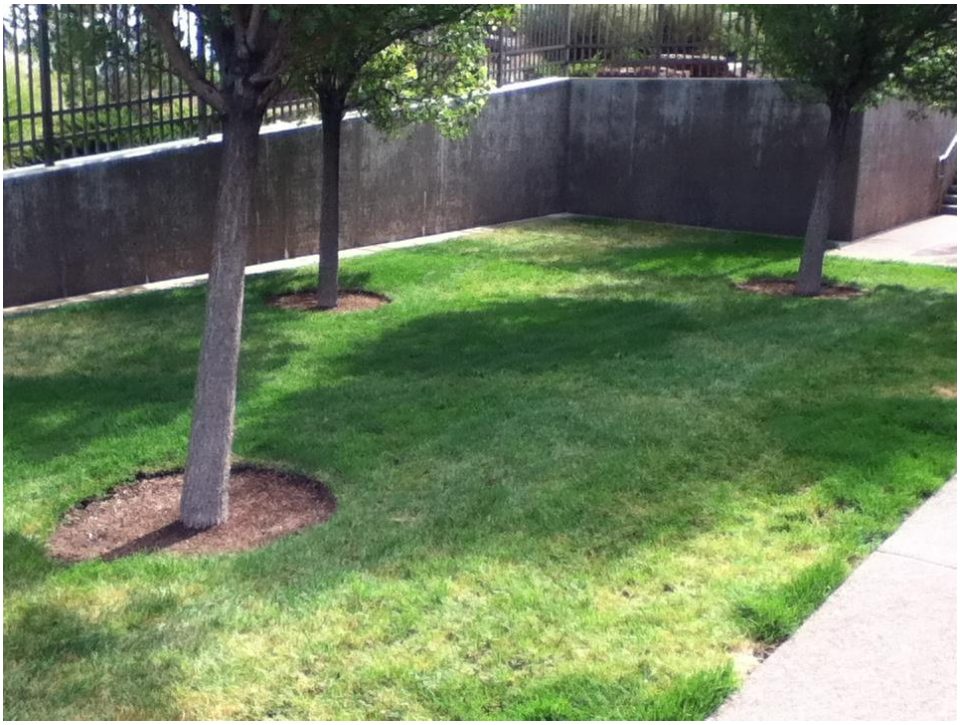
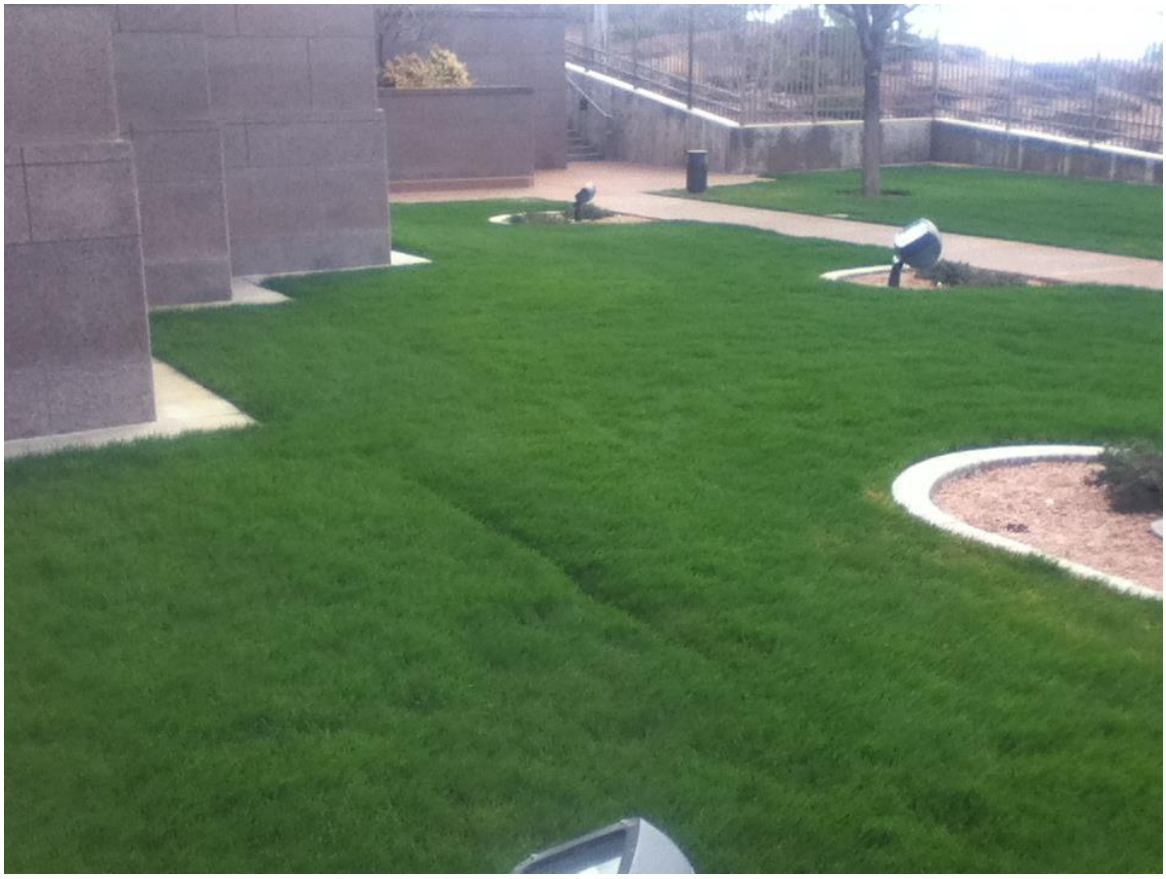


Figure 5: Fully repaired turf at the Snowflake Temple – 5 August 2013. The turf condition is far superior to the pre-damaged turf and the heavily damaged area is no longer discernable.

Figure 6: Turf on the south lawn of the Snowflake Temple - 18 February 2015. Notice the dark green color and fullness that is not common during February in Northeast Arizona.

Figure 7: Turf on the south lawn of the Snowflake Arizona Temple – 3 March 2015. This turf is in full vigor one month earlier than typical after being treated with the Vita Landscape System for approximately 18-months.



Based on demonstrated successes at the Snowflake Temple and multiple locations in the White Mountain area of Arizona, the Mesa Temple Engineer (Juan Trujillo) requested that Growing Season, Inc. partially integrate the Vita Landscape System at the Mesa Arizona Temple to address multiple challenge areas and to "verify" the Vita Landscape System.

Figure 8: Snowflake Arizona Temple in February 2015.

Introduction to the Mesa Arizona Temple Landscape

The Mesa Arizona Temple has been a central feature in the Phoenix Valley since its dedication in 1927 and is still the centerpiece and ensign of the Church in the Southwest Region. In addition to patrons who visit the Mesa Temple to perform inside ordinances, the Mesa Temple grounds are purposely visited by hundreds of thousands of people annually to enjoy the serenity of the landscape, take photographs with loved ones, watch the Easter Pageant performance of *Jesus the Christ*, view the Nativity scenes during the Christmas Season, visit the Visitor Center, or otherwise seek to improve their lives in the presence of the Temple.

Thomas Coburn, Managing Director of the Temple Department, provided the following insight during a Mormon Channel interview:

> "*…Temples are not inexpensive buildings. They're built to a standard that's much higher than the meetinghouse standard which is already a high standard. They're built to a much more demanding and exacting level and they do need to be maintained at a higher level…*" (The Mormon Channel, Into All the World Ep. 35, ~10:20 min.)

The footprint of the Mesa Temple and Visitor's Center is approximately 17-acres, about 10-acres of which is highly vegetated with a combination of turf, flower beds, citrus, and trees. This large-tract of intense vegetation demands steady effort and financial resource allocation "to be maintained at a higher level". Further, the Mesa Temple is located in Architecture, Engineering and Construction (AEC) Region 10.2 (Southern Warm Desert Eco-Region), which is one of the most demanding climates in which to support year-round non-native vegetation. Challenges specific to managing the Mesa Temple grounds are expressed in the subsequent sections.

Special Events at the Mesa Arizona Temple

Easter Pageant

The Mesa Temple is home to the Annual Easter Pageant during March and April, in which a live performance of *Jesus the Christ* is performed 9 times before an estimated 81,000 people. The Easter Pageant is highly anticipated and consistently provides a Christ-centered Easter message to the people of the Southwest and, in some instances, the World. Facilitating the production of the Easter Pageant

requires a tremendous amount of resources and places severe strain on turf and vegetation on the North Mall (bowl) and Northwest corner of the Temple grounds, creating aesthetic compromise and increased financial burden. Cited examples are as follows:

1. Total turf destruction in high-traffic / equipment traffic areas in the Northwest corner of the Temple lot during Stage set-up and take down
2. Total turf destruction in the backstage area where performers busily labor during practice and performances. The turf destruction acutely leads to allergy problems for some performers and lighting challenges during the performance.
3. Total turf destruction in the audience seating area (the North Mall)
4. Patterned turf destruction from natural "walking paths" created by audience entrances and exits

The landscape features observed during the Easter Pageant are an obvious departure from Temple Standard turf caused by a number of factors, primarily heavy traffic during the event, halting of irrigation for a two-month period, and un-prepared turf that is still recovering from the Nativity events held during the Christmas season. For the past few seasons, the remediation approach is to install new sod across all affected areas at an estimated cost of $0.85 per square foot, or approximately $111,000 across the 3-acre affected area.

