Advances in Life Science and Technology
ISSN 2224-7181 (Paper) ISSN 2225-062X (Online)
Vol.53, 2017
www.iiste.org

Growth Regulators Induced the Photosynthetic Pigments of Drumstick (Moringa oleifera)

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Abstract
In the preliminary experiments 2, 5, 10, 15 and 20 mg L^{-1} in Triadimefon, 10, 25, 50 and 75mg L^{-1} in GA_3 and *P. fluorescens* was used for treatments to determine the optimum concentration of TDM, GA_3 and *P. fluorescens* among the treatments 10mg L^{-1} TDM, 50 mg L^{-1} GA_3 and 1mg L^{-1} *P. fluorescens* concentrations increased at 50 % of photosynthetic pigments. After 30 days of the growth the treatments were given, 30 pots for each treatments with TDM, GA_3 and *P. fluorescens* respectively and 10 pots were kept untreated and served as control. 10mg L^{-1} TDM, 50 mg L^{-1} GA_3 and 1mg L^{-1} *P.fluorescens* were given to each pot by soil drenching. The plants were uprooted randomly on 45, 60, 75 and 90 DAS and separated leaves used for determining the photosynthetic pigments of *Moringa oleifera.*
Keywords: Growth regulators, Antioxidant, Moringa oleifera.

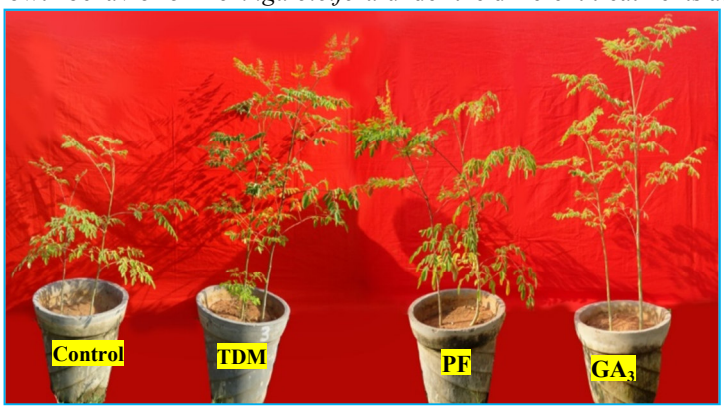
INTRODUCTION

Moringa, belongs to the family Moringaceae, it contains only one genus with 13 species mostly widely cultivated species is *Moringa oleifera*, a multipurpose tree native to the foothills of the sub Himalayan tracts of north western in India. Now distributed in Pakistan, Asia-Minor, Africa and Arabia, Philippines, Cambodia, Central America, North and South America and Caribbean Islands (Leone *et al.,* 2015). In some parts of the world *M. oleifera* is referred to as the 'drumstick tree' or the 'horse radish tree', whereas in others it is known as the kelor tree. It can grow well in the humid tropics or hot dry lands, can survive destitute soils, and is little affected by drought. It tolerates a wide range of rainfall with minimum annual rainfall requirements estimated at 250 mm and maximum at over 3000 mm and a pH of 5.0–9.0 (Anwar *et al.,* 2007).

MATERIALS AND METHOD

Total Chlorophyll (Arnon., 1949).
Five hundred milligrams of fresh leaf material was ground with 10ml of 80 % acetone at 4°C and centrifuged at 2500 rpm for 10 minutes. This procedure was repeated until the residue became colourless. The extract was transferred to a graduated tube and made up to 10 ml with 80 % acetone and assayed immediately. Three milliliters aliquots of the extract were transferred to a cuvette and the absorbance was read at 645, 663 and 480 nm with a spectrophotometer (U-200 1-Hitachi) against 80 per cent acetone as blank.
Xanthophyll (Neogy *et al.,* 2001)
500 mg of fresh weight of tissues taken from the 3rd leaf and periphery of the tuber were used for the assay. The tissue was ground with 10 ml of 80% acetone at 4°C using a pestle and a mortar and centrifuged at 1000 rpm for 15 minutes. The residue was re-extracted with 80% acetone until the colour completely disappeared from the residue. The aqueous acetone extract was shaken thrice with an equal volume of hexane in a separating funnel and the combined hexane fractions were washed with equal volume of water. To separate xanthophyll from carotenes, the hexane fraction containing carotenoid was extracted repeatedly with 90% methanol. The methanol fraction containing xanthophyll was measured for absorbance at 450 nm in a spectrophotometer.
Carotenoid (Kirk and Allen, 1965).

