AJH
eISSN- 0976-724X

THE ASIAN JOURNAL OF HORTICULTURE
Volume **11** | Issue 1 | June, 2016 | 25-29
Visit us -*www.researchjournal.co.in*

RESEARCH PAPER

DOI : 10.15740/HAS/TAJH/11.1/25-29

Article history **:**
Received : 02.02.2016
Revised : 07.04.2016
Accepted : 20.04.2016

Role of nutrients on biochemical changes in various growth stages of watermelon

■ **J.P. SAJITHA, R.M. VIJAYAKUMAR[1], L. PUGALENDHI[2], D. DURGA DEVI[1] AND JAGADEESWARAN[3]**

Members of the Research Forum

Associated Authors:
[1]Department of Fruit Crop, Horticultural College and Research Institute, Tamil Nadu Agricultural University, COIMBATORE (T.N.) INDIA

[2]Department of Vegetable Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, COIMBATORE (T.N.) INDIA

[3]Department of Remote Sensing and GIS, Horticultural College and Research Institute, Tamil Nadu Agricultural University, COIMBATORE (T.N.) INDIA

Author for correspondence :
J.P. SAJITHA
Department of Vegetable Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, COIMBATORE (T.N.) INDIA
Email : burserasaji@gmail.com

ABSTRACT : An experiment was conducted to find the effect of different levels of nutrients through water soluble fertilizers along with Azophosmet and humic acid on biochemical attributes of watermelon. Application of 125 per cent of water soluble fertilizers *viz.*,250:125:125 kg/ha of NPK in addition to Azophosmet and humic acid showed the best performance in almost all the parameters studied in both seasons I and II, as it recorded the highest total chlorophyll content (1.588, 2.574, 2.426 and 2.162 mg g^{-1} in season I and 1.652, 2.638, 2.556 and 2.379 mg g^{-1} in season II, T_8 recorded the highest soluble protein content (6.02, 11.66, 11.19 and 8.42 mg g^{-1} in season I and 6.18, 12.24, 11.58 and 9.14 mg g^{-1} in season II, nitrate reductase activity at all days observed during both seasons *viz.*, season I and season II (9.29, 16.89, 14.0,9.11 µg NO_2 g^{-1} h^{-1} and 9.74, 17.24, 14.35 and 9.46 µg NO_2 g^{-1} h^{-1} at 30th, 45th, 60th and 75th DAS. IAA oxidase was the highest at 30th DAS and declined at 45th, 60th and 75th DAS in both the seasons.

KEY WORDS : Watermelon, Water soluble fertilizer, Azophosmet, Humic acid, Chlorophyll content, Soluble protein content, Nitrate reductase activity, IAA oxidase activity

HOW TO CITE THIS ARTICLE : Sajitha, J.P., Vijayakumar, R.M., Pugalendhi, L., Devi, D. Durga and Jagadeeswaran (2016). Role of nutrients on biochemical changes in various growth stages of watermelon. *Asian J. Hort.*, **11**(1) : 25-29, **DOI : 10.15740/HAS/TAJH/11.1/25-29.**

Watermelon is a popular dessert fruit, grown in tropical and the Mediterranean regions of the world and believed to have originated in Africa (Simmonds, 1979). It's global consumption is greater than that of any other cucurbit and accounts for 6.8 per cent of the world area devoted to vegetable production (Goreta *et al.*, 2005). The fruit is characterized by a smooth external rind (green or yellow) and a juicy, sweet, red coloured flesh. Presently few hundred watermelon cultivars, both seeded and seedless, are cultivated commercially around the world. The red colour imparted to watermelon is due to carotenoid and lycopene (Ronen *et al.*, 1999).The biochemical parameters directly indicate the efficiency of plants in terms of growth and yield. The vigorous growth during all the phenophases of growth and development in watermelon was resultant of various biochemical processes. Hence, the present attempt was made to access role of nutrients in the biochemical mechanisms responsible for yield improvement in watermelon in response to various fertilizer levels.

