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Dry matter accumulation and leaf chlorophyll content of bitter gourd (*Momordica charantia* L.) as influenced by fertigation

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ABSTRACT

Field experiments were carried out to elucidate the effect of macro and micronutrient fertigation on dry matter accumulation and chlorophyll content in the leaf of bitter gourd during 2001 and 2002. Application of different levels of fertigation significantly influenced the total dry matter accumulation and chlorophyll a, b and total chlorophyll in leaf at different stages of crop growth during both the seasons. Application of 100 per cent macro and micronutrients in water soluble form, significantly influenced the total dry matter production. Chlorophyll a, b and total chlorophyll content increased with increase in the fertigation levels and the highest being in 100 per cent macronutrient applied in combination with micronutrients. The content in the leaf increases up to 60 days and thereafter in, slowly declined during both the season.

Key words : Dry matter, Chlorophyll, Bitter gourd, Fertigation, Macronutrient, Micronutrient.

Bitter gourd is a commercially and medicinally important vegetable belonging to the cucurbitaceae family. It is mainly grown for its fruit in the tropical parts of the world. Besides the highest calorific value, the fruits are rich in Vitamin-C, phosphorus and iron (Wills *et al*., 1984). Bitter gourd is also known for its various medicinal properties (Morton, 1967) with a more recent attention focused on its use as a hypoglycemic agent (Perl, 1988).

Accumulation of nutrients in a plant depends on many factors such as physico-chemical characteristics of soil, variety and agroclimatic condition prevailing in a place. The study on dry matter accumulation and leaf chlorophyll content at different stages of crop growth is essential for understanding the nutrient requirement and also to estimate the nutrient removal by the crop. Nutrient content and uptake as a function of dry matter production during the different stages of crop growth will bring out the nutrient requirements of the plant, besides indicating the physiological status of the plant.

The fertigation proved to increase the dry matter production (DMP) through vegetative growth and nutrient absorption through expanded root system. Fertigation offers increased flexibility in managing orchard nutrition programs because of the potential for more closely synchonizing nutrient application with plant demand (Haynes, 1985). There is a need, however, to assess the effectiveness of any new fertilization strategy relative to traditional methods. Hence, the present investigation was carried out to study the effect of fertigation on dry matter accumulation and leaf chlorophyll content of bitter gourd.

MATERIALS AND METHODS

The study was conducted at University Orchard, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore during 2001 (season I) and 2002 (season II) in bitter gourd hybrid CoBgoH-1. The soil of the experimental field was alkaline (pH 8.1) in reaction and sandy loam in texture. The experimental field containing available N (175.00 kg ha^{-1}), available P (17.20 kg ha^{-1}) and available K (626.00 kg ha^{-1}) in the soil. The treatments included were three levels of macronutrients in water-soluble form (100%, 75% and 50%) and three levels of macronutrients in water soluble form applied in combination with micronutrients (polyfeed) (100%, 75% and 50%) with a control (conventional method of fertilizer application).

The seeds of the bitter gourd hybrid were sown at a spacing of 1.5 x 2 m. The experiment was laid out in a randomised block design and the fertigation was given once in a week starting from the 4^{th} week after sowing. The total dry matter production was recorded at 40, 60, 80 and 100 DAS. Five plants were selected in each replication and the plants were uprooted and fresh weights were noted. Freshly chopped materials were dried at 80°C in an oven to get per cent dry matter and the dry matter yield was calculated. The chlorophyll a, b and total chlorophyll content were estimated as per the method suggested by Yoshida *et al*. (1976) and expressed in mg g^{-1} on fresh weight basis.

RESULTS AND DISCUSSION

The total dry matter production increased significantly with advancement in the crop age and with every increase in the level of fertigation. The total dry matter production varied significantly during 40 DAS from 10.27 (T_7) to 12.96 g plant^{-1} (T_4) in the first crop. In the second crop also similar results were noticed (Table 1). The total dry matter production of 155.13 (T_7) to 375.429 (T_4) and 156.37 (T_7) to 376.28 g plant^{-1} (T_4) were recorded at 100 DAS in both the seasons showed marked influence of treatment on the total dry matter production. In both the season, the treatment T_4 registered the highest total dry matter production. At all stages, fertigation influenced the production of dry matter. Glass and Siddique (1984) reported that low external concentration of nutrients restrict the dry matter production. This might be due to the fact that nitrogen plus micronutrients might be responsible for enhancing the photosynthetic ability and better availability of potassium could have helped in the translocation of metabolites from source to sink. This is in agreement with earlier works of El-Sherif *et al*. (1993) in tomato.

