Cotton (*Gossypium* spp.) is one of the best known commercial fibre crops. Since it is mostly grown in arid and semi-arid regions, studies on drought resistance in this crop is a long-standing need for agricultural practices. The present investigations aim at elucidating the physiological and biochemical changes as well as evaluating the drought resisting potential of two varieties of cotton in response to water deficits and stress alleviation treatments. *Gossypium hirsutum* L. cv. MCU 9 and LRA 5166 were selected for these studies. As both the varieties are recommended for cultivation under dry regions, studies on their adaptability to such adverse conditions with special reference to their biochemical characterization became a necessity.
Cotton plants were raised in earthen pots with a soil mixture of red soil, farmyard manure and sand. Thirty-day old plants were subjected to water stress by withholding watering. Leaf samples were analysed for relative water content and various biochemical fractions on 3, 6 and 9 days after withholding water supply. Water stressed plants were rewatered on the 9th day and their revival capacity was studied one and three days after rewatering.

The present studies revealed that during the stress period there was a decrease in relative water content, total leaf area and net photosynthetic rates while there was a gradual increase of the above activities on alleviation of stress.

Both the chlorophyll-a and b pigments decreased during water stressed period. The decrease in the chlorophyll-b was more pronounced than chlorophyll-a, thereby changing the chlorophyll a/b ratio. Chlorophyll contents quickly improved only in MCU 9 due to rewatering.

A high ratio of root-shoot dry matter was observed both under stress and revived conditions, in both the varieties.

Imposition of water stress led to an increase or accumulation of sugars, soluble nitrogen, total free amino acids and electrolyte leakage and there was a decrease of them during revival.
A similar increase in the activities during stress and a decrease upon revival were noticed for enzymes like amylase, peroxidase and acid phosphatase.

There was a decline in starch content during water stress and a gradual accumulation of the same upon recovery was observed.

Respiration was high during initial stages of stress, but reduced under severe stress. Rewatering brought forth revival in the rate of respiration.

In the water stressed leaves, proline showed several hundred-fold accumulation. Upon rewatering, the proline content depleted drastically.

The total nitrogen content was high in the initial period of stress and also during recovery, but decreased under severe stress conditions.

With increasing intensity of stress, the energy content, buffer soluble protein and protein nitrogen attenuated and the contents improved upon rewatering.

Water stressed plants had low amount of nucleic acids and RNA was found to be more sensitive than DNA to water stress. The content of nucleic acids increased upon rewatering.
Inorganic nutrients showed greater changes during stress and revival periods. Among the minerals studied, potassium showed high accumulation in water stressed plants and depleted upon recovery. The contents of sodium, calcium and magnesium showed a declining trend in the stressed plants and they gradually increased during the revival period. Phosphate and iron content decreased during stress conditions, but accelerated upon recovery. But in MCU 9 variety, the phosphate and iron contents gradually enhanced as the intensity of stress increased, but the contents were low as compared to the control.

Among organic acids, malic acid accumulated during water stress followed by depletion during the revival period, whereas the citric, lactic and fumaric acids as well as the total organic acid content declined with the stress development and increased upon rewatering.

The results of the present investigation revealed that the two varieties differ in their responses to water stress and its alleviation upon rewatering. MCU 9 is identified to be of more drought tolerant and LRA 5166 as more of drought avoiding type. Though two mechanisms of drought resistance are possessed by these two varieties, variety MCU 9 seems to be superior to LRA 5166 on account of its potential adaptivity to low water content and its quick recovery upon rewatering.
Following are the physiological and biochemical characteristics that seem to enable variety MCU 9 to tolerate water stress.

1. Higher accumulation of free proline, sugars, nitrogen, potassium and organic acids especially malic acid

2. Higher activity of respiration and enzyme amylase and high membrane integrity as revealed by low electrolyte leakage and low enzyme acid phosphatase activity

3. Slow depletion of buffer soluble protein, nucleic acids, organic acids like fumaric, lactic, succinic and citric acids and also minerals like sodium, phosphate calcium and iron and energy content during water stress conditions

4. Quick recovery in terms of leaf area, chlorophyll pigments, net photosynthesis, root/shoot dry weight ratio, non-reducing and total sugars, respiration, energy content, buffer soluble protein, nitrogen content, nucleic acids, total organic acids and minerals like calcium, magnesium and phosphate.

Based on the various biochemical parameters studied and results obtained, variety MUC 9 is more suitable for cultivation under dry farming areas. Further, field trials to be conducted
under various agroclimatic conditions and yield analysis will extend the scope and efficacy of the variety as a hope for water deficit areas.

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