RESEARCH METHODS

The experiment was conducted in Coimbatore district, Tamil Nadu, during 2012-2013. The experiment was laid out in Randomized Block Design (RBD) having 9 treatments, including control and all the treatments were replicated thrice. The plot size of 8x5m was prepared and seeds of watermelon hybrid Kiran were sown on raised ridges at a spacing of 1.8x 0.6m.The nine different treatments tested were T_1 (75% - 150:75:75 NPK kg/ ha), T_2 (100% - 200:100:100 NPK kg/ha), T_3 (125% - 250:125:125 NPK kg/ha), T_4 (150% - 300:150:150 NPK kg/ha), T_5 (75% - 150:75:75 NPK kg/ha + Azophosmet + humic acid), T_6 (100% - 200:100:100 NPK kg/ha + Azophosmet + humic acid), T_7 (125% - 250:125:125 NPK kg/ha + Azophosmet + humic acid), T_8 (150% - 300:150:150 NPK kg/ha + Azophosmet + humic acid) and T_9 (100% RDF through soil application). The water soluble fertilizesr used were poly feed, mono ammonium phosphate and multi-K. In control, urea, single superphosphate and muriate of potash were used. All the fertilizers were given in split doses for 8 weeks. First dose was applied 21 days after sowing, while the remaining dose was applied in weekly interval after the first dose. All other cultural practices were adopted to raise the crop as per recommendation. The data in respect to biochemical changes in crop growth were recorded at 30th, 45th 60th and 75th day which were then statistically analyzed for the test of significance following the method of Panse and Sukhatme (1978).

RESEARCH FINDINGS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following heads :

Total chlorophyll content :

Chlorophyll pigments play vital role in crop productivity. In the present study, total chlorophyll contents showed an increasing trend upto flowering and declined towards maturity. Application of 125 per cent recommended dose of nutrients as water soluble fertilizer along with Azophosmet and humic acid under drip fertigation showed higher chlorophyll content in the leaves (Table 1). The phenomenon of increased chlorophyll content with increased level of nutrients observed in the present study was also confirmed by several workers (Meenakshi and Vadivel, 2003 and Balasubramanian, 2008). Hebber *et al*. (2004) also revealed that being a constituent of chlorophyll, increased supply of nitrogen accelerate higher synthesis of chlorophyll without altering the composition of the pigment. Nitrogen along with phosphorus and potassium is the most recognized basic element required for most metabolic activities of plants resulting in the synthesis of chlorophyll and cytochrome which are essential for photosynthesis and respiration process of plants. These results are in conformity with the earlier reports by Neerja *et al*. (2005).

Further, humic acid might have helped in the chelation of metal ions in soil making them available in absorbable and usable form for plant growth that resulted in increased chlorophyll content in the leaves and thus photosynthetic efficiency causing perfectional influx of photosynthates to the sink. The current findings are in agreement with the earlier observation of Tamilselvan *et al*. (2006). Increase in the chlorophyll content of tomato leaves was observed as a result of *Azospirillum* inoculation and it was more prominent as in the case of cyst based liquid formulation. The similar result was recorded by Gnanachitra (2000) wherein, the *Azospirillum* inoculation increased the chlorophyll content of tea leaves.

Soluble protein content :

The soluble protein content in leaves indirectly indicates the photosynthetic efficiency of the crop, since it constitutes more than 70 per cent of the RuBp carboxylase, the enzyme responsible for CO_2 fixation in

Table 1 : Nutrients on total chlorophyll content at different growth stages of watermelon hybrid Kiran

Treatments	Total chlorophyll (mg g^{-1})							
	30th day		45th day		60th day		75th day	
	Season I	Season II	Season I	Season II	Season I	Season II	Season I	Season II
T_1	1.169	1.255	2.064	2.102	1.937	2.022	1.743	1.956
T_2	1.256	1.355	2.103	2.121	1.939	2.028	1.787	1.970
T_3	1.359	1.459	2.259	2.293	2.125	2.185	1.885	2.105
T_4	1.479	1.558	2.424	2.461	2.274	2.364	2.039	2.230
T_5	1.275	1.396	2.139	2.144	1.999	2.032	1.793	1.987
T_6	1.403	1.503	2.309	2.32	2.159	2.221	1.952	2.119
T_7	1.588	1.652	2.574	2.638	2.426	2.556	2.162	2.379
T_8	1.551	1.610	2.536	2.596	2.385	2.497	2.123	2.334
T_9	1.105	1.112	1.943	1.962	1.829	1.892	1.654	1.905

photosynthesis (Noggle and Fritz, 1986). The RuBp carboxylase enzyme activity was indirectly measured by the estimation of soluble protein content in the leaves. In the present investigation, drip fertigation at 150 per cent recommended dose of nutrients as water soluble fertilizer along with Azophosmet and humic acid has improved soluble protein content at all stages of crop growth (Table 2). Similar trend of results have been documented by Sachdev *et al*. (1987). High N level could enhance the protein synthesis throughout the growth period by direct participation as an ingredient of protein. High P level could also intensify the protein synthesis by way of supplying required metabolic energy. The increased level of K, however, had not influenced the rate of protein synthesis as also observed by Stalyarav (1974). The findings of Meenakshi and Vadivel (2003) had confirmed the above mentioned results.

