# Irrigation Requirements of *Vetiver* Cultivars under Urban Landscape Conditions of Kuwait

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## *Abstract*

Vetiver (*Chrysopogon zizanoides* L. Nash*)* is a plant with several exceptional qualities such as tolerance to hot weather conditions and heavy metals, capacities for slope stabilization and rehabilitation, soil and water conservation, reclamation of soil and degraded lands and erosion control. These qualities make it a highly potential plant to grow under the prevailing environmental conditions of Kuwait. Knowledge of the irrigation requirement of this introduced plant is a priority in countries where water availability is a serious constraint. Three irrigation regimes were administered by irrigating the plants at predetermined soil moisture depletion levels (i. e. no stress control, 50% moisture depletion, and 75% moisture depletion) at Urban Demonstration Garden (UDG) in Salmiya. Among irrigation treatments, no stress irrigation (2.514 lit/ $m^2$/day) was found to be necessary for vigorous growth especially during the summer months. In winter, it can grow vigorously with 0.860 lit/ $m^2$/ day. Water-use-efficiency was the highest when plants were irrigated at 75% depletion in soil moisture.

## Introduction

*Chrysopogon zizanoides* L. Roberty, previously known as *Vetiveria zizanoides* L. Nash, is a xerophytic and hydrophytic grass, proven in several tropical countries to be efficient in sand stabilization, soil and water conservation, erosion control, soil reclamation, ecological rehabilitation and remediation of soils contaminated with heavy metals (Grimshaw, 2006). When considering a plant as a candidate for inclusion in the nation's plant palette for urban greenery projects, knowledge of its irrigation requirement is a priority in countries where water availability is a serious constraint. In view of this fact, KISR's Aridland Agriculture and Greenery Department (AAD) initiated a project (FA077C) in October 2010, in an attempt to introduce sterile Vetiver cultivars to Kuwait. This task of determining irrigation requirements was conducted at the Urban Demonstration Garden (UDG) in Salmiya.

## Objective

- To determine the irrigation requirements of Vetiver under urban landscaping conditions in Kuwait.

## Methods

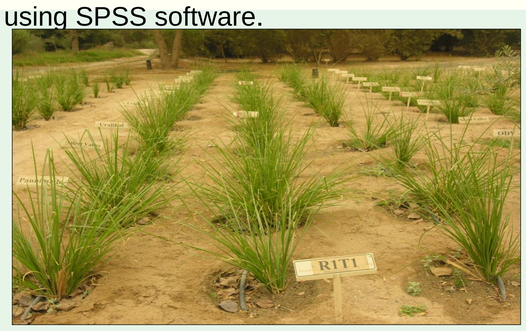
A randomized complete block design of four cultivars (ODV-1, Silent Valley, Urlikal, and Pannimedu), with five replications, in which three slips of three tillers each was used to ascertain the response of plants to various irrigation regimes. The plant spacing was 1 m x 1 m. Three irrigation regimes were administered by irrigating the plants at predetermined soil moisture depletion levels (i.e. no stress control, 50% moisture depletion, and 75% moisture depletion). Sixty *Vetiver* plants were planted for each irrigation trial. The irrigation treatments were applied from 30 May 2011 onwards after the establishment of the plants. Soil moisture probes and moisture meters were installed for each irrigation trial.

Water-use-efficiency. Water use efficiency was calculated based on the average water utilized per plant in each treatment and the above the ground biomass on dry weight basis at the termination of the experiment.

$$\text{Water Use efficiency} = \frac{\text{Biomass at dry weight basis}}{\text{Total water utilized per plant (l)}} \times 100$$

Irrigation Scheduling. Based on the growth performance and water-use-efficiency, average daily demand and peak daily demand per plant were derived. These recommendations were made for four seasons (Ministry of Planning, 2008) namely, winter (December – February), spring (March- May), and summer (June – October) and autumn (November).

Data Analysis. The data were analyzed using two- way ANOVA with irrigation as the main factor and various cultivars as sub factors using SPSS software.




***Vetiver* plants in May 2011, before initiation of the irrigation trials.**

## Results

Quantity of irrigation water used for various irrigation trials and recommended irrigation schedule are detailed in Tables 1 and 2. From 300 to 390 DAI, especially in summer, no stress irrigation was required. In other months, Vetiver could perform well with minimal irrigation (75% depletion).

Results indicated that water use efficiency on dry weight basis was highest when Vetiver plants were irrigated at 75% depletion followed by 50% depletion and no stress irrigation (Table 3).

## Conclusion

Although *Vetiver* can survive with minimal irrigation, it is recommended that no stress irrigation (2.514 l/$m^2$/d) be provided in summer to promote canopy, basal width and number of tillers especially in the later stages of plant growth.

*References*

Grimshaw, R. 2006. Global and regional applications of the Vetiver system. *Proceedings of Workshop on Potential Applications of Vetiver Plant in the Arabian Gulf Region*, Kuwait, p 35-45.

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| Season | Average Daily Demand (l / $m^2$) |
|---|---|
| Winter | 0.860 |
| Spring | 2.052 |
| Summer | 2.514 |
| Autumn | 1.213 |

**Table 2. Irrigation Scheduling for Vetiver in Kuwait**

Winter (December – February), spring (March- May), summer (June – October) and autumn (November) - Ministry of Planning, 2008.

**Table 1. Quantity of Water Used per Square Meter for Irrigation in Various Irrigation Trials**

| Month | No Stress | 75% Depletion | 50% Depletion |
|---|---|---|---|
| | Quantity per $m^2$ (liters) | | |
| June 2011 | 2.428 | 1.547 | 2.237 |
| July 2011 | 2.649 | 1.658 | 2.252 |
| August 2011 | 2.509 | 1.635 | 2.246 |
| September 2011 | 2.497 | 1.598 | 2.151 |
| October 2011 | 2.486 | 1.429 | 2.139 |
| November 2011 | 2.316 | 1.213 | 1.958 |
| December 2011 | 1.530 | 0.950 | 1.250 |
| January 2012 | 1.308 | 0.745 | 0.850 |
| February 2012 | 1.435 | 0.885 | 0.956 |
| March 2012 | 1.649 | 1.164 | 1.156 |
| April 2012 | 2.150 | 1.335 | 1.985 |
| May 2012 | 2.358 | 1.428 | 2.105 |
| June 2012 | 2.428 | 1.547 | 2.237 |

***Vetiver* plants in November 2011, 180 d after the initiation of irrigation studies.**

***Vetiver* plants in January 2011, 240 d after the initiation of irrigation studies.**

| Treatment | Average Dry Weight (kg) | Average Water Used per Plant (l) | Water Use Efficiency on Dry Weight Basis |
|---|---|---|---|
| No stress | 8.714 | 25.315 | 34.423 |
| 75% Depletion | 9.833 | 15.587 | 63.087 |
| 50% Depletion | 7.667 | 21.285 | 36.019 |

**Table 3. Water-use-efficiency of *Vetiver* in Various Irrigation Treatments**

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