



Research Article

EFFECT OF PLANT GROWTH REGULATOR ON PHOTOSYNTHETIC EFFICIENCY OF THREE DIFFERENT VARIETIES OF *LINUM USITATISSIMUM* LINN.

S. A. Gaikwad¹, D. K. Gaikwad² & P. D. Chavan²

¹Department of Botany, Vidnyan Mahavidyalaya, Sangola

²Department of Botany, Shivaji University, Kolhapur

*Corresponding Author: S. A. Gaikwad; Email: seemgaik@gmail.com

Abstract: Humans are always depends on plants mostly to obtain the most important necessities for life: food, shelter & clothing. The plant cell walls often contain lignin as well as cellulose. *Linum usitatissimum* Linn. belongs to the family Linaceae is a most powerful source of the commercial fiber. In present investigation effect of PGR on the total chlorophyll content and chlorophyll stability index in leaves of three different variety of *Linum usitatissimum* have been studied. It is observed that GA treatment is helpful to increase photosynthetic efficiency of flax plant.

Key words: Chlorophyll content, *Linum usitatissimum*, chlorophyll stability index, Local variety, NL97- Variety, Nagarkot variety

INTRODUCTION

Among various plant pigments, chlorophylls are primarily involved in harvesting the solar energy and converting it into chemical energy. Chlorophylls are the green pigment performing the most important role in photochemical reactions during photosynthesis. Mainly there are two types of chlorophylls present in higher plants Chlorophyll-a plays a main role in photosynthetic act while, Chlorophyll-b plays a secondary function. The level and state of chlorophyll pigments in the leaf tissue are important factors which determine the overall photosynthetic efficiency of a plant.

Linum usitatissimum Linn. Flaxseed belongs to the family Linaceae, and is commonly known as linseed. The genus *Linum* Linaceae comprises over 180 species, which are taxonomically divided into five sections forming two major clades [1]. It is native to the region extending from the eastern Mediterranean to India. Earlier studies indicated that, it is a most powerful source of the commercial fiber [2], [3]. In present investigation effect of PGR on the total chlorophyll content and chlorophyll stability index in leaves of three different variety of *Linum usitatissimum* Local variety, NL97- Variety, Nagarkot variety at two developmental stages vegetative stage and reproductive stage of its lifecycle have been studied to know their effect on photosynthetic efficiency of Flax plant .

MATERIAL METHOD:

The most widely used method of Arnon [4] was followed for estimation of Chlorophylls. Randomly sampled fresh leaves from treated flax varieties were brought to laboratory, washed with distilled water and blotted to dry and cut into small pieces with razor. Chlorophylls were extracted by homogenization of 500 mg of leaf material in 80% ice cold acetone in cold mortar with pestle. A pinch of MgCO₃ was added to neutralize the acids released during extraction. The extract was filtered through Whatman No.1

filter paper using Buchner's funnel. Final volume of the filtrate was made 50 ml with 80 % acetone. The filtrate was transferred into a conical flask wrapped with black paper to prevent photo-oxidation of the pigments. Absorbance values of the extract were recorded at 663 nm and 645 nm on a Shimadzu, UV-190 double beam spectrophotometer agent 80 % acetone as a blank.

RESULT DISCUSSION

Chlorophylls

The level of chlorophyll in the leaf tissue depends on two processes the rate of its synthesis on one hand and the rate of its degradation on the other. Photosynthesis is related to chlorophyll content [5].