Table 2 : Nutrients on soluble protein at different growth stages of watermelon hybrid Kiran

Treatments	Soluble protein (mg g^{-1})							
	30th day		45th day		60th day		75th day	
	Season I	Season II	Season I	Season II	Season I	Season II	Season I	Season II
T_1	4.57	4.71	9.73	9.96	9.15	9.18	6.85	7.34
T_2	4.78	4.98	9.87	10.14	9.24	9.26	7.09	7.42
T_3	5.29	5.39	10.49	10.92	9.82	9.91	7.52	7.97
T_4	5.71	5.76	11.13	11.50	10.43	10.64	7.95	8.48
T_5	4.95	5.06	10.02	10.34	9.31	9.31	7.40	7.53
T_6	5.48	5.50	10.63	10.98	9.89	10.08	7.63	8.08
T_7	5.92	6.01	11.59	11.99	10.92	11.17	8.18	8.87
T_8	6.02	6.18	11.66	12.24	11.19	11.58	8.42	9.14
T_9	4.34	4.52	9.26	9.48	8.66	8.65	6.51	6.95

Table 3 : Nutrients on nitrase reductase activity at different growth stages of watermelon hybrid Kiran

Treatments	Nitrate reductase activity (µg of NO_2 g^{-1} h^{-1})							
	30th day		45th day		60th day		75th day	
	Season I	Season II	Season I	Season II	Season I	Season II	Season I	Season II
T_1	7.60	7.79	14.1	14.33	10.81	11.22	6.42	6.69
T_2	7.65	7.99	14.16	14.46	11.39	11.57	6.94	7.22
T_3	8.21	8.64	15.00	15.32	12.47	12.62	7.76	8.08
T_4	8.76	9.21	15.86	16.25	13.28	13.66	8.45	8.82
T_5	7.69	8.11	14.20	14.50	11.80	11.91	7.22	7.56
T_6	8.34	8.77	15.05	15.40	12.74	12.98	8.01	8.37
T_7	9.29	9.74	16.89	17.24	14.00	14.35	9.11	9.46
T_8	9.16	9.62	16.64	17.06	13.75	14.29	8.86	9.23
T_9	7.24	7.39	13.35	13.68	10.28	10.57	6.02	6.25

Table 4 : Nutrients on IAA oxidase activity at different growth stages of watermelon hybrid Kiran

Treatments	IAA oxidase (µg of unoxidised auxin g^{-1} h^{-1})							
	30th day		45th day		60th day		75th day	
	Season I	Season II	Season I	Season II	Season I	Season II	Season I	Season II
T_1	226.75	223.25	182.11	181.42	162.65	161.62	152.85	150.61
T_2	229.76	227.85	184.53	184.36	166.17	165.73	155.07	153.44
T_3	236.87	236.52	193.32	193.43	175.95	175.56	162.49	161.35
T_4	248.51	248.20	204.56	204.95	186.76	186.22	173.59	172.21
T_5	231.98	231.46	188.98	188.95	170.06	168.94	158.32	155.62
T_6	239.12	239.54	196.84	196.98	179.21	178.41	165.91	165.24
T_7	258.13	257.38	211.47	210.27	191.87	190.35	178.63	176.75
T_8	253.35	252.81	208.15	207.69	189.51	188.32	177.44	175.02
T_9	220.57	219.51	177.82	176.63	158.54	158.13	148.52	147.53

Nitrate reductase activity :

The 'nitrate reductase' activity has been considered as an important factor in improving 'nitrogen use efficiency' of crops and in turn, yielding ability. The pathway of 'N assimilation' is considered the major route of conversion of inorganic form into a biologically useful organic form in plants. In the present investigation, drip fertigation at 125 per cent recommended dose of nutrients as water soluble fertilizer along with Azophosmet and humic acid has improved the nitrate reductase activity at all stages of crop growth (Table 3). Similar trend of results have been documented by Sachdev *et al*. (1987). Utilization of N depended upon this enzyme and high activity was related to high yield and protein content of many crops (Mishra *et al*., 1980). It could also be understood from the present study, that N applied at higher dose through drip fertigation had a greater impact on accelerating the NRase activity. Barlaan and Ichi (1997) opined that increase in N content increased the NRase activity since it was a substrate (nitrogen) induced enzyme. Improved protein synthesis might also be the ultimate result of enhanced NRase activity.