In general, chlorophyll ‘a’ and ‘b’ contents increase with crop growth. But in the present work, the chlorophyll contents increased up to 60 DAS and thereafter it declined. There was significant difference in chlorophyll content with every increase in the level of water soluble fertilizer plus micronutrients. The chlorophyll content ranged from 0.85 to 1.13 at 100 DAS in season I and 0.91to 1.47 mg g^{-1} of fresh weight at 100 DAS during season II. The treatment T_4 recorded maximum chlorophyll ‘a’ of 1.13 mg g^{-1} during season I and 1.47 mg g^{-1} during season II (Table 2).

The highest chlorophyll ‘b’ content was obtained with the application of 100 per cent water soluble fertilizer plus micronutrients. T_4 recorded the highest chlorophyll ‘b’ content of 0.56 mg g^{-1} of fresh weight at 100 DAS in season I. During the II season, the same treatment recorded maximum chlorophyll ‘b’ content of 0.563 mg

Table 1: Effect of macro and micronutrient fertigation levels on total dry matter accumulation per plant (g) in bitter gourd

Treatments	Total dry matter accumulation (g plant^{-1})								Pooled mean at 100 DAS
	Season I				Season II				
	Days after planting								
	40	60	80	100	40	60	80	100	
T_1 (100% WSF)	12.426	60.876	213.454	294.592	13.070	62.446	213.230	325.390	309.991
T_2 (75% WSF)	11.771	54.337	171.879	225.836	12.164	55.590	171.592	240.928	233.382
T_3 (50% WSF)	10.475	45.152	134.439	175.016	10.939	46.392	133.716	176.606	175.811
T_4 (100% WSF + MN)	12.962	66.641	239.797	375.529	12.927	67.358	240.653	376.282	375.906
T_5 (75% WSF + MN)	12.071	57.394	190.526	251.905	12.534	58.620	189.815	276.807	264.356
T_6 (50% WSF + MN)	11.069	48.972	154.108	200.037	11.372	50.247	153.433	207.928	203.983
T_7 (100% NF soil application)	10.271	41.675	120.839	155.136	10.343	42.920	120.204	156.376	155.756
S.E. $\pm$	0.0998	0.2089	0.7551	0.6888	0.2185	0.1601	0.0944	0.1357	-
C.D. (P=0.05)	0.2174	0.4551	1.6453	1.5007	0.4761	0.3488	0.2057	0.2957	-

WSF = Water Soluble Fertilizer MN = Micronutrient NF = Normal Fertilizer

Table 2: Effect of macro and micronutrient fertigation levels on chlorophyll ‘a’, ‘b’ and total chlorophyll content (mg g^{-1}) in bitter gourd

Treatments	Season I			Season II		
	Chlorophyll ‘a’ (mg g^{-1})	Chlorophyll ‘b’ (mg g^{-1})	Total chlorophyll (mg g^{-1})	Chlorophyll ‘a’ (mg g^{-1})	Chlorophyll ‘b’ (mg g^{-1})	Total chlorophyll (mg g^{-1})
	100 DAS	100 DAS	100 DAS	100 DAS	100 DAS	100 DAS
T_1 (100% WSF)	0.971	0.460	1.472	1.119	0.460	1.913
T_2 (75% WSF)	0.914	0.456	1.424	1.026	0.456	1.482
T_3 (50% WSF)	0.871	0.410	1.356	0.949	0.410	1.360
T_4 (100% WSF + MN)	1.133	0.563	1.746	1.477	0.563	2.040
T_5 (75% WSF + MN)	0.958	0.464	1.469	1.105	0.464	1.569
T_6 (50% WSF + MN)	0.899	0.442	1.396	0.988	0.442	1.430
T_7 (100% NF soil application)	0.852	0.400	1.311	0.916	0.400	1.316
S. E. $\pm$	0.0022	0.0087	0.0088	0.0123	0.0025	0.1787
CD (P=0.05)	0.0048	0.0189	0.0191	0.0269	0.0053	0.3894

WSF = Water Soluble Fertilizer MN = Micronutrient NF = Normal Fertilizer

g^{-1} of fresh weight at 100 DAS (Table 2). Nitrogen being the constituent of chlorophyll and its continued synthesis would have enhanced the photosynthetic activity of the plant. Klein *et al*. (1989) is of the view that in apple, nitrogen nutrition influenced the chlorophyll content.

There was significant difference in total chlorophyll content with every increase in the level of fertigation with water soluble fertilizer (Table 2). The maximum total chlorophyll content of 1.74 and 2.04 mg g^{-1} was recorded in the treatment with macro and micronutrient applied in combination at the recommended level (100%). The phenomenon of increased chlorophyll content with increased nutrition met with the present investigation was also reported by several workers (Patel and Patel, 1985).

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