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EFFECT OF WATER STRESS ON NUCLEIC ACID METABOLISM IN WHEAT

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Plants have the capacity to adjust under variable environmental condition. Water is generally considered as one of the limiting factors which affects the physiological and biochemical processes affecting crop productivity (Boyer, 1982). Nucleic acid metabolism has a major role in the overall performance. Experiments were, therefore, carried out to study the nucleic acid metabolism in drought tolerant/susceptible wheat genotypes grown under water stress conditions.

A series of experiments were conducted in glass containers of 15 cm diam., and 10 cm in depth. Wheat seeds of genotypes DS-4, Chakwal-86 (tolerant), Pavon and DS-17 (susceptible) (Ashraf & Khan, 1990; Ashraf *et al.*, 1992) soaked in water were planted over plastic screen (Naqvi *et al.*, 1994) and placed in glass containers containing the treatment solutions of 0 (control), and -0.6 MPa (PEG-6000), prepared according to

Table 1. Some growth parameters of four wheat genotypes grown under water stress conditions.

Treatment	Shoot Length (cm)	Root Length (cm)	Shoot Dry weight (g) plant^{-100}	Root Dry weight (g) plant^{-100}
0.00 MPa				
Chakwal-86	14.23	16.71	20.77	13.25
DS-4	15.77	13.21	21.45	12.96
DS-17	15.37	9.06	21.00	10.55
Pavon	16.59	12.67	22.45	13.96
-0.6 MPA				
Chakwal-86	12.56	10.40	16.47	6.98
DS-4	14.29	12.70	16.00	7.99
DS-17	11.25	5.36	10.47	3.25
Pavon	11.95	6.83	11.98	3.50
L.S.D. ($P<0.05$)				
Treatment	0.911	0.932	1.21	1.234
Genotype	1.289	1.318	1.560	1.621

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Ashraf *et al.*, (1994). Thirty seeds ofeach genotype were sown in each container with each treatment having four randomized replicates. Seedlings were grown in a programmed growth cabinet under a 10 h photoperiod (400 uE $m^{-2}S^{-1}$). The seedlings were harvested after 14 days to record the growth data on shoot and root length and dry weight. Fresh samples were analysed for DNA (Hoogendoom *et al.*, 1990), RNA (Minami *et al.*, 1988) and protein (Lowry *et al.*, (1951).

Growth reduction was observed in all the wheat genotypes, with better growth found in DS-4 and Chakwal-86 (Table 1). The reduction in growth is a primary effect of every stress which may be due to different metabolic disturbances (Ashraf *et al.*, 1995). Since protein synthesis takes place on polyribosomes and depends on DNA and RNA molecules, therefore disturbance in protein metabolism as a result of water stress could depend on a preceding disturbance in nucleic acid metabolism. A reduction in DNA and RNA content was recorded in all genotypes (Fig. 1A,B). However, this reduction was more pronounced in drought susceptible genotypes (DS-17 and Pavon, with 53% reduction in DNA and more than 60% in RNA). Similar results have been reported in sugarcane (Ortega *et al.*, (1984) and wheat (Belkhman, 1984).

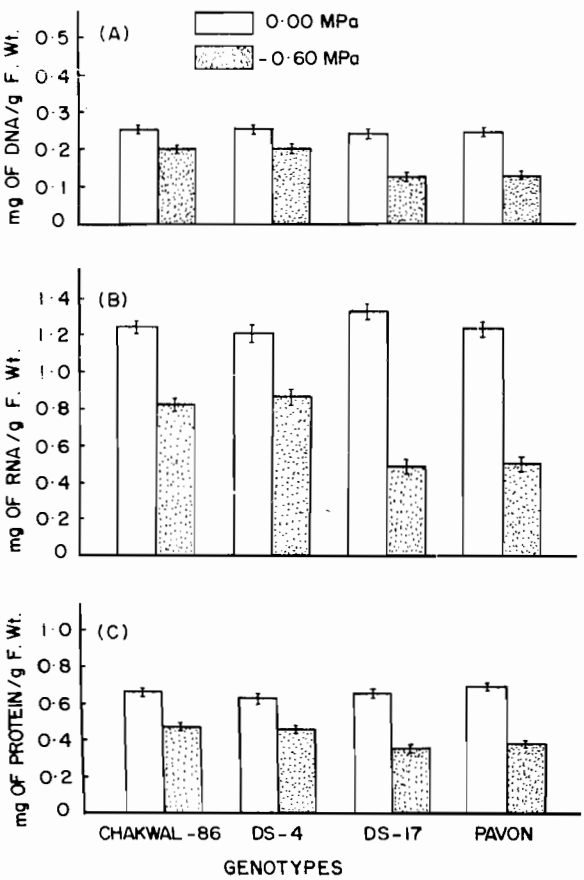

Fig. 1. Effect of water stress on DNA (A) RNA (B) and soluble protein (C) of different wheat genotypes.

Reduction in nucleic acids may also be due to their degradation. Martin & DaSilva (1972) found that water stress increased the activity of RNase and the increase in RNase activity induced by dehydration may lead to reduction in RNA content and therefore a decrease in protein synthesis. The result of the present study showed that protein content decreased due to water stress in all the genotypes (Fig.1C). The reduction in protein content was less in tolerant genotypes (Chakwal-86, Ds-4, 24% and 31% respectively) than that of susceptible ones (DS-17, Pavon, 46%) (Fig.1C). Such similar reports on the reduction in protein due to water deficit have been made by Ranieri *et al.*, (1989) and Martin & DaSilva (1972).

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