Figure 9: Mesa Temple Easter Pageant stage area prior to stage set-up and immediately following the Nativity season.

Figure 10: Cast area immediately preceding Easter Pageant performances in 2015.

Figure 11: Easter Pageant cast area prior to the 2015 Easter Pageant.

Nativity / Christmas Lights

The Mesa Temple annually encourages public viewing across the entire facility to celebrate the Christmas season with an "exquisite Nativity display accented by hundreds of thousands of Christmas lights" (www.ldschurchtemples.com/mesa/). Much like the Easter Pageant, portions of the Temple grounds, primarily turf areas, are temporarily re-purposed as historical settings and footpaths in the process of creating an atmosphere that invites people of all faiths to celebrate the Nativity. High volumes of foot traffic induce strain on the grounds and result in degradation of the turf. Re-sodding the damaged areas is typical, expensive, and leads to unsightly turf areas.

Figure 12: Sodded grass area on the North Mall of the Mesa Temple grounds following the Nativity season.

Figure 13: Patched sod area on the Northwest lawn following the traffic of the Nativity season.

Turfgrass at the Mesa Temple

Turfgrass is a vital component of the inviting ambiance of the Mesa Temple landscape. In addition to evoking the mind to recognize the Temple as an oasis in the midst of a desert, specific contributions of the turf include:

1. Reduced ambient temperatures on the Temple grounds
2. Attractive, natural green look without dust
3. Beautiful ground-surface for family gatherings and pictures following Temple Ceremonies
4. Reduced noise from neighboring traffic and business

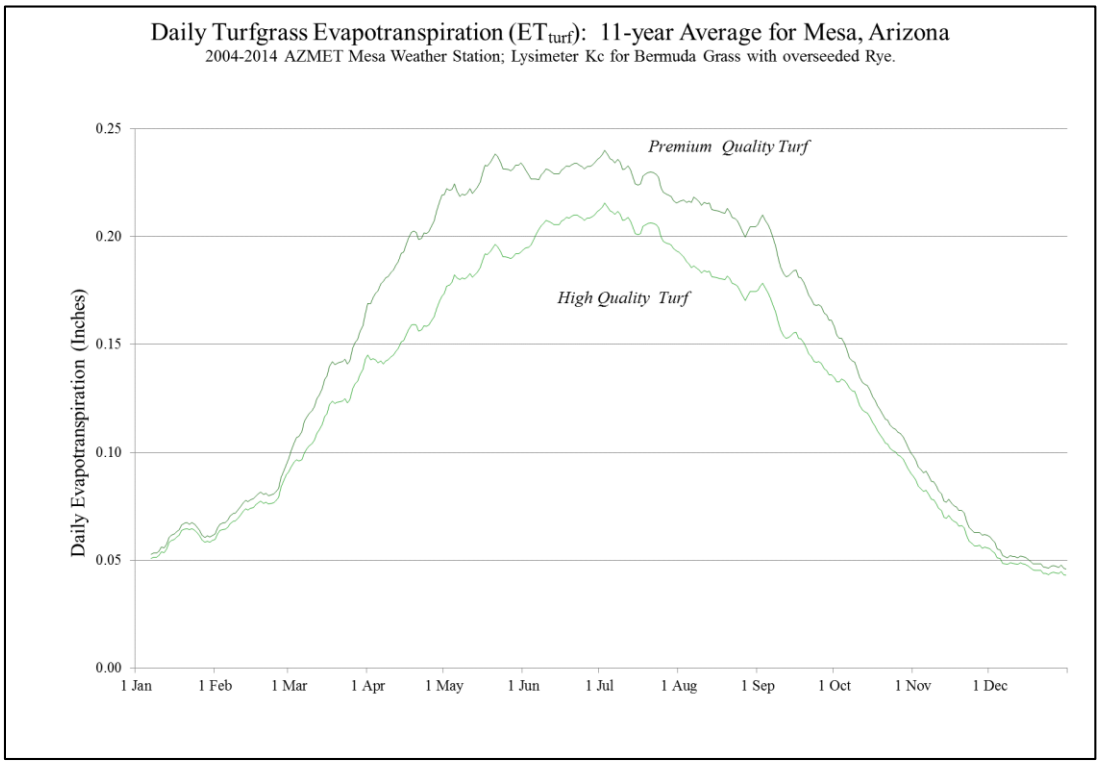
As the Mesa Temple is truly located in a desert, turf does not occur easily or naturally on the grounds. Turf requires substantial effort, resources, and commitment, especially to maintain premium quality turf fitting of the Temple Standard. The Mesa Temple turf is Midiron Bermuda grass that is over-seeded with perennial ryegrass for the winter months to produce green turf year-round. The most persistent turf

challenges at the Mesa Temple include high water demand, weak coloration (yellowing), presence of rust (disease), non-uniformity in and across irrigation zones, and shallow rooting depths. These challenges are both abiotic and management induced.

Turf Water Demand

Water performs three essential functions in the biological process of every plant: 1. Provide form and structure, 2. Regulate temperature, and 3. Move nutrients through the plant. Atmospheric conditions (temperature, humidity, wind, day length, etc.) and turf conditions (health, variety, height, coverage, etc.) directly affect how much water a turf system requires. In Central Arizona, high quality turf can use as much as 0.25-inches of water per day during summer months and as little as 0.05-inches during the middle of winter, corresponding with changes in plant growth and climate ("inches of water" relates to the depth of water uniformly spread across a given area, i.e. an acre-inch of water is one-inch of water spread across an acre and is equal to 27,000-gallons). In a typical year, a high quality turf stand will use approximately 55-inches of water.

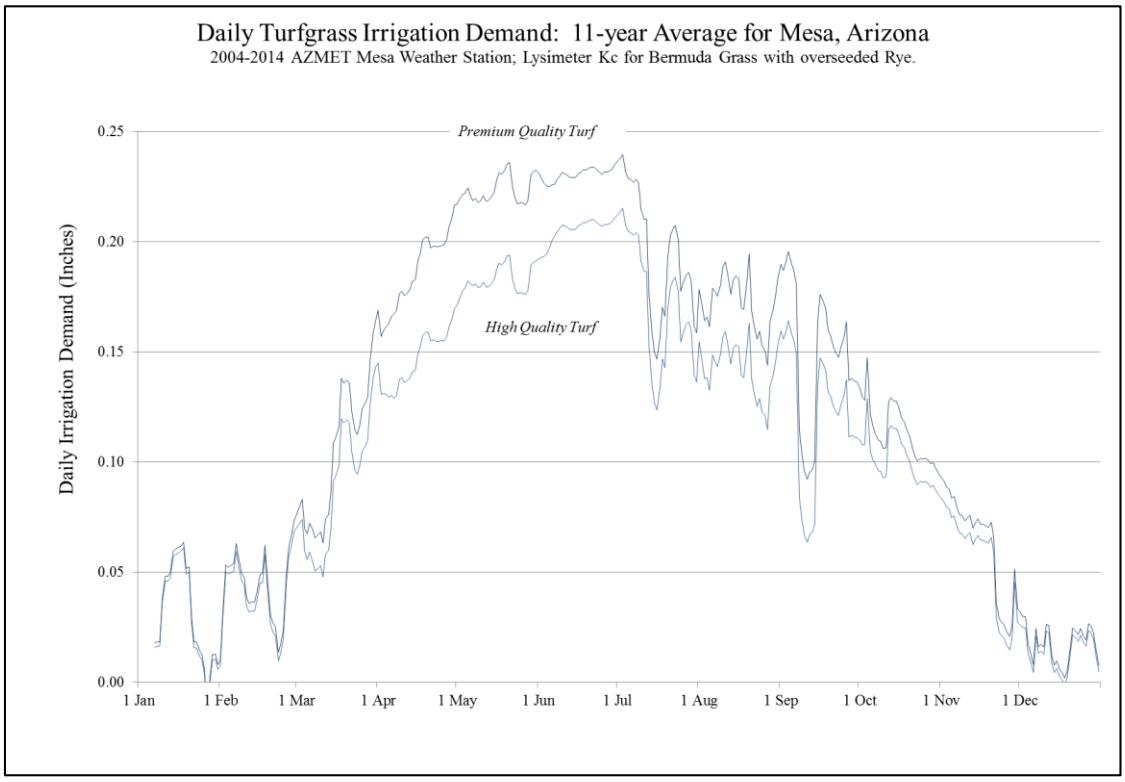
Figure 14: Daily Turfgrass Evapotranspiration for Mesa, Arizona



Average annual precipitation in Mesa, Arizona is approximately 8-inches. Depending on the timeliness of the precipitation events, turf in Mesa will require approximately 47-inches of supplemental water from

irrigation (55" required – 8" precipitation = 47" irrigation). Timing, frequency, depth, and irrigation system efficiency are important management considerations that must be considered in developing an irrigation schedule. This is especially relevant during the late summer months when Monsoon storms frequently deliver significant precipitation.

Figure 15: Daily Turfgrass Irrigation Demand for Mesa, Arizona



Explanation of Plant Water Use

Evapotranspiration (ET) is the industry standard for approximating plant water requirements. ET uses meteorological conditions (temperature, relative humidity, wind speed, day length, etc.) collected at standardized weather stations to consistently relate atmospheric conditions to measured crop water use. In practice, a reference ET (ET_{os}) is measured and then multiplied by a crop coefficient (K_c) to relate the atmospheric conditions to the type of vegetation.