Fig -1: Growth behavior of *Moringa oleifera* under the different treatments at 45th days**.**



RESULT

Total Chlorophyll

The total chlorophyll contents of the *Moringa* leaves increased with the age in control and treated plants. The maximum increase was found on 90 DAS in TDM treatments and it was 112.22 % over control. Among the treatments, PF and GA_3 slightly increased and it was 102.63 and 101.38 respectively on 90 DAS when compare to control plants.

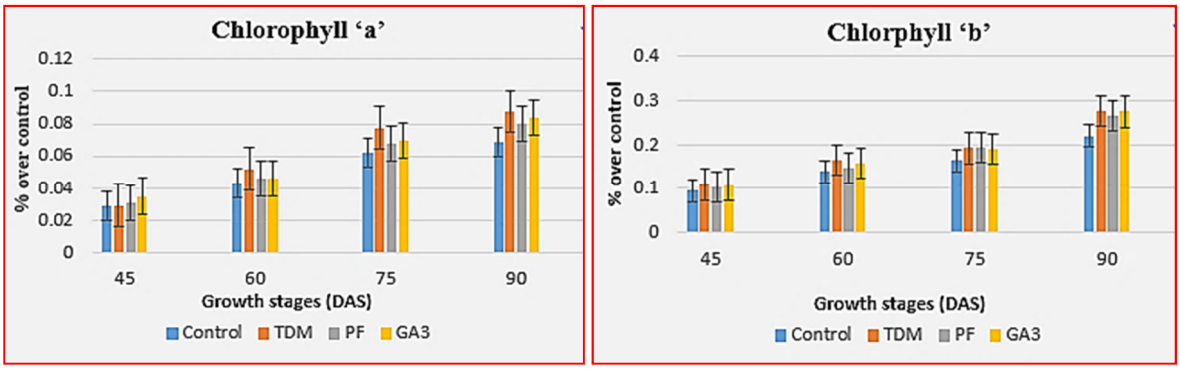
Carotenoid content

The Carotenoid content increased with the age in control and treated plants on all sampling of days. The higher carotenoid contents were observed under TDM treatments on 90 DAS and it was 120.68 % over control. The similar results were also observed in PF and GA_3 treated plants.

Xanthophyll content

The xanthophyll content increased with the age in control and treated *Moriga oleifera* plants. The slight increase in xanthophyll content under TDM and PF treatments but increased under GA3 treatments when compared to control on 90 DAS. At least increase was recorded in 90 DAS samples under TDM treatments and which was up to 109.02 % over control.

Fig-2(a,b,c): Effect of Triadimefon, *Pseudomonas fluorescence* and Gibberellic acid on chlorophyll content of *Moringa oleifera* (value are mean ± SD 5 samples expressed in mg/g fresh weight)