Effect of PGR on the total chlorophyll content and chlorophyll stability index in leaves of three different variety of *Linum usitatissimum* Local variety, NL97- Variety, Nagarkot variety at two developmental stages vegetative stage and reproductive stage of its lifecycle are shown in Fig. 1&2 and Table 1&2. It is evidence from results that GA treatment has significantly affected on total chlorophyll content on all studied varieties at both stages of developments. NL 97 variety is superior than other studied varieties under controlled condition i.e. 104.7±0.872 mg/100g fresh weight. For local varieties at vegetative state all PGR treatment shows significant affects except Ascorbic acid treatments i.e. decrease from 72.187±0.768 to 64.538±0.957mg/100g. While in case of NL-97 variety only GA and Vipul treatment shown significant increase in chlorophyll content at vegetative state of development. In case of Nagarkot variety except Vipul treatment all other PGRs helpful for increase total chlorophyll contents. Same kind of chlorophyll levels has been reported by several researchers in several plants. Karadge [6] has reported 96.97 mg chlorophylls 100g-fresh wt. in the leaves of *Portulaca oleracea*, while it is 202.4 mg in *Euphorbia geniculata*[7]. Chlorophyll content in young and mature leaves of *Guizotia*

abyssinica is 82.57 and 84.72 mg 100g-1 fresh wt. respectively [8]. Total chlorophyll content in different *Cleome* species in range 51.61 to 262 mg 100g-1 fresh wt. [9].

In case of reproductive state also GA treatment is highly helpful to increase chlorophyll level in all studied flax varieties. At this phase of development in local variety and NL 97 variety only GA and Vipul treatments are helpful. While in case of Nagarkot variety except CCC treatment all other treatments are responsible for increase in chlorophyll content. Similar results were found by Sharma *et al.* [10] in case of potato *Solanum tuberosum* L.. Exact reverse results have been reported by various workers i. e. Chlorophyll content was found to be increased after application of CCC [10] [11] [12] [13]. Stoddert [14] recorded increase in chlorophyll content due to application of 0.01-0.5M concentration of CCC in *Lolium temulentum* L. Niimi [13] found that chlorophyll content of CCC treated grapevine leaves was higher as compared to control. Tezuka *et al.* [11] noticed that the chlorophyll content was increased after treatment of CCC in Kyoho grapes. Tezuka *et al.* [12] noticed that photosynthetic activity was stimulated by CCC and improved content of chlorophyll in CCC treated hollyhock plant. At reproductive stage NL97 variety shows highest level of total chlorophyll at GA treatment i.e. 156.655±0.356 mg/100g fresh weight. At controlled condition also NL97 variety of flax is superior than other.

From the overall observation it can be concluded that in case of flax varieties GA treatment is most helpful than other PGR Ascorbic acid, Vipul and CCC. And at reproductive stage there is significantly higher chlorophyll level than that at vegetative state. Higher level of chlorophyll indicates higher productivity of plants. Therefore it can also be concluded that NL97 variety is having higher photosynthetic efficiency than other studied varieties.

Chlorophyll Stability Index: CSI

The effect of PGR GA, Ascorbic acid, Vipul and CCC on the chlorophyll stability index of in leaves of three different variety of *Linum usitatissimum* Local variety, NL97- Variety, Nagarkot variety at vegetative stage and reproductive stage of their lifecycle is shown in Table 3&4 and depicted in Figure 3&4. It is evident from the results that in local variety the chlorophyll stability index increases due to PGR treatment at both developmental stages except decrease in CCC treatment at reproductive stage 0.7482 to 0.6934±0.0382. It is higher at GA treatment in vegetative

stage and at Vipul treatment in reproductive stage 0.8999±0.0036 and 0.8623±0.0194 respectively while minimum at distilled water treatment at vegetative stage 0.6712±0.0054 and at CCC treatment in reproductive stage 0.6934±0.0382.

In case of NL97 variety of flax the chlorophyll stability index decreases due to PGR treatment at both developmental stages except increase in ascorbic acid treatment at vegetative stage 0.8593 to 0.8991±0.0481 and in GA treatment at reproductive stage i.e. 0.8212 to 0.8405±0.0044. The higher fall down observed at GA treatment in vegetative stage and at Vipul treatment in reproductive stage 0.8252±0.0121 and 0.7133±0.0366 respectively.