The Arizona Meteorological Network (AZMET) provides daily ET figures for locations across Arizona, including the weather station approximately 3.5 miles southwest of The Mesa Temple at Mesa Community College. The charts provided as part of this report are developed using the public domain information from the AZMET Mesa weather station.

Weak Coloration

Turf quality is best measured by the visual appearance of the turf, namely the fullness of coverage and the depth of the proper, green coloration. The green color in a plant is the expression of the plant's chlorophyll absorbing and reflecting specific light spectrums from the sun as it is capturing the sun's energy. Recall that a plant's primary process of photosynthesis is a process by which light energy from the sun is captured and converted to a stored carbohydrate energy that the plant will use as part of its lifecycle. A healthy plant will typically absorb red and blue spectrums and reflect a true green color since the green light spectrum is generally too harsh of a light spectrum for a plant to thrive in. As plant health and nutrition declines or abiotic stresses occur, the plants ability to select light spectrums decreases, the energy conversion efficiency decreases, and the reflected color will change.

At the Mesa Temple, the turf nearly always has a yellowish, or "weak" coloration. This is caused by a number of issues that can systematically be addressed, all relating to plant health. Yellow discoloration typically occurs when a plant has water stresses (either too wet or too dry) or has a suite of nutrient deficiencies, primarily Nitrogen and Potassium with associated micro-nutrients necessary for proper nutrient location within the plant cells. Because a plant is a living organism and is very responsive to surrounding conditions, plant coloration is a primary means for evaluating management programs, spedifically the effectiveness of irrigation and fertility programs. In summary, if plant color is non-ideal, a vital plant need is not being met.

The most effective management of turf will be a flexible schedule of applying nutrients to the turf in smaller doses multiple times though the annual cycle, as needed, as opposed to regimented applications of prescribed fertilizers according to calendar dates. Nutrient need should be determined by soil and tissue sampling and by visual observation of the plant. (The caution with relying solely on visual observations is that it is a reactive measure since the plant is indicating needs by demonstrating visual clues.) The method of continuous fertility management coupled with a proper irrigation schedule will almost always result in the best results, both agronomically and economically.

Ultimately, the goal of the turf at the Mesa Temple is to be inviting to patrons and visitors and promote an attitude of beauty fitting of the purpose of the Temple. Yellowish grass is less effective in portraying this image than deep green turf.

Figure 16: The top picture shows weak colored turf on the South Lawn area of the Mesa Temple and the bottom picture demonstrates properly colored turf in the treated area of the South Lawn Vita Project Area.

Turf Disease - Rust

Disease is commonly an indication of poor plant health and in many cases is an indicator of ineffective turf management practices. At the Mesa Temple during the months of March and April, rust was prolific across much of the perennial ryegrass turf. Rust is a stress-induced suite of fungal spores that can appear and spread across the turf causing a reddish-yellow hue in the turf. It is also a source of allergens and can easily transfer to the shoes, pants, and gowns of those who walk across the turf.

Rust is a relatively slow presenting disease and healthy turf grass usually outpaces its onset and never provides a host location. Some common known causes for rust are mowing too low or with dull blades which stunts the turf's ability to grow back, low fertility, or improper irrigation (too wet or too dry, or possibly both if irrigation durations are sufficiently long). The best cure for rust and other common turf grass disease is proper management that promotes vibrant healthy turf.

Figure 17: East lawn with rust present, exhibited through the yellow hue and patchy appearance.

Figure 18: Close-up of rust spores on late-season ryegrass at the Mesa Temple.

Figure 19: Rust spores accumulated on work boots in the East lawn. These strongly colored spores are especially noticeable on white shoes, gowns, and pants commonly worn during picture sessions on Temple Lawns.

Non-uniformity of Turfgrass

Following the concept of immediate visual categorization, contrasts in color and / or fullness for a given area of turf tend to attract the viewer's attention and focus, causing the mind to judge the turf as imperfect. These contrasts are referred to as non-uniformity and are typically caused by insufficient fertility, poor irrigation system uniformity, unaddressed variations in soils, and low turf health.

At the Mesa Temple, non-uniformity is found throughout the grounds, both within irrigation zones and across irrigation zones, indicating three things: 1. Overall turf health and soil fertility is insufficient, 2. the sprinkler system is not consistently designed and / or maintained with an adequate coefficient of uniformity (CU), and 3. The irrigation schedule is not properly matched from zone to zone. In the desert where water is the backbone of any vegetation management program, the water delivery system must be treated with vital concern. Further, water is the primary method of plant nutrient uptake so lack of uniform water application also means lack of uniform fertility application.

Figure 20: Turf areas directly west of the Visitor's Center at the Mesa Temple. Notice the greenish circular patches and variation in yellowness and coverage indicting the fertility and water management program. The greener turf in the foreground is an early stage Vita plot that is beginning the recovery process.

Sand-bedding

Remediation practices often develop into standard practice to address issues created by remediation practices, and so on. Sand bedding sodden turf at the Mesa Temple has developed into one of those standard practices based on the frequency of replacing the turf. Placing sand below turf offers a few perceived benefits; 1. It levels easily and doesn't shrink so that turf elevations are maintained, 2. It stores easily onsite for convenience, and 3. It does not promote deep grass root anchoring so failed or damaged turf can easily be removed for the next iteration of turf grass. The current media used in this practice is washed sand (the type used in cement and mortar foundations) and physically embodies a lesson from the Parable of the Sower,

> *"Some fell upon stony places, where they had not much earth: and forthwith they sprung up, because they had no deepness of earth: And when the sun was up, they were scorched; and because they had no root, they withered away." (Matt 13:5-6, KJV)*

In the literal sense, the grass sod applied on top of sterilized sand never anchors roots and has not been able to become permanent at the Mesa Temple. Because of a very shallow rooting depth, the grass has limited access to irrigation water and necessary nutrients that are stored below the soil surface. The result is that some areas will need to be re-sodden in perpetuity unless deep roots are promoted through proper fertility, management, and a change in media substrate.

Figure 21: Sod patch on the East lawn. The picture on the left is a portion of the sod rolled back to expose the coarse sand bedding. The picture on the right highlights the receding turf in the middle of the patch.

Figure 22: Sod patch on the Northwest lawn rolled back to expose the coarse sand bedding. This picture was captured approximately two months after the sod was laid and demonstrates the shallow rooting depth.

Sloped Areas

The northern half of the Mesa Temple grounds features an aesthetically pleasing depression (Bowl) that truly enhances the depth and beauty of the Temple, especially as people view the Temple and Visitor's Center from Main Street looking south. The challenge presented here is that it is very difficult to uniformly water sloped and flat turf with the same management. When irrigation water is applied to the slope, it flows downward to the flat spot, creating dry areas on the top of the slope and boggy areas at the foot of the slope.

Figure 23: North Mall at the Mesa Temple. This picture highlights the aesthetic value of the subtle elevation variation across the Mesa Temple grounds.

Figure 24: View looking northward around the northwest circumference of the North Mall. Notice the rim of the bowl appears dry while the foot of the slope is greener, a variation caused by the discrepancy in water. The large sum of water pooled in this view is from a leak and further demonstrates the challenges for irrigating sloped terrain.

High-traffic Areas

All turf is susceptible to degradation in areas of high traffic concentration. There are a number of areas along edges of curbing and sidewalks at the Mesa Temple where turf is consistently dead. There are also locations where maintenance carts have avoided the nearby cart path to cross turf, creating unnecessary damage to turf areas. Consideration should also be given to strategic concrete "pull-outs" where high foot traffic may develop from people walking hand-in-hand allowing others to pass on the sidewalks.

Figure 25: Cart path worn on the short-cut corner in the Northwest turf area of the Mesa Temple grounds.

Figure 26: Worn grass near walkway on the east side of the Mesa Temple following the Nativity season.

Garden Beds at the Mesa Arizona Temple

The Mesa Temple is adorned with diverse garden beds that provide aesthetic depth and color to the Temple Grounds. The beds are typically well-maintained and complimentarily featured with coordinated colors and sizes of plants. To the casual patron and visitor, the flowerbeds certainly achieve their goal in creating an atmosphere of beauty. Upon inspection, however, there are a handful of agronomic issues across the garden beds at the Mesa Temple.

1. There is considerable effort and expense devoted to replacing injured, dead, or dying plants in the garden beds. This process becomes cyclic when dealing with transplants. Transplant shock is the phenomenon that occurs when plants are transferred from nursery conditions into native soils. It is not uncommon for certain plants to shed all of their foliage during the transplant process as roots are anchoring. When transplants are placed during stressful conditions, the stress of the transplant shock is frequently too severe for a young plant to survive. Thus, many locations will require routine transplanting in order to maintain the appearance of the garden. This practice is incredibly expensive and certainly not in accordance with the image that the gardens portray.

   The means for amending this transplant cycle is by improving plant health and abiotic conditions at the time of transplanting so that transplant success is promoted and transplant frequency is dramatically reduced. This can be accomplished through transplant timing and specific nutrient "dips" at time of transplant. Transplanting should not be scheduled during the heat of the summer.

Figure 27: East flower bed. Notice the bare spots and declining plant vigor.

Figure 28: Flowerbed along the South Lawn. The top picture is from 21 April 2015 with bright and full flowers. The flowers were removed on 22 April as demonstrated in the bottom photograph. Comprehensive garden removal and replacement continued throughout May. These plants were originally installed in November 2014.