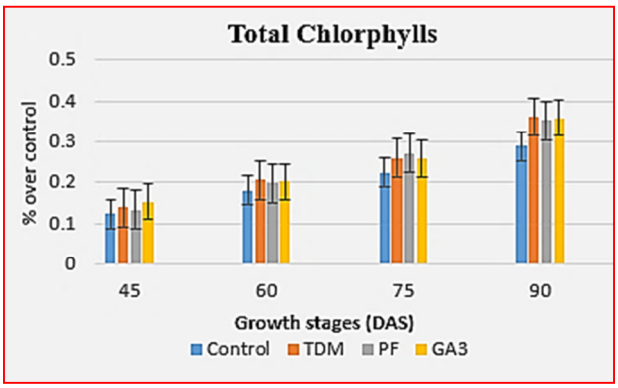
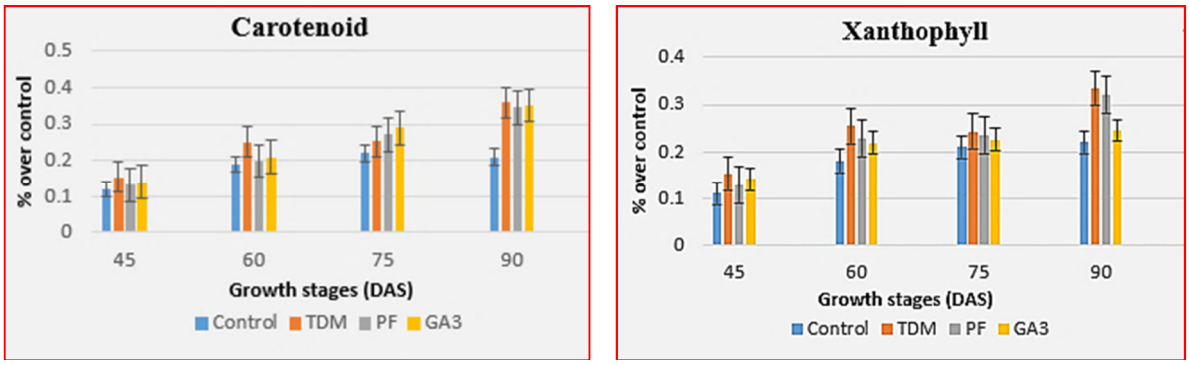


Fig -3(a,b): Effect of Triadimefon, *Pseudomonas fluorescence* and Gibberellic acid on Carotenoid and Xanthophyll contents of *Moringa oleifera* (values are mean ± SD 5samples expressed in mg/g fresh weight)



DISCUSSION

Treatments with TDM, PF and GA_3 significantly increased the total chlorophyll contents in *Moringa* plants. Similar results were observed in Paclobutrazol treated barley (Sunitha *et al.,* 2004), carrot (Gopi *et al.,* 2007) and tomato (Still and Pill, 2004). Paclobutrazol treated leaves were dark green due to high chlorophyll content in potato (Tekalign *et al.,* 2005). Sebastian *et al.,* (2002) reported enhanced chlorophyll synthesis in *Dianthus caryophyllus* treated with Paclobutrazol. Gibberellic acid increased the vegetative growth and pigment concentration in maize (Kaya *et al.,* 2006). In *Lotus tenuis,* low photosynthetic photon flux density induced an orthotropic growth of stems with greater supply of GA_3 (Clua *et al.,* 1997). Foliar application of GA_3 improved the chlorophyll levels in salinity stressed maize plants (Tuna *et al.,* 2008). Salamone *et al* (2001) PF produced highest amount of cytokinins viz; isopentenyl adenosine (IPA) trans-zeatinribosa (ZR) and dihydrozeatinribose (DHZR) during stationary phase.

The carotenoid content of the *Moringa oleifera* leaves increased with age in control and treated plants. Triadimefon increased the carotenoid content in *Catharanthus* plants (Jaleel *et al.,* 2006). Similar results were observed in cucumber (Feng *et al.,* 2003). An increase in carotenoid content was reported in maize plants (Kaya *et al.,* 2006). Plant growth of wheat decreased with increasing salinity levels, but was increased by seed treatment with GA_3 which accompanied increased photosynthetic pigment contents (Kumar and Singh, 1996).

TDM treatment increased the xanthophylls content in *Moringa oleifera* plants, but GA_3 and PF treatments were decreased. Triadimefon treatment increased the chlorophyll, carotenoids, xanthophylls content in the leaves of barley (Forster, 1977), Triazole treatment increased the xanthophyll content to a higher level in cucumber leaves (Feng *et al.,* 2003).

COCLUSION

The present study is concluded that the observation of chlorophyll, carotenoids and xanthophyll content of *Moringa oleifera.* Among the treatment of TDM, *Pseudomonas florescence* and gibberellic acid was gradually increased and TDM treatment was maximum increased with chlorophyll, carotenoids and xanthophyll content of *Moringa* on 90 DAS when compared to the control plants.

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