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FFECT OF DIFFERENT WATER REGIMES ON YIELD AND WATER USE OF RED ONION (*ALLIUM CEPA*) GROWN UNDER NON-CALCIC BROWN SOILS (*HAPLUSTALF*) IN THE LOW COUNTRY DRY ZONE OF SRI LANKA

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EXTENDED ABSTRACT

Irrigation water shortage still remains as one of the major limiting factors for agricultural production even in major irrigation schemes. As the multiphase large diversion projects and other major irrigation schemes are already exploited, the phase of expansion in the country's irrigated area have become limited (IIMI, 1992). The emphasis now is on increasing water use efficiency of the existing irrigation systems and efficient on-farm water management for higher productivity. Hence, present study was conducted to identify appropriate irrigation water regime, in terms of yield, yield attributes of red onion and water use efficiency with straw mulch and compost.

The effect of six irrigation regimes based on IW/CPE ratio with presence or absence of rice straw mulch (10 t/ha) and compost (10 t/ha) on yield of red onion and water use efficiency was tested in a split-split plot design with three replicates at the Regional Agricultural Research and Development Centre, Aralaganwila (DL_{2b} agro-ecological region). Different IW/CPE ratio (0.25, 0.5, 0.75, 1.0, 1.25 and 1.5) were the main plot treatment, while presence or absence of rice straw mulch (10 t/ha) were the sub plot treatments. Presence or absence of Compost (10 t/ha) was the sub-sub plot treatment.

Red onion (cv. Vethalam) was planted at the spacing of 10 x 10 cm and crop management practices were adopted as the recommendation of the Department of Agriculture (DOA, 1990). The total rainfall received during *yala* 2010 and 2011 was 334 mm and 113 mm respectively. Daily rainfall amount and evapotranspiration rates were measured using recording type rain-gauge and class A evaporation pan. Irrigation water was applied based on daily evapotranspiration rate and crop coefficient (Kc) relevant to different growth stages as follows; initial stage, 25 days (0.5), Growth stage, 40 days (0.7), mid stage, 20 days (1.8) and maturity stage, 10 days (1.0) (FAO, 1992).

Leaf relative water content was measured in 3 weeks interval and calculated using the following formula (Turner, 1981):

$$LRWC\ (\%) = [(F.W - D.W) / (T.W - D.W)] \times 100 \quad \text{.....eq. (1)}$$

Where, LRWC (%) = Leaf relative water content, FW = fresh weight leaves, DW = dry weight leaves, TW = Turgid weight.

Composite soil samples were collected just before the irrigation up to 20 cm depth in soil in each plot at 3 weeks interval to determine the gravimetric soil moisture content. Ten tagged representative plants were harvested from each plot for recording yield attributes of onion. The water use efficiency, as kg of onion bulb yield per cubic meter of water used was calculated by dividing the bulb yield of red onion with total water used as irrigation and rainfall.

According to the results, among the different water regimes tested, IW/CPE ratio 1.5 (M_6) recorded the significantly highest number of bulbs per plant, weight per bulb and bulb yield during both the years The lowest yield parameters were recorded with irrigation at 0.25 IW/CPE ratio. There was no significant difference of bulb yield among the IW/CPE ratio of 0.75, 1 and 1.25. Application of mulch and compost significantly increased the red onion yield and yield components in both seasons. Significant interaction between different water regimes and application of mulch on yield and yield components of red onion was not observed. Application of compost (10t/ha) also significantly increased the crop yield and yield components (except bulbs per cluster) of red onion in both seasons. There was also no significant interaction between different water regimes and application of compost on crop yield and yield components except weight of one bulb. Significantly higher number of Plants/$m^2$of red onion at 9 weeks after planting was recorded by the IW/CPE ratio 1.5 followed by IW/CPE ratio of 1.25 and 1. However, significant mulch effect or compost effect on number of plants/m^2 was not observed. There was a significant interaction between application of mulch and compost on number of plants/m^2. This is mainly due to the higher number of plants under non-mulch treatment over mulched treatment only in compost applied plots

Among the different water regimes tested, IW/CPE ratio of1.5 recorded the highest leaf relative water content at 3, 6, and 9 weeks after planting in both the years. There was a significant difference of leaf relative water content among different water regimes except IW/CPE ratio of 1 and 1.5 in year 2010 where there was no difference in Leaf Relative Water Content. Lowest Leaf Relative Water Content was recorded in IW/CPE ratio of 0.25. Application of mulch and compost also increased the leaf relative water content in both the years. There was a significant interaction exist between water

regimes and application of mulch in both years, except 6 weeks after planting, where interaction was not significant. Leaf Relative Water content varies in wider range (42.1 to 92.7 at 3 weeks after planting and 49.4 to 76.7 at 9 weeks after planting in year 2010) in mulched treatment than the non-mulched treatment (38.2 to 79.5 at 6 weeks after planting and 48.4 to 64.6 at 9 weeks after planting in year 2010).

There was also a significant interaction exists between application of mulch and compost on leaf relative water content. Under the application of compost, there was a wide range of Leaf Relative Water Content (53.8 to 63. 0 at 3 weeks after planting and 56.4 to 64.8 at 6 weeks after planting). However, without application of compost, Leaf Relative Water Content varied in a narrow range (56.2 to 60.6 at 3 weeks after planting and 54.86 to 58.7 at 6 weeks after planting). Significantly higher gravimetric soil moisture content at 3, 6 and 9 weeks after planting in both 2010 and 2011 years were recorded by the IW/CPE ratio of 1.5 and 1.25. However, there was a significant increase of gravimetric soil moisture content at 3, 6 and 9 weeks after planting under mulch and compost application in both the years.

In year 2010 *Yala* season received 334.5 mm of rainfall compared to 113.0 mm in 2011 *Yala* season. Generally, water use efficiency in 2010 *Yala* season was lower than year 2011. In year 2010, when effective rainfall was higher, significantly highest water use efficiency was recorded in highest water regime (IW/CPE ratio 1.5). In contrast, when effective rainfall was lower, highest water use efficiency was recorded in lowest water regime (0.25 IW/CPE ratio). Majority of rainfall received at the beginning of planting and crop harvesting stage in both 2010 and 2011 *Yala* seasons. However, when there was relatively low amount of effective rainfall, contrasting results were observed. Although, contrasting results of water use efficiency among water regimes were observed in two seasons, there was significantly higher water use efficiency of red onion under straw mulching and compost application in both the years.

Based on the results, it was concluded that application of straw mulch and compost have an increasing effect on red onion yield, leaf relative water content, gravimetric soil moisture content and water use efficiency. However, since highest red onion bulb yield, yield components, soil and plant moisture status were recorded in highest soil moisture regime (1.5 IW/CPE ratio) tested, further studies are needed to find out the optimum water regime to achieve maximum crop yield and water use efficiency in sandy non-calcic brown soil in the low country dry zone of Sri Lanka.

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