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EFFECT OF POTASSIUM ON CHLOROPHYLL AND PROLINE CONTENT OF THE LEAVES IN ASHGOURD UNDER DIFFERENT MOISTURE LEVELS

Water stress in plants influences many metabolic processes, and the extent of its effects depends on drought severity. Many of the studies which were conducted under controlled as well as field conditions indicated that potassium improved water relations of the plants. Among the different physiological effects of K nutrition on crops, Thomson and Weier (1962) reported a decreased chlorophyll content when K application rate was enhanced. Under irrigated conditions, Khanna *et al.*(1980) studied the effect of K on yield components and observed a decreased chlorophyll content. Proline content, a sensitive indicator of stress condition is well known. Proline was reported to be the most sensitive aminoacid component formed during water stress conditions. Barnett and Naylor (1966) reported free proline accumulation up to 1000 times the normal

Table 1. Effect of potassium and irrigation on chlorophyll content at stage 1 (mg/g leaf tissue)

Treatment	Level of potassium				Mean
	K_0	K_1	K_2	K_3	
		a) Chlorophyll 'a'			
Level of irrigation					
I_1	1.69	1.85	1.91	1.24	1.67
I_2	1.73	1.38	1.66	1.27	1.51
I_3	1.61	1.07	1.32	1.15	1.29
Mean	1.68	1.44	1.63	1.22	
		b) Chlorophyll 'b'			
I_1	1.53	1.05	1.24	1.08	1.28
I_2	1.25	0.66	1.11	0.91	0.98
I_3	1.01	0.88	1.22	0.69	0.95
Mean	1.26	0.86	1.19	0.89	
		c) Total chlorophll			
I_1	3.22	2.89	3.16	2.32	2.90
I_2	2.98	2.24	2.87	2.18	2.57
I_3	2.61	1.96	2.53	1.83	2.23
Mean	2.94	2.36	2.85	2.11	
			(a)	(b)	(c)
Sem±			0.209	0.244	0.414
CD (0.05) K			NS	NS	NS
CD (0.05) I			0.307	NS	NS
CD (0.05) KI			NS	NS	NS

NS = Not significant

Table 2. Effect of potassium and irrigation on chlorophyll content at stage 2 (mg/g leaf tissue)

Treatment	Level of potassium K_0	K_1	K_2	K_3	Mean
		a) Chlorophyll 'a'			
Level of irrigation					
I_1	0.86	0.51	0.73	0.56	0.67
I_2	0.69	0.62	0.61	0.64	0.64
I_3	0.83	0.91	0.56	0.63	0.74
Mean	0.79	0.68	0.64	0.61	
		b) Chlorophyll 'b'			
I_1	0.86	0.49	0.61	0.50	0.62
I_2	0.62	0.42	0.57	0.61	0.55
I_3	0.89	0.77	0.57	0.51	0.68
Mean	0.79	0.56	0.58	0.54	
		c) Total chlorophyll			
I_1	1.72	1.00	1.31	1.07	1.28
I_2	1.30	1.04	1.18	1.17	1.18
I_3	1.72	1.38	1.15	1.15	1.35
Mean	1.58	1.14	1.22	1.13	
			(a)	(b)	(c)
SEm±			0.073	0.055	0.115
CD (0.05) K			0.124	0.093	0.195
CD (0.05) I			NS	0.081	NS
CD (0.05) KI			0.214	0.161	NS

NS = Not significant

as one of the most dramatic stress characters. Udayakumar *et al*. (1976) studied the effect of K on proline accumulation in cucumber cotyledons and found that both water stress and KC1 application induced free proline accumulation, but the increase in the latter case was higher. Hence this experiment was conducted to assess the variation in chlorophyll and protein content of leaves at the major stages of the crop, with changing potassium supply at different moisture level.

A field experiment was designed for assessing the efficiency of potassium under different levels of irrigation on the chlorophyll and proline content of summer vegetables, ashgourd, at Vellanikkara during the year 1988-89. The experiment consisted of twelve treatments from all possible combinations of four levels of potassium viz., K_0, K_1, K_2 and K_3 representing 0, 75, 150 and 225 per cent of KAU recommendation (25 kg K_2O/ha) for the crop respectively and three irrigation levels viz., I_1, I_2 and I_3 representing IW/CPE ratios 0.75, 0.50 and 0.25 respectively. The experiment was laid out in RBD and replicated thrice. N and P at the rate of 70 and 25 kg/ha respectively were also applied as urea and superphosphate. K was applied in the form of muriate of potash as per the

Table 3. Effect of potassium and irrigation on proline content at different stages (µmol/g dry tissue)

Treatment	Level of potassium				Mean
	K_0	K_1	K_2	K_3	
	a) Stage 1 (35 DAP)				
Level of irrigation					
I_1	3.08	5.17	5.21	4.57	4.51
I_2	2.93	4.27	5.46	4.77	4.36
I_3	3.97	4.52	4.87	3.68	4.26
Mean	3.33	4.65	5.18	4.34	
	b) Stage 2 (50 DAP)				
I_1	2.83	4.27	4.47	4.82	4.10
I_2	3.43	4.37	4.92	4.81	4.38
I_3	3.28	5.61	4.82	3.18	4.22
Mean	3.18	4.75	4.73	4.27	
				(a)	(b)
SEm±				0.560	0.527
CD (0.05) K				0.949	0.892
CD (0.05) I				NS	NS
CD (0.05) KI				NS	NS

NS = Not significant

treatments. Two pits from each plot were used for destructive sampling. The crop in one pit was harvested during full vegetative stage, i.e., 35 days after planting (35 DAP) and that in the other during flowering stage (50 DAP). Chlorophyll content of fresh sample was estimated following Witham *et al.* (1971) and proline was estimated as described by Bates *et al.* (1973).

The chlorophyll content at the full vegetative growth and flowering stage are presented in Table 1 and 2. The chlorophyll content differed significantly in response to K during the stage 2. It was reduced as a result of potassium application. The reduction in the chlorophyll content by K application was reported by Thomson and Weier (1962) in *Phaseolus vulgaris*. Reports from Khanna *et al.* (1980) also confirmed the above results and they assumed it to be due to the increased rate of leaf expansion when compared to chlorophyll synthesis. Significant responses were observed on the chlorophyll 'a' content with change in irrigation levels during the first stage.

The data on the proline content at different stages are presented in Table 3. In general, addition of potassium to the rooting medium significantly increased the leaf proline content during the both stages studied. In both stages, effects of K_1, K_2 and K_3 were on par and K_0 responded with the lowest value. In this investigation, K application was found to induce a significant accumulation of proline when compared to control.

During stage 1, K_2 (40 kg/ha) recorded 55.6 per cent increase in proline content when compared to K_0 (3.33%) and during stage 2, the increase was 49.37 per cent higher compared to control when K was applied, at 20 kg/ha. There was a reduction in proline content when applied K was higher than 40 kg/ha. Waldren and Teare (1974) commented that proline accumulation due to water stress was enhanced only if the stress induced was severe. In this present study, since the effect of irrigation levels on proline content was not significant, it may be assumed that the moisture level maintained did not induce a severe water stress to the crop.

In conlusion, the results revealed a negative influence of K fertilization on chlorophyll content. Proline content, a sensitive indicator of stress condition was positively correlated with K application and K_2 (40 kg/ha) recorded the maximum content.

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