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EFFECT OF UREA ON CHLOROPHYLL CONTENTS AND YIELD OF *GLYCINE MAX* (L.) VAR. RELATED WITH SENESCENCE

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Abstract

The effect of different urea concentration on chlorophyll contents, pod size and weight per 100 seeds of *Glycine max* L. (soybean) was studied. Urea increased chlorophyll contents as well as pod size and weight per 100 seeds at V_6 and R_2 stage at all its application rate. There was no effect of urea treatment at R_8 stage as plant senescence gets start.

Key words : Chlorophyll, pod size, weight per 100 seeds, urea, *Glycine max* L.

Introduction

Plant and their parts develop continuously from germination to death. The latter part of the developmental process that leads from maturity to ultimate complete loss of organization and function is termed senescence. The plants, which have only one reproductive phase followed by death are called monocarpic and that have more than one reproductive phase before death is called polycarpic. The death of the whole plant commonly occurs (annual and biennial species) upon completion of fruiting (Wang *et al*., 2008). Although, senescence progress with thee age. It is controlled by internal and external signals and it can be delayed or accelerate by altering these signals. The early stage of senescence becomes harmful because at this stage leaves have minimum photosynthates which results in loss of yield (Kaur and Jagetiya, 2003). Senescence, after complete photosynthesis may be helpful in improving the yield. Soybean is important monocarpic crop. The study of its senescence is, therefore, essential if one can postpone for some time period or up to complete photosynthesis. In the present studies, different concentrations of urea has been