In Nagarkot variety the chlorophyll stability index decreases due to PGR treatment at vegetative stages except increase in ascorbic acid treatment 0.9431 to 0.9881±0.0163. at reproductive stage of this variety all PGR shows positively increase in stability index except in ascorbic acid treatment i.e. fall down 0.7494 to 0.7329±0.0086. Lowest chlorophyll stability index observed in CCC treatment at vegetative stage and ascorbic acid treatment at reproductive stage 0.8614±0.0269 and 0.7329±0.0086 respectively.

It is evident from results depicted in Table. 3&4 and Fig. 3&4 that among all studied plant varieties highest chlorophyll stability index observed in ascorbic acid treatment of Nagarkot variety at vegetative stage and in vipule treatment of Local flax variety 0.9881±0.0163 and 0.8623±0.0194 respectively. Raja Babu *et al.* [15] reported a higher value of chlorophyll a/b ratio and chlorophyll stability index in some cultivars of rice indicating their tolerance to salt stress. Chhabra *et al.* [16] have used the chlorophyll stability index as a criterion in screening of Indian mustard varieties for drought resistance. In resistant plants, the chlorophylls are more stable showing high chlorophyll stability index. Therefore from all observation it can be concluded that application of PGR at reproductive stage increases resistance power in flax varieties against pathogen or any stress. Application of PGR at vegetative stage is beneficial only in Local flax variety. The chlorophyll stability index as a criterion for screening of the crop plants for their drought tolerance is also well established in several plants like groundnut [17] and grapevines [18]. According to Rai *et al.* [19], the chlorophyll stability index is unsuitable criterion for screening the drought tolerance in the genus *Eucalyptus*.

Table. 1 Change in total chlorophyll content of *Linum usitatissimum* varieties under PGR treatment at vegetative stage

Treatment	Total chlorophyll mg/100gm Vegetative stage		
	Local	NL-97	Nagarkot
Control	72.187±0.768	104.7±0.872	78.92±0.233
D.W.	50.71±0.724	99.73±0.249	75.819±0.563
GA	98.339±0.253	139.389± 0.151	99.275±0.534
Ascorbic	64.538±0.957	99.829±0.577	84.902±0.834
Vipul	76.995±0.311	105.051±0.612	76.844±0.419
CCC	78.241±0.663	95.02±0.584	79.872±0.783

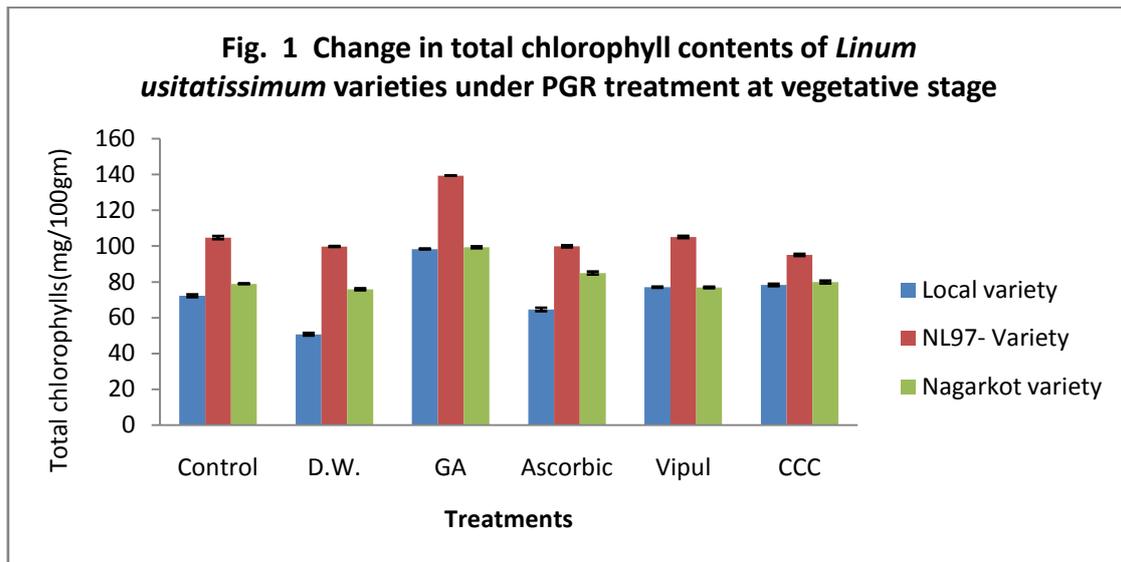


Table. 2 Change in total chlorophyll contents of *Linum usitatissimum* varieties under PGR treatment at reproductive stage

Treatment	Total chlorophylls mg/100gm Reproductive stage		
	Local	NL-97	Nagarkot
Control	106.868±0.977	130.988±0.862	129.211±0.504
D.W.	73.439±0.435	147.433±0.232	130.706±0.879
GA	110.377±0.787	156.655±0.356	150.348±0.735
Ascorbic	87.783±0.437	114.201±0.623	148.6±0.189
Vipul	110.211±0.783	142.306±0.664	148.27±0.899
CCC	99.942±0.945	111.488±0.658	125.525±0.224

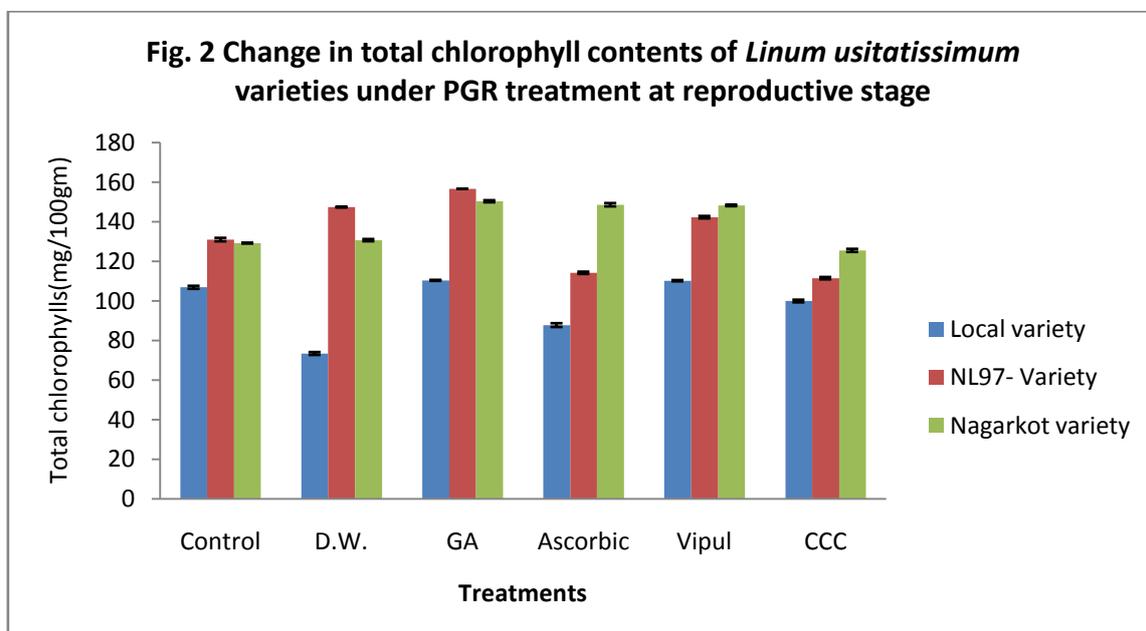


Table. 3 Chlorophyll stability index of *Linum usitatissimum* varieties under PGR treatment at vegetative stage

Treatment	Chlorophyll stability index		
	vegetative stage		
	Local	NL-97	Nagarkot
Control	0.7028±0.0122	0.8593±0.0655	0.9431±0.0798
D.W.	0.6712±0.0054	0.8829±0.0104	0.9601±0.0517
GA	0.8999±0.0036	0.8252±0.0121	0.9278±0.0142
Ascorbic	0.8383±0.0316	0.8991±0.0481	0.9881±0.0163
Vipul	0.7521±0.0203	0.8318±0.0171	0.8906±0.0192
CCC	0.7529±0.0194	0.8449±0.0162	0.8614±0.0269

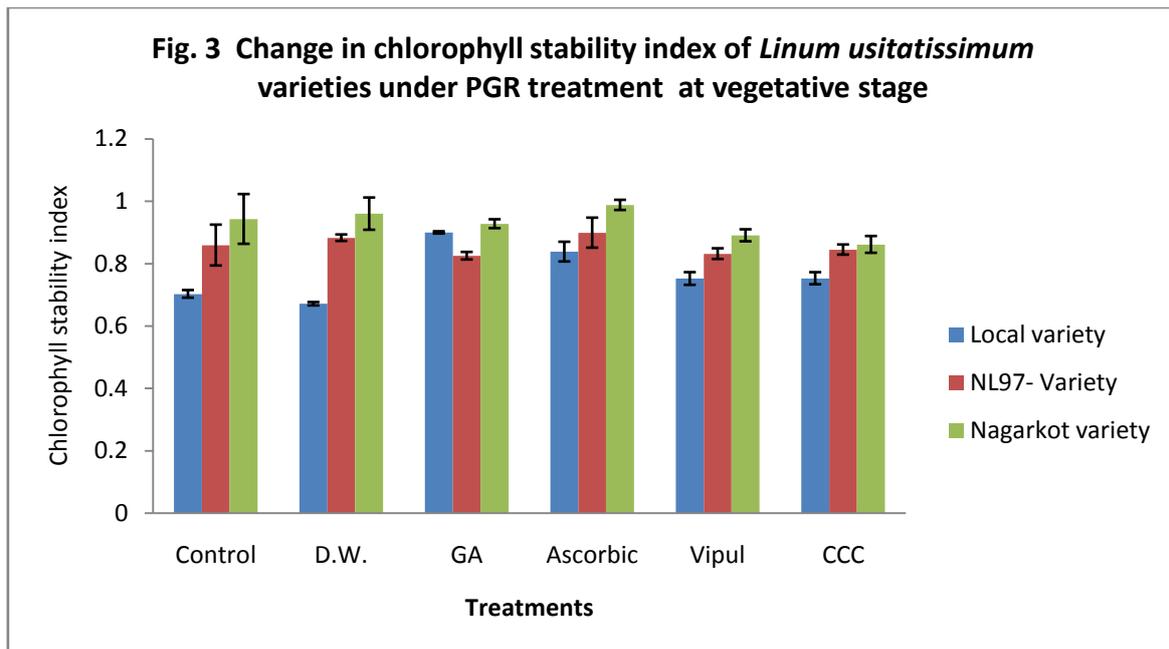


Table. 4 Chlorophyll stability index of *Linum usitatissimum* varieties under PGR treatment at reproductive stage

Treatment	chlorophyll stability index		
	Reproductive stage		
	Local	NL-97	Nagarkot
Control	0.7482±0.0234	0.8212±0.0276	0.7494±0.0548
D.W.	0.843±0.0332	0.7376±0.0455	0.7785±0.0328
GA	0.7738±0.0106	0.8405±0.0044	0.8068±0.0089
Ascorbic	0.7835±0.0103	0.778±0.0094	0.7329±0.0086
Vipul	0.8623±0.0194	0.7133±0.0366	0.807±0.0128
CCC	0.6934±0.0382	0.7468±0.0206	0.7881±0.0389

CONCLUSION :

It can be concluded from results that, in flax plant at reproductive stage there is significantly higher chlorophyll level than that at vegetative state and NL 97 variety is superior than other studied varieties under controlled condition. This variety has higher photosynthetic efficiency than other studied flax varieties. At flowering stage GA treatment is highly helpful to increase chlorophyll level in all these flax varieties. It indicates GA treatment is helpful for increase productivity of plant. From study of PGR treatment on chlorophyll stability index in flax

varieties, it can be concluded that ascorbic acid treatment and vipule treatment may be helpful to increase salt stress tolerance in *Linum usitatissimum*.

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