2. There is a significant measure of pests present among the garden beds. Insect and lepidopteron (worm) pests are unsightly and do noticeable damage to plant foliage. Further, when pests are spotted they draw the mind away from the idyllic setting of the Temple. Pest pressure will fluctuate throughout the year and efforts should be made to control the presence and proliferation of pests to the extent possible.

   Pest control is an interesting challenge at a Temple location where the use of most restricted use pesticides is not feasible due to regular daily traffic and the odor of less severe products would still detract from the ambience a garden setting provides. Even when feasible, a common side-effect of chemical pesticide is a secondary pest outbreak of non-primary pests (such as mites) that become increasingly difficult to control, especially if beneficial insect populations are damaged by the pesticides.

A principle to consider is that plant pests preferentially feed on weak or nutrient deficient plants. An environment with healthy, vigorously growing plants creates a two-fold beneficial effect, an improved tolerance to pest pressure while discouraging pests from feeding on the healthier plants. As pest populations decrease due to a stronger plant environment, beneficial insects such as ladybugs also become more effective at maintaining an acceptable level of pest pressure.

Figure 29: Rudbeckia with heavy aphid pressure

Figure 30: Bagrada bug found in the East flowerbed. The bagrada is an invasive species that typically consumes vegetation at the plant's growing point, causing substantial health and visual damage.

3. The garden plots at the Mesa Temple are managed and tended to by committee. Each garden plot has an assigned gardener who is allowed to tend to that specific garden plot as seen fit. Naturally, each gardener has a unique style and preference as to what is ideal, acceptable, aesthetically pleasing, etc. The result is that the gardens at the Mesa Temple have variances in appearance and quality.

Citrus Trees at the Mesa Temple

The Mesa Temple landscape is shaded by hundreds of trees of various form and purpose. One of the more unique features of the Mesa Temple landscape is the attractive use of citrus trees for local historicity and aesthetic beauty. The challenge with cultivating a fruit bearing tree in an ornamental setting is that it requires more specific nutritional inputs than the surrounding plants. At the Mesa Temple, the citrus trees express poor coloration, small narrow leaves, and generally low fruit production.

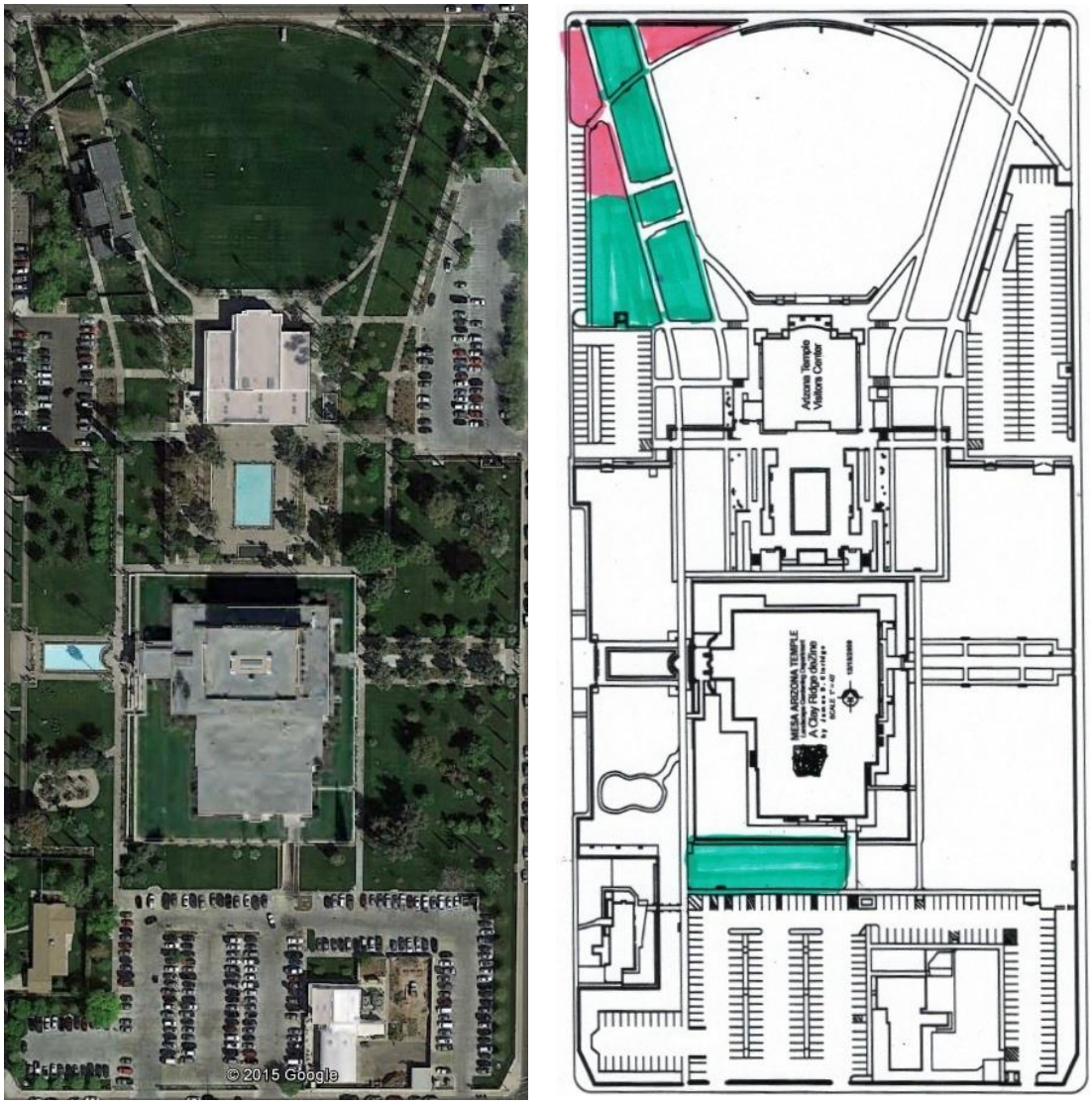
It is recommended that citrus professionals within the Church's agricultural entities, such as Mr. Dan Skousen of Deseret Farms of Ruskin Florida, be consulted on how to best address the citrus trees at the Mesa Temple. Mr. Skousen made a visit to the Mesa Temple in March 2015 at the request of Growing Season, Inc., and subsequently confirmed that the citrus trees are in generally poor shape and should be addressed through improved fertility, following soil and tissue sampling protocols.

Figure 31: Citrus tree on the East side of the Mesa Temple grounds demonstrating iron deficiency. These leaves are also comprehensively pale, indicating a compounded nitrogen shortage.

The Vita Landscape System at the Mesa Arizona Temple

The Vita Landscape System (Vita) was incorporated in selected areas at the Mesa Temple beginning in the summer of 2014 and became more formalized in specific areas at the Mesa Temple in November 2014. Vita was first included on the Mesa Temple grounds after demonstrating technical and economical merit in turf at the Snowflake Temple and in arboricultural settings on multiple Church properties in Northeast Arizona. The projects and results included herein are compiled solely as a demonstration of actual results experienced with the Vita Landscape System at the Mesa Temple, providing a proof of concept that the application of Vita products and the associated management is transferable to the Mesa Temple.

Figure 32: Aerial Image of the Mesa Temple on left and map layout of the Vita Project Areas on the right. The maps are oriented with North aligned with the top of the page.



Vita Project Areas at the Mesa Arizona Temple

The areas of interest in regards to the Vita Landscape System at the Mesa Temple are referred to as Vita Project Areas. The Vita Project Areas were strategically selected by Growing Season, Inc. to demonstrate the merits of the Vita Landscape System in worst-case scenarios, focusing on locations previously identified as challenge areas. These challenging areas were selected to demonstrate that the Vita Landscape System can be highly successful in "rescue" events although it is preferentially utilized in a pro-active manner to provide healthy landscape systems in perpetuity. The locations and results follow below for each of the Vita Project Areas. All applications of Vita Products were applied by hand within the Vita Project Areas using specified tank mixes.

Figure 33: Don Jackson of Growing Season, Inc. applying Vita Agri / VPX Booster in the Easter Pageant Stage area in November 2014. Photo provided by Bloomer Aerial Photography.

South Lawn Responses to Vita

The south lawn area is the plot of turf directly south of the Temple, proper. This spot was selected based on high southern exposure to sunlight and prevailing winds, high-visibility, and delineated segregation between treatment and control sites. The east half of the South Lawn is the Control and the west half is the Treatment with the existing delivery ramp as the divider. For this project area, both the turf and garden beds areas are included. The management of the Control side follows standard operating practices at the Mesa Temple and management of the Treatment side includes 2 monthly applications of Vita Agri / VPX Booster from November 2014 through April 2015 and multiple nitrogen applications during November and December. This area also received two tertiary Vita applications during the summer of 2014 prior to the formalization of this project.

Figure 34: South Lawn side-by-side. The Vita plot is on the left and the Control is on the right. The photos were taken within 5 minutes in similar sunlight from representative areas within the plots.

Turf quality is best measured by the visual appearance of the turf, namely the fullness of coverage and the depth of the proper, green coloration. The side-by-side pictures in this section were taken in mid-day conditions with similar, south-facing camera angles to provide equal perspective and demonstrate the differences between the control and treatment plots. The Vita treatment area demonstrates an appropriate green color and has fully filled thin spots since the beginning of the treatment. The control area demonstrates slightly translucent grass blades, an overall yellowing, and an appreciable amount of rust.