IAA oxidase activity :

Indole acetic acid (IAA), a important bio regulator, regulates the apical dominance and initiation of vegetative and flower buds. The amino acid tryptophan and zinc level in the leaves influences IAA. IAA oxidase was the enzyme responsible for destruction of auxin through the process of oxidation. Therefore, the enzyme activity causes reduction in auxin content and there by decreases the normal growth of the plant. In the present investigation, drip fertigation at 125 per cent recommended dose of nutrients as water soluble fertilizer along with Azophosmet and humic acid showed its profound effect in suppressing the oxidation of auxin (Table 4). It was also revealed that the plants receiving optimum dose of fertilizers were able to maintain favourable auxin balance through IAA oxidative degradation. In plants with lesser levels of available nutrients in soils, IAA synthesis might have been insufficient for encouraging IAA oxidative metabolism (Gowri, 2005). In the present study *i.e.*, increased IAA oxidase activity was accompanied with reduced vine length, which might be due to the accelerated auxin degradation by IAA oxidase.

REFERENCES

Balasubramanian (2008). Comparative analysis of growth, physiology, nutritional and production changes of tomato (*Lycopersicon esculentum* Mill.) under drip fertigation and conventional systems. Ph.D. (Hort.) Thesis, Tamil Nadu Agricultural University, Coimbatore, T.N. (INDIA)

Barlaan, E.A. and Ichi, M. (1997). Relationship of nitrate and nitrite reductase activities to yield and agronomic traits in rice. In: Proc. 8th SABRAO Int. Congr. September, 24-28, Seoul, Korea. pp. 181-182.

Gnanachitra, M. (2000). Studies on the development of acid tolerant *Azospirillum* for tea. Ph.D. Thesis, Tamil Nadu Agricultural University, Coimbatore, T.N. (INDIA).

Goreta S., Perica, S., Dumicic, G., Bucan, L. and Zanic, K. (2005). Growth and yiel of watermelon on polyethylene mulch with different spacings and nitrogen rates. *American J. Hort. Sci.,* **40** (2) :366-369

Gowri, S. (2005). Physiological studies on aerobic rice (*Oryza sativa* L.). M.Sc. Thesis, Tamil Nadu Agricultural University, Coimbatore, T.N. (INDIA).

Hebber, S.S., Ramachandrappa, B.K., Nanjappa, H.V. and Prabhakar, M. (2004). Studies on NPK determined by nuclear and traditional techniques. *Nutr. Cycl. Agroecosyst.,* **68** : 1-11.

Meenakshi, N. and Vadivel, E. (2003). Effect of fertigation on growth and dry matter production of hybrid bitter gourd (*Momordica charantia* L.). *Orissa J. Hort.,* **31**(2): 33-34

Mishra, S.P., Sinha, S.K. and Rao, N.G.P. (1980). Genetic analysis of nitrate reductase in relation to yield in heterosis sorghum. *Z. Pflanzenzenbta,* **85** : 16-18.

Neerja, R., Kumar, S. Ramesh and Dhatt, K.K. (2005). Effect of nitrogen levels and growing media on growth, flowering and bulb production of lillium cultivars. *J. Orna. Hort.,* **8** (1) : 36-40.

Noggle, C.R. and Fritz, C.J. (1986). *Introductory plant physiology*. Prentice Hall of India Pvt. Ltd. New Delhi. pp. 171.

Panse, V.G. and Sukhatme, P.V. (1978). *Statistical methods for agricultural workers*, II Edn. ICAR, New Delhi. pp.134-192.

Ronen. G., Cohen, M., Zamir, D. and Hirschberg, J. (1999). Regulation of carotenoid biosynthesis during tomato fruit development: expression of the gene for lycopene epsilon cyclase is down- regulated during ripening and is elevated in the mutant Delta. *Plant J.,* **17**: 341–351.

Sachdev, P., Debe, D.L. and Rastogi, D.K. (1987). Effect of varying levels of zinc and molybdenum on plant constituents and enzyme activity at different growth stages of wheat. *J. Nuclear Agric. & Bio.,* **16** (4) : 187-196.

Simmonds, N.W. (1979). *Principles of crop improvement*. Longman Group Ltd. 277 p.

Stalyarav, A.I. (1974) . Characteristics of nitrogen metabolism in tomatoes, cucumber and onion in relation to nutrition. *Fiziologiya I.Biokhimiya Kul Hurnykh Rastenii*, **6** : 506 – 511.

Tamilselvan, T., Anburani, A. and Manivannan, S. (2006). Response of black night shade (*Solanum nigrum*) to organic nutrients. In: National Seminar on Convergence on Technologies for Organic Horticulture. Tamil Nadu Agricultural University, Coimbatore, India.