Journal of Scientific Research
Banaras Hindu University, Varanasi

Vol. 55, 2011 : 65-69
ISSN : 0447-9483

EFFECT OF MOISTURE STRESS ON LEAF TOTAL PROTEINS, PROLINE AND FREE AMINO ACID CONTENT IN COMMERCIAL CULTIVARS OF *ZIZIPHUS MAURITIANA*

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ABSTRACT

The budded plants of three cultivars of *Z. mauritiana* Lamk. namely Gola, Umran, Kaithli were transplanted in polyethylene bags. Moisture stress was created by withholding irrigation for 28 days and Gola survived upto 28 days, Umran upto 21 days and Kaithli only upto 14 days. During the stress period, soil moisture content was found to decrease in all the three cultivars. The total proteins decreased with increase in stress in the leaves of all the three cultivars, and the decrease was maximum in Kaithli followed by Gola, however, the free amino acids increased with moisture stress. The higher rate of accumulation of free amino acids was found in case of Gola followed by Umran and Kaithli. But the proline accumulation in the cultivars was increased during stress period. The proline accumulation in Gola accumulated at faster rate than Umran and Kaithli.

Keywords: *Ziziphus mauritiana*, proteins, proline, free amino acid, moisture stress

Introduction

Ziziphus mauritiana L. is being cultivated in several parts of the world. In India, it is one of the most important fruit crop of arid and semi arid region. *Ziziphus spp.* are well adapted to dry and hot climates of north-western plains, central- India and dry region of peninsular of India (2). It is drought tolerant and it can survive under moisture stress on marginal and infertile land where most other fruit species fail to grow. There is variation in drought tolerance of different cultivars and some of them performed better even under extended drought spells. Perhaps due to variation in there photosynthetic efficiency and other physiological aspects. The present studies were made to find the effect of moisture stress on some of the important biochemical parameters leading to their better survival mechanism.

Materials and Methods

The experiment was conducted at Experimental Orchard, Department of Horticulture, CCS Haryana Agricultural University, Hisar. The budded plants of three cultivars of *Z. mauritiana* Lamk. namely Gola, Umran, Kaithli were transplanted in polyethylene bags (200 µ thickness of 16 x 18 inch size) in February, 2007. The plants were of uniform age, healthy and were transplanted carefully. After establishment of the plants, polyethylene bags were saturated and the control was taken at field capacity (control) and different observations were recorded after 7, 14, 21 and 28 days of field capacity. Since, cultivar Gola survived upto 28 days, Umran upto 21 days and Kaithli only upto 14 days thus upto 14^{th} day data could be analysed through factorial Completely Randomized Design. The leaves were analysed for the total soluble protein by Folin-Ciocalteau reagent (9), Proline by the method of Bates *et al.* (4) and free amino acids content by Yemm and Cocking (15). The extract obtained by extraction of total soluble sugar was used for estimation of free amino acids.

Results and Discussion

The maximum proteins content in leaves were recorded at field capacity (control) and decreased with the increased in stress period in all the cultivars (Table 1). The protein content was maximum in cultivar Gola followed by Umran and Kaithli. The water stress injury causes damage to protein synthesizing mechanism. The possible reason for decreased protein content under water stress may be due to increased activity of protease and also it may be due to proteolysis or decreased synthesis or both. Leaf proteins undergo accelerated hydrolysis as water stress develops. Similar findings were reported by Achituv and Barakiva (1) in citrus.

The proline content in leaves was minimum at field capacity (control) and increased with increase in stress period in all the three cultivars (Table 2). The maximum proline was recorded in Gola followed by Umran and Kaithli. Significant variation in proline content among cultivars was observed. Similar findings were reported by Ramtake and Karibasappa (11) in grape genotypes. A positive correlation between magnitude of free proline accumulation and drought tolerance has been suggested as an index for determining drought tolerance potential of cultivars. The major reason for increase in the proline concentration during water stress was due to lesser incorporation of continuously synthesized proline amino acid during proline synthesis (14). Proline accumulation is also responsible for the hydration of biopolymers, surviving as a readily utilizable energy source and serving as a nitrogen source compound during periods of inhibited growth. Other possible ways of proline accumulation are through increased proteolysis or due to decreased protein

synthesis. Clifford *et al.* (6) studied the proline accumulation in ber and found that there was 35 fold increases in proline concentration in leaves during drought conditions. The proline proved to be one of the major solutes in drought tolerance in ber. In severely drought stresses leaves of *Z. rotundifolia*, high leaf nitrate reductase activities were paralleled by increase in proline concentration, suggesting an osmoprotective role for proline (3). Proline accumulation during drought is also supported by Chaitanya *et al.* (5) and Ramanjulu and Sudhakar(10) in mulberry, Lakmini *et al.* (8) in coconut and Rao *et al.* (12) in important tree species of Tarai region.

The minimum free amino acid in leaves was recorded at field capacity (control) and it increased with increase period of moisture stress in all three cultivars (Table 3). The maximum free amino acid was recorded in Gola followed by Umran and Kaithli. The increase in free amino acids could either be due to disruption in protein synthesis, induced proteolysis or its partial hydrolysis (7). The changes in amino acid made a significant contribution to the osmotic adjustment. Likewise, Rao *et al.* (13) reported that amino acid content in leaves increased with stress in cultivars of aonla.

Table 1 : Effect of moisture stress on total proteins content (mg g^{-1} dry weight basis) in different cultivars of ber

Period of Stress	**Varieties**			
	Gola	**Kaithli**	**Umran**	**Mean (S)**
Control	293.48	103.80	159.66	**185.66**
7 days	205.38	85.48	116.34	**135.73**
14 days	150.35	51.06	89.68	**97.03**
21 days	91.23	--	53.73	
28 days	53.15	--	--	
Mean (V)	**216.40**	**80.11**	**121.89**	

*Data could be analyzed upto 14^{th} day.

CD (P=0.05)

V = 2.18

S = 2.18

V x S = 3.78

Table 2 : Effect of moisture stress on proline content (µg g^{-1} dry weight basis) in different cultivars of ber

Period of Stress	Varieties			
	Gola	**Kaithli**	**Umran**	**Mean (S)**
Control	251.08	213.15	266.10	**243.44**
7 days	301.00	247.12	300.80	**282.97**
14 days	374.22	297.07	340.57	**337.29**
21 days	451.65	--	398.42	
28 days	537.58	--	--	
Mean (V)	**308.77**	**252.45**	**302.49**	

*Data could be analyzed upto 14^{th} day.

CD (P=0.05)

V = 4.42

S = 4.42

V x S = 7.66

Table 3 : Effect of moisture stress on free amino acids (mg g^{-1} dry weight basis) in different cultivars of ber

Period of Stress	Varieties			
	Gola	**Kaithli**	**Umran**	**Mean (S)**
Control	56.08	45.90	49.25	**50.41**
7 days	75.85	65.00	71.92	**70.92**
14 days	110.82	76.10	91.27	**92.73**
21 days	150.12	--	101.67	
28 days	212.75	--	--	
Mean (V)	**80.92**	**62.33**	**70.81**	

*Data could be analyzed upto 14^{th} day.

CD (P=0.05)

V = 3.55

S = 3.55

V x S = 6.16

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