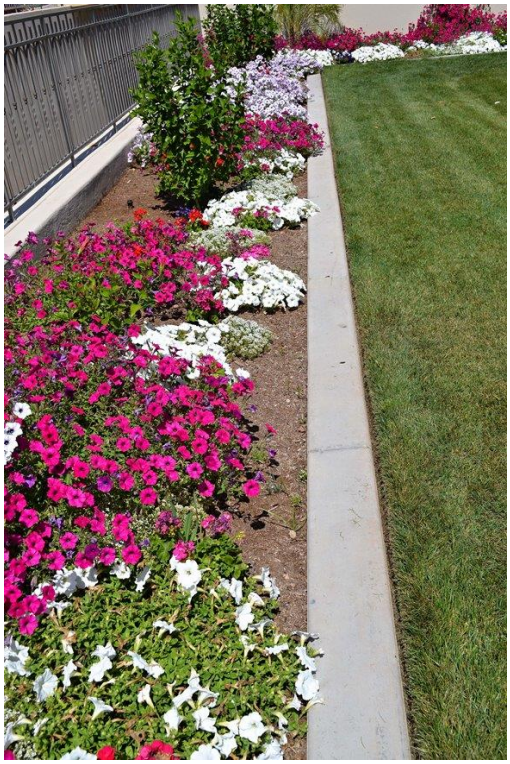
Figure 35: South Lawn side-by-side. The Vita plot is on the left and the Control is on the right. The photos were taken within 5 minutes in similar sunlight from representative areas within the plots. Notice the differences in the shades of green. The burned area in the Treatment plot is recovering from January 2015 construction traffic (see additional text and pictures within this *South Lawn* section).

Figure 36: Backhoe on the South Lawn as part of an 8-day construction event during January and February 2015. Notice the turf damage related to the backhoe path.

Figure 37: Photo of the Vita treated side of the South Lawn (West side) on 7 March 2015. Notice that the construction scars are not visible and the color of the turf is deep and uniform.

The garden beds surrounding the South Lawn area are equally impressive in terms of response to Vita. The garden plots received applications of the previously specified Vita products and responded in a similar fashion, increasing in color, coverage, and plant vigor. On 22 April 2015, the annual gardens were completely removed in accordance with standard practice. It is believed that the annual plant carry-over period can be significantly increased through the application of the Vita Landscape System, possibly eliminating the need for wholesale garden extraction and transplanting.

Figure 38: South Lawn area garden side-by-side. The Vita treatment plot is on the Left and the Control is on the right. Notice the difference in fullness, color, and plant size.



An important note relating to the South Lawn management is that irrigation events requested by Vita personnel were not completely applied as directed. Irrigation events were missed on multiple occasions while additional irrigations were applied on other occasions. Further, accurate records of irrigation events are not available for this area. Despite the incomplete application of the Vita Landscape System, the results are still highly visible and compelling. Two major conclusions of the irrigation discrepancies are 1. The Vita Landscape System is more than only better management of irrigation strategies since significant turf responses were realized with non-ideal irrigation applications and 2. If the South Lawn irrigation operation is a microcosm of the Mesa Temple grounds, an immediate adjustment should be made to the irrigation protocol across the entire Temple grounds.

In addition to the general challenges noted with the South Lawn Vita Project Area, three specific challenges of note occurred within the treated South Lawn area: 1. A construction project in late January through early February 2015 severely damaged the turf in the Vita treatment area, 2. The Vita treatment area was subjected to an 11-day period without irrigation between 20 April and 1 May, and 3. The turf was aggressively mowed ("scalped") on 21 April 2015.

Figure 39: Vita treatment side of the South Lawn project area showing damage inflicted during a construction project during January and February 2015. Similar to the recommendations for the Easter Pageant construction, precautions should be made to protect the turf and landscape during all construction events.

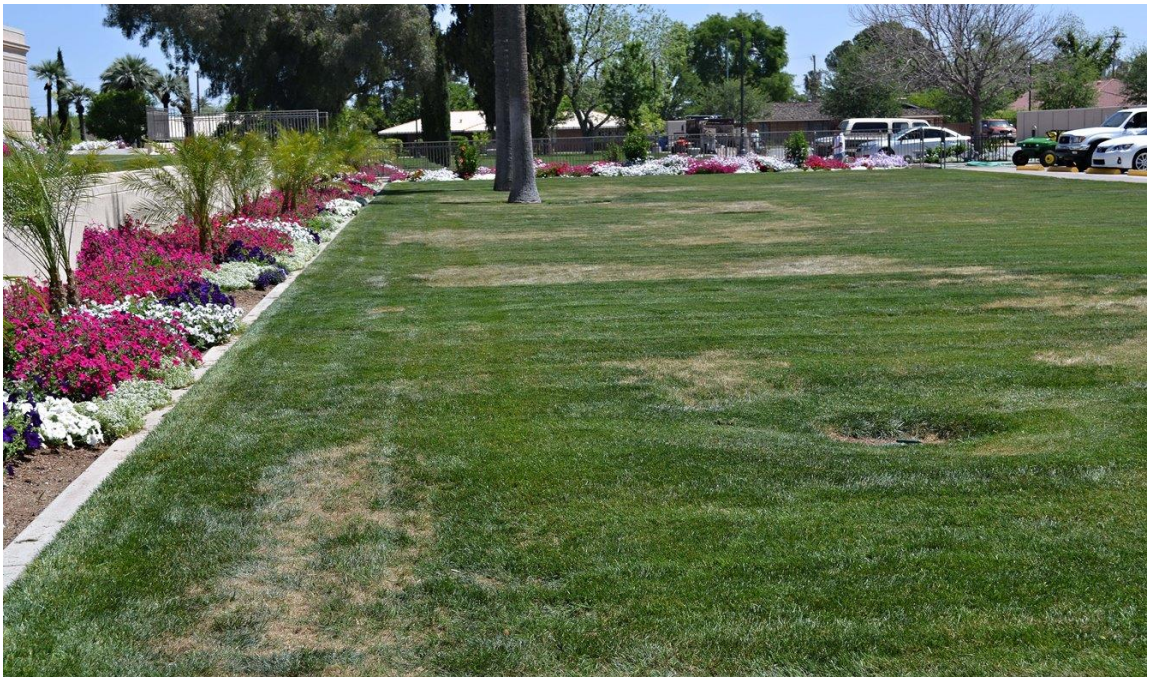


Figure 40: Treatment area of the South Lawn Vita Project Area three days after being "scalped" and over a week without an irrigation event. The turf in this picture is to a height of less than 1 inch and far below the photosynthetic portion of the turf, leading to poor coloration and slow growth response. Notice also that the beautiful accent flower garden is extracted as of 22 April 2015.

Ornamental Garden Responses to Vita

The Vita Landscape System is designed to promote plant health across an entire spectrum of plant types and conditions. The ornamental garden beds that border the West and East sides of the Mesa Temple are very diverse and present an excellent opportunity to examine the validity of the Vita Landscape System. This Vita Project Area is segregated as follows: The Control plot borders the Eastern side of the Temple from the Baptistry entrance to the Southern end where it intersects with the South Lawn; The Treatment plot borders the West side of the temple from the Main Entrance to the Southern end where it intersects with the South Lawn. The West side was selected as the Treatment area since it receives the harsh afternoon sun stresses and is in a more prominent location.

The Vita protocol for treating the ornamental garden beds was to foliar apply specified Vita products to the Treatment plot (West border) without altering any irrigation or gardener inputs. Beginning with the first application on 3 November 2014, the treated garden bed received 11 applications of the Vita Agri / VPX Booster product as part of the management protocol, basically twice a month during the treatment period.

The primary result of the Vita application is an improvement in the ornamental garden plot's aesthetic value through an increase in plant vigor, fullness, and overall health. This is witnessed by improved colorations, increase in full blooms, and increase in ground cover across the garden area. It is anticipated that improving the plant health during the 2015 winter / spring season will prove even more beneficial in improving plant sustainability and beauty during the summer months. As anticipated, a visible reduction in harmful pests was also realized, further improving the quality of the garden plots. The result of the Vita application in this Project Area is considered substantial.

Figure 41: Pictures of the ornamental garden plots taken on 5 April 2015. The picture on the left is the Vita treatment plot on the West edge of the Temple near the main entrance. The picture on the right is untreated near the East, Baptistry entrance.

Figure 42: Wilting plant in the untreated garden area

Figure 43: Vita treatment garden bed on the west entrance of the Mesa Temple.

Northwest Lawn Responses to Vita

The Northwest Lawn Vita Project Area receives significant foot traffic during the Nativity season and the Easter Pageant, primarily from Temple visitors who prefer natural foot paths to defined concrete sidewalks. The Northwest Project Area is a highlight of what turf grass should look like and exhibits the expected results of the Vita Landscape System. The included photographs highlight the turf's proper color, density, and vigor and create a dramatic contrast with the bordering untreated turf areas that display substantial stress responses during the Easter Pageant.

Figure 44: Picture of the lawn plots directly west of the Visitor's Center and south of the Easter Pageant stage in mid-April 2015. The picture in the foreground is the Vita treated area and the turf in the background is untreated. The treated area was subjected to heavy foot traffic up to two weeks prior to this picture.

Figure 45: Far South stage area treated with the Vita Landscape System (same as picture immediately above) next to sodded stage area. Notice the darker green coloration. The imperfections in this turf plot are the results damage incurred during the Easter Pageant Season and are expected to completely recover.

Figure 46: Vita Northwest Turf Project Area immediately north of the stage and cast area during the Easter pageant. This area was a frequent shortcut path for viewer foot-traffic and was able to withstand visual and lasting damage. Compare to the North mall area in the background.

Figure 47: Vita treated zone in the Northwest Lawn Project Area. Notice the green, full turf. The corner shown in this picture is subjected to heavier foot traffic and light cart traffic.

Figure 48: Vita treated zone South of the Easter Pageant stage, bordering the west Temple parking lot.

Easter Pageant Stage and Cast Area

The Easter Pageant is a signature event at the Mesa Temple, highlighted by the nightly performance of *Jesus the Christ*. As previously outlined and repeated here for convenience, there are major landscaping burdens that accompany the production of the Easter Pageant. The following list is a summary of the challenges faced and damages incurred in relation to the Easter pageant:

1. Total turf destruction in high-traffic / equipment traffic areas in the Northwest corner of the Temple lot during Stage set-up and take down
2. Total turf destruction in the backstage area from performers who busily labor during practice and performances. The turf destruction has historically lead to allergy problems for some performers as well as lighting challenges during the performance.
3. Total turf destruction in the audience seating area (the North Mall)
4. Patterned turf destruction from natural "walking paths" created by audience entrances and exits.

With full disclosure of the challenges from the Mesa Temple staff, Growing Season, Inc. determined that the problematic areas related to the Easter Pageant were ideal proving grounds for the effectiveness and reach of the Vita Landscape System. The Vita protocol was to rapidly prepare the turf in the stage and back-stage areas prior to construction of the Easter Pageant Theater, institute the Vita Landscape System as feasible during the Easter Pageant season, and intensely manage the areas following the Easter Pageant, with the objective of restoring Temple Standard turf as rapidly as possible. The seating area (North Mall) and the area immediately in front of the stage are <u>not</u> included in this Vita Project Area.

Figure 49: Easter Pageant stage area in November 2014 following initial applications of the Vita Landscape System.

Figure 50: Easter Pageant stage area in January 2015, following the Nativity season.

Figure 51: Easter Pageant stage area in January 2015, following the foot traffic and dry-down from the Nativity season; looking northward.

Figure 52: Telehandler in Easter Pageant area during stage construction - 23 February 2015.

Figure 53: Easter Pageant north stage area following stage set-up - 7 March 2015.

Figure 54: North stage area during Easter Pageant rehearsal sessions - 7 March 2015.

Figure 55: Crane removing the center portion of the Easter Pageant Stage – 21 April 2015.

Figure 56: Crane extracting portions of the Easter Pageant Stage – 21 April 2015.

Figure 57: Forklift staging and loading Easter Pageant stage components - 21 April 2015.

Figure 58: Severe turning damage in the center portion of the Easter Pageant stage area – 21 April 2015.

Figure 59: Construction tracks south of the Easter Pageant stage area – 21 April 2015.

Figure 60: Tractor trailer hauling stage components from the Easter Pageant north stage area – 22 April 2015.

Figure 61: North side of the Easter Pageant stage during disassembly of the stage – 22 April 2015.

Figure 62: Easter Pageant center stage area on 23 April 2015 following the removal of the stage structure.

Figure 63: Close-up of construction tracks in the Easter Pageant stage area – 24 April 2015.

Figure 64: Close-up of deep tracks from construction damage in the Easter Pageant stage area – 24 April 2015.

Figure 65: Easter Pageant north stage area on 25 April 2015.

Figure 66: Center section of the Easter Pageant stage area on 25 April 2015 following compost application, power raking, and Vita Agri / VPX Booster application.

Figure 67: South side of the Easter Pageant stage area on 6 May, less than two weeks after final stage disassembly. Notice the return of the deep green coloration in the grass areas and expansion of the grass into the heavily damaged areas. The Vita Landscape System was applied during this period.

Figure 68: Center portion of the Easter Pageant stage area on 6 May 2015. Notice the healthy coloration of the turf and the increasing coverage of turf into the previously damaged areas.

Figure 69: Area north of the Easter Pageant Stage with replacement sod laid over the heavy constructions areas.

Figure 70: Center stage area following freshly laid sod – 15 May 2015.

Figure 71: Easter Pageant southern cast area between the Nativity season and Easter Pageant set-up – January 2015.

Figure 72: Easter Pageant backstage area on 7 March 2015 during rehearsal sessions. Notice the lush green grass and the heavy equipment tracks.

Figure 73: Cast and crew area immediately following the Easter Pageant performances on 6 April 2015.

Figure 74: Easter Pageant cast and crew area on 27 April 2015 following the final stage disassembly.

Figure 75: Easter Pageant livestock area and construction stack-yard on the west edge of the cast area. Notice the deep tracks and damaged turf – 23 April 2015.

Figure 76: Easter Pageant livestock area along the west edge of the cast area – 1 May 2015.

Figure 77: Easter Pageant livestock area along the west edge of the cast area – 15 May 2015. Replacement sod was not applied in this area due to the success of the Vita Landscape System.

Figure 78: Easter Pageant cast and crew area on 5 May following rehabilitation treatments with the Vita Landscape System. Notice the full green color and the turf's expansion into bare soil areas.

Figure 79: South cast area on 15 May after being sodded. Notice the Vita landscape turf coloration compared to the newly laid sod.

Figure 80: View of the cast area following sodding, looking from south to north. The green area in the forefront is part of the Northwest treatment area and is subjected to the Vita Landscape System and moderate traffic during the Easter Pageant season.

Erection and disassembly of the Easter Pageant stage are unavoidable steps in the production process of the Easter Pageant. The required placement and turning of heavy cranes, forklifts, telehandlers, tractor-trailers, and other loading equipment place a substantial strain on the surrounding turf areas, acutely through trampling and chronically through severe soil compaction. The moderate to heavy foot traffic during the performances serve to compound the original damage of the set-up equipment, not allowing the turf to recover. The goal of the Vita Landscape System in this particular application is to mitigate large scale turf damages in the Easter Pageant area and dramatically reduce the time, cost, and effort typically expended in returning the turf to the Temple Standard. In future iterations of the Easter Pageant production, serious consideration should be given to laying temporary sheathing in high traffic areas to reduce the impacts of construction equipment on the fragile turf system, following the concept that less remediation will be required if less damage is incurred.

The primary portion of the Easter Pageant stage and cast area was ultimately sodded to Bermuda in early May 2015. Observations show that the existing turf was returning and gaining vigor as a result of the Vita Landscape System efforts, but the time constraint was too demanding for a full recovery of the turf area in the heavily trafficked and trampled areas. Areas that suffered only foot-traffic damage were able to be recovered and areas with construction equipment traffic were not recoverable within an acceptable time. The Vita Landscape System requires the presence of plant material to affect plant growth and, ultimately, the process of recovery in the setting of complete plant damage requires time for bordering turf to merge together unless an external input such as hydro-seeding or sod installation is employed.

It is believed that the damage caused by the construction of the Easter Pageant stage and backstage areas would have been completely restored to Temple Standard by the Vita Landscape System in time as there was significant undergrowth and greening in the backstage area during the Easter Pageant as well as positive new growth in the two week period immediately following the stage deconstruction. Foot traffic areas adjacent to the stage held-up remarkably well through the duration of the Pageant, dust was completely eliminated in the cast area, and no cases of allergic reactions were reported. Further, the stage and cast area received numerous positive remarks throughout the Pageant for being “improved” compared to past iterations. The Vita Landscape System’s contributions to the 2015 Easter Pageant should be considered successful on many levels.

North Mall / Bowl Area

Figure 81: Picture of the North Mall in January 2015, prior to the dry-down and set-up of the Easter Pageant facilities.

Figure 82: Easter Pageant audience area during the Easter Pageant season. Notice the walkway and trampling of the turf. The Vita Landscape System was not applied to the seating area.

Figure 83: Easter Pageant audience area near the end of the performance season. Notice the trampled turf and the existence of sodding lines from turf remediation in 2014.

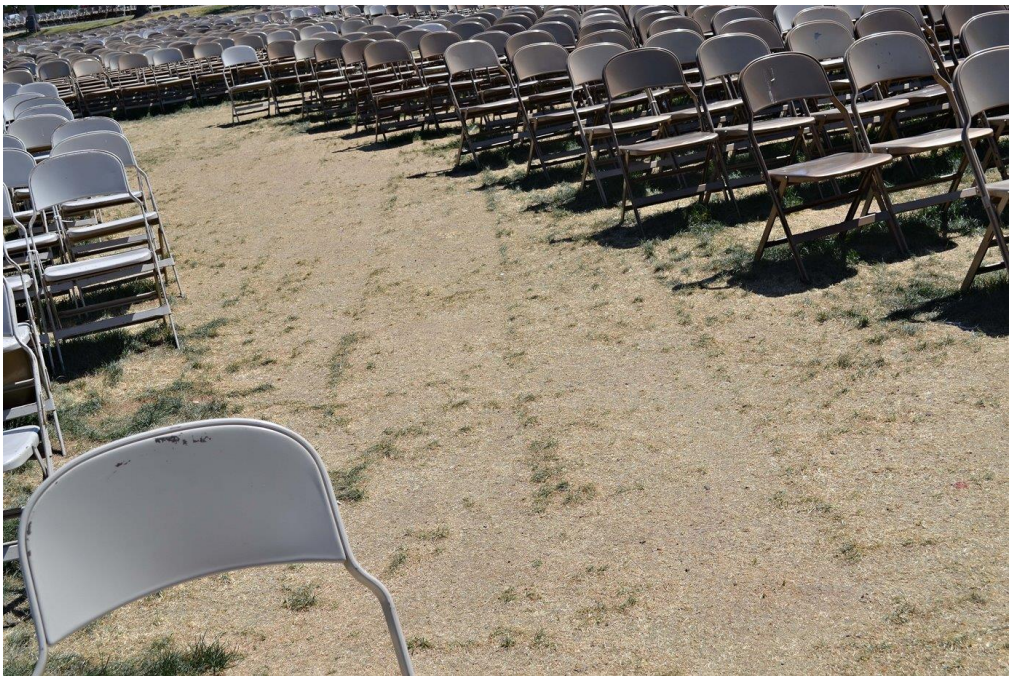


Figure 84: Extracted sod from the North Lawn during the Easter Pageant. This photo illustrates the practice of sand-bedding the sod in which minimal roots are established.

Easter Pageant Landscape Recommendations

The following items have been identified for improved turf performance during and following future iterations of the Easter Pageant:

1. In known heavy construction areas, a grid-type reinforcement underlayment should be installed to protect the foundational grass roots from being sheared during equipment maneuvering. This type of system offers multiple benefits in the Easter Pageant stage area in that it will allow for green grass during and immediately following the Pageant, will eliminate the time delay and expense associated with re-sodding, and will dramatically reduce the chronic effects of soil compaction.

2. In known heavy construction areas, temporary sheathing should be laid to cover pathways where construction equipment will travel multiple times. Suitable sheathing would include plywood type materials that can be relocated multiple times during erection and disassembly of the stage.

3. During the Easter Pageant Season, drought stress is the primary stress to the turf on the north side of the Visitor's center since irrigation events are cancelled for up to 8 weeks. Serious consideration should be given to designing an irrigation system to work around the Easter Pageant infrastructure to provide the turf supplemental irrigation during this period and allow for the Vita suite of products to be uniformly applied to promote proper plant hydration and physiological function.

4. Immediately following the Easter Pageant, areas with severe acute damage should be remedied with mulch soil amendments and be hydro-seeded with Bermuda grass. During April and early May, hydro-seeded turf stands will be present within 10-days and be up to Temple Standard much faster than sod. Further, the cost of hydro-seeding is approximately half of the cost of sodding.

Mountain Laurels on the Northwest Sidewalk Corridor

In addition to formal Vita Project Areas, a few spot treatments were applied to isolated areas with visible stresses. One highlighted area is the Mountain Laurel (sophora sacundiflora) row along the west sidewalk corridor. Upon primary investigation, it was noted that significant damage was being inflicted by the presence of a large volume of a lepidopteran pest, the genista caterpillar (Uresiphita reversalis). Damage was visibly present and live worms were thriving. A onetime application of Vita Agri / VPX Booster was applied to 3 of the 4 plants on March 2015 during the process of treating the Project Areas. The laurels treated with Vita rebounded immediately with reduced pest impact while the untreated laurel continued to decline until aggressively pruned on 13 April. The laurels treated with Vita hosted fewer lepidopteran pests and showed very little damage while the untreated laurel continued to decline.

Figure 85: Worm pressure on a Mountain Laurel plant along the west sidewalk corridor.

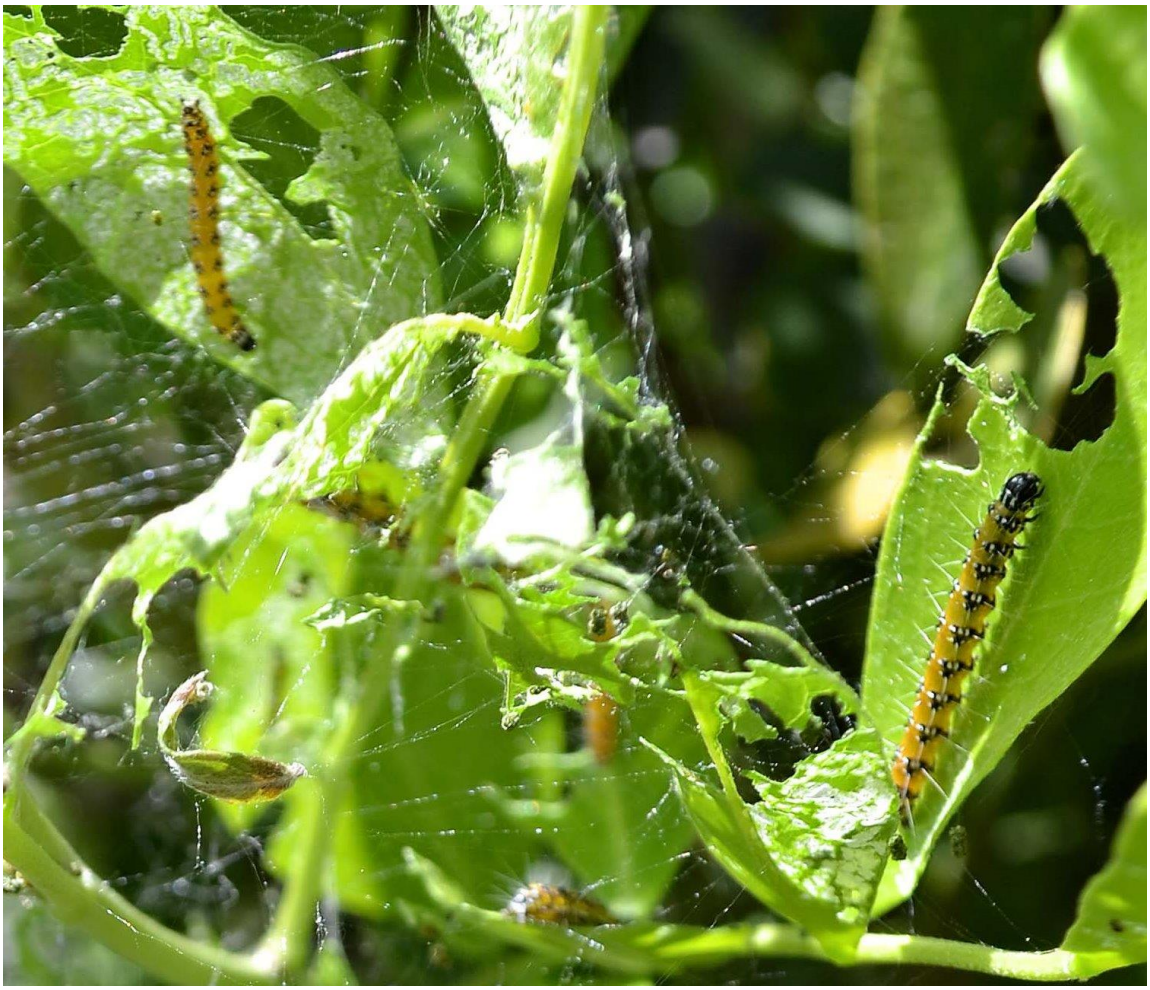


Figure 86: Worm induced plant damage on Mountain Laurel's on the west sidewalk corridor.

Figure 87: Mountain Laurel treated with Vita products in March 2015. Notice the improved coloration and absence of large scale tissue damage, both direct results of improved plant health.

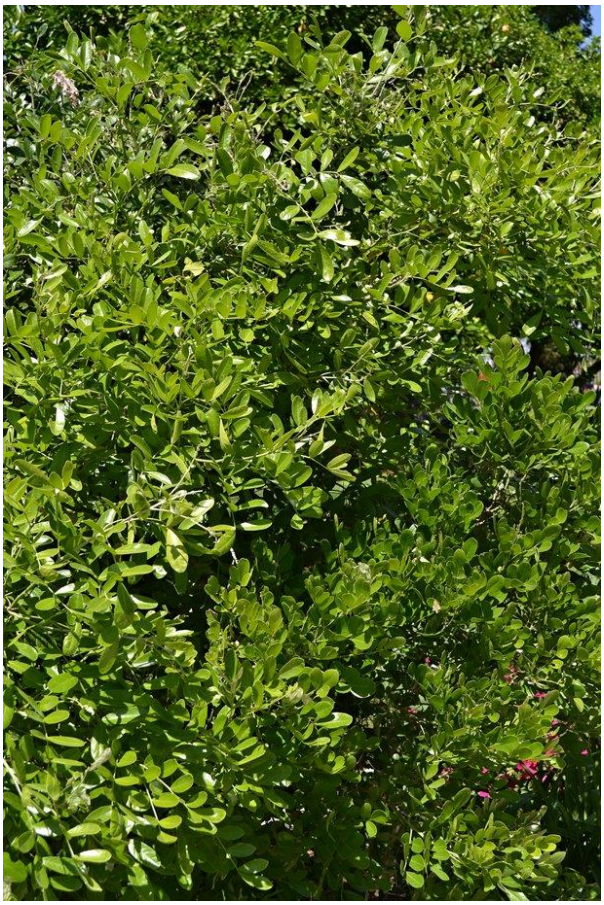


Figure 88: Severely damaged mountain laurel that was heavily pruned in early April to remove the dead foliage.

Citrus Tree Responses to Vita

A small sample size of citrus trees were treated with Vita Agri / VPX Booster in conjunction with the Vita Landscape System and demonstrated dramatic visual changes in the citrus leaf coloration on new and old growth leaves. Additionally, new fruiting locations with properly colored fruit began to emerge shortly after the selected trees were treated with the initial Vita suite. The highlighted trees are located within the Northwest Lawn Vita Project Area and were subsequently treated with the same protocol as the Northwest Lawn area.

Figure 89: Citrus tree in the Northwest Lawn area in November 2014 prior to applications of any Vita Products.

Figure 90: Citrus tree in the Northwest lawn area in December 2015. Notice improved coloration in leaves and fruit.

Figure 91: Don Jackson of Growing Season, Inc. highlighting a large developing fruit on a treated Citrus tree in the Northwest Lawn Project Area.

Figure 92: Citrus tree on 25 April 2015 after being treated for 6 months by the Vita Landscape System. Notice the proper coloration and uniform, larger leaf size.

Cost of the Vita Landscape System

The Vita Landscape System is a comprehensive method for maximizing plant health through the application of proprietary amendments in conjunction with site-specific irrigation and fertility practices. Experience has shown that Vita universally improves plant health across diverse landscape settings and is best utilized in maintenance doses determined by the dynamic conditions of the soil and plants at the time of application. In a typical setting, the Vita Landscape System will cost approximately $50 per 10,000 square foot per application with monthly applications during the vegetative season. In rescue scenarios, the cost of the Vita Landscape System can cost upwards of $500 per 10,000 square foot per application for a short duration.

Experience has shown that properties that utilize the Vita Landscape System on a regular schedule demonstrate a gross reduction in landscape costs while benefitting from a consistent, improved aesthetic appeal. The beneficial cost offsets provided by the Vita Landscape System include mitigations and reductions in turf sod replacement (approx. $8,500 per 10,000 ft^2), hydro-seeding ($2,100 per 10,000 ft^2), ornamental plant replacement, tree removal and replacement, irrigation water, fungicide and pesticide applications, fertilizer applications, and associated labor costs. The Vita Landscape System provides value beyond direct cost comparisons since it produces uniquely efficacious results that exceed the ability of other inputs.

In summary, the Vita Landscape System promotes a healthy, more self-sufficient landscape environment with increased visual appeal, typically requiring less external inputs and costs.

Ancillary Observations of the Mesa Arizona Temple Landscape

During the application of the Vita Landscape System on the project areas at the Mesa Temple, there were a handful of non-ideal operational practices that were observed. Although understood that these items are not the focus of the report, it is under oath of personal and professional conscious that these items are stated in this report. They are listed below with the best intent.

1. Temple grounds crews were witnessed driving service vehicles over turf areas on many occasions where sidewalks or cart paths are provided. It is understood that under certain circumstances it is necessary and of little harm to cross turf in vehicles. However cart traffic has become commonplace in cutting corners and creates permanent damage to the turf when perpetuated. Like many things, this is not an overwhelmingly egregious offense, but it is an indicator of the attitude of the personnel responsible for caring for the turf that is being damaged. When possible damage to the turf should be avoided, especially by those hired to care for the turf.

Figure 93: Evidence of cart tracks across a Vita Project Area.

Figure 94: Heavily tracked area in the northeast corner of the Mesa Temple grounds that has permanent damage from consistent short-cutting by maintenance carts.

Figure 95: Evidence of cart tracks short-cutting across a recovering turf area.

Figure 96: Maintenance cart in the northwest corner the Mesa Temple grounds.

2. Long-term irrigation system leaks are present across the Mesa Temple grounds. A sprinkler system is a pressurized water delivery system that relies on consistent pipeline pressure to uniformly deliver water within a given area. Leaks in the system compromise design pressures and lead to non-uniform applications. Ultimately, the area adjacent to a leak receives an over-abundance of water while areas far from the leak may receive no water. Secondary effects are more obvious in that leaks waste water, flood unintended areas, and are an indicator of poor maintenance. The recommended practice is to check sprinkler zones for leaks and sprinkler head damage following a mowing event and perform sprinkler zone audits on a quarterly basis, typically aligning with seasonal irrigation schedule adjustments.

Figure 97: Long term irrigation system leak in the Northwest Lawn of the Mesa Temple grounds. This leak has persisted for the duration of the Vita projects despite multiple discussions with Temple maintenance personnel.

Figure 98: Irrigation zone leak near the Easter Pageant stage area. This leak is especially troublesome because it is in an area of high importance with freshly laid sod.

Figure 99: Large irrigation system leak in the North Mall area.

3. The irrigation system at the Mesa Temple is in various states of repair. During irrigation audits performed by Growing Season, Inc. on multiple Vita Project Areas, mismatched, non-adjusted, and non-operational sprinkler heads, inadequate water pressures, and inconsistent precipitation rates (depth of water / unit of time, ie inch/hour) were common. For instance, in Zone 84, 15 of 20 heads needed to be adjusted to keep overspray off of the sidewalk, 6 heads needed to be replaced before the audit could be performed, and 1 head was completely buried. The adjacent irrigation zone, Zone 85 consists of a combination of rotor and rotator heads and has a precipitation rate that is 50% less than Zone 84. It is highly recommended that the entire irrigation system, a fundamental infrastructure item, be fully evaluated, properly designed, and corrected by an irrigation professional.

Figure 100: MP Rotator sprinkler head in Zone 84 that was completely buried. This head was found during a sprinkler system audit performed by Growing Season, Inc.

4. The mowing practices at the Mesa Temple can be improved with a few simple changes.

   First, mower blades should be sharpened weekly. As grass is clipped, it undergoes some degree of stress that must be overcome in order for the grass to return to vibrancy. Dull or damaged mower blades increase the acute stresses on the turf system by tearing and shredding the grass, multiplying the plant area that must be healed. The result is weakened turf that yellows, is more susceptible to disease and abiotic stresses, and generally appears poor.

   Second, the process of "scalping" the turf should be eliminated from the management scheme. Scalping is often performed during the transition from ryegrass to Bermuda grass in the spring (and vice-versa in the fall) with the intent of marginalizing the ryegrass to allow the Bermuda grass to thrive. The result is an obvious transition period, twice a year, in which the turf looks very poor. The preferred method is to maintain the primary grass's mowing height with increased plant health and fertility to support the photosynthesis of both turf systems through the transition. The result is green turf that allows an imperceptible change in shade as the seasonally dominant turf prevails. It is anticipated that the turf at the Mesa Temple can retain strong coloration year-round with proper management and fertility.

Figure 101: Treatment portion of the South Lawn Vita Project Area during the middle of the project term.

Figure 102: Treatment area of the South Lawn Vita Project Area after being dried and "scalped". The turf in this picture is to a height of less than 1-inch and far below the photosynthetic portion of the turf, leading to poor coloration and slow growth response.

Figure 103: Lawn mower on the North Mall. Notice the dust being produced and the turn-pattern on the up-slope that demonstrates the deep green turf being aggressively cut, exposing the soil surface and yellow turf.

Contact

Don Jackson
Growing Season, Inc.
2107 Marble Road
Clay Springs, Arizona 85923
928-242-5164
drj.gsi@hotmail.com

Acknowledgements

Juan Trujillo – Mesa Arizona Temple Engineer

Courtney Peterson – Mesa Arizona Temple.

President Norris Baldwin – Previous Temple President, Snowflake Arizona Temple

Shaun Davis – Facilities Manager, Show Low Facilities Management

Jacob Ordyna – Facilities Manger, Snowflake FM Group

Dan Skousen – Deseret Farms of Ruskin Florida

Bill Ruth – Vita Products, Inc.

References

AEC Staff. 2015. *Landscape Architect Checklist.* 2-page checklist. http://aec.ldschurch.org/aec/design_guidelines/SupportDocs/LandscapeArchitectChecklist.pdf?t=2015_5_1_14_17. (Accessed June 2015)

AZMET: The Arizona Meteorological Network. http://ag.arizona.edu/AZMET/index.html. (Accessed June 2015)

Brown, P. and Kopec, D. 2000/2014. *Converting Reference Evapotranspiration into Turf Water Use.* Arizona Cooperative Extension. 5-page fact sheet. cals.arizona.edu/water/az1195.pdf (Accessed June 2015).

Coburn. T. Interviewed by Tim Taggart on *Into All The World Episode 35.* The Mormon Channel. http://www.mormonchannel.org/listen/series/into-all-the-world-audio/thomas-coburn-managing-director-of-the-temple-department-episode-35 (Accessed June 2015)

Drees, B. M. and Bogran, C. *Genista Caterpillar on Texas Mountain Laurel.* Texas A&M AgriLife Extension online fact sheet. http://landscapeipm.tamu.edu/ipm-for-ornamentals/genista-caterpillar-on-texas-mountain-laurel/ (Accessed June 2015).

Intellectual Reserve, Inc. 1979 / 2000, *The Holy Bible*. Matt 13:5-6, P. 1209. The Church of Jesus Christ of Latter-day Saints, Salt Lake City, Utah.

Intellectual Reserve, Inc. 1979 / 2000, *The Book of Mormon: Another Testament of Jesus Christ*. Jacob 2:19, P. 120-121. The Church of Jesus Christ of Latter-day Saints, Salt Lake City, Utah.

Intellectual Reserve, Inc. 2011. *Facilities Management Guidelines for Meetinghouses and Other Church Property.* P. 1. The Church of Jesus Christ of Latter-day Saints, Salt Lake City, Utah.

Wright, D. and Shields, K. 2015. *Water Conservation Guidelines: A Guide for Facilities Managers.* 43-page manual. http://aec.ldschurch.org/aec/landscape/docs/WCG.pdf?t=2015_5_1_14_12. (Accessed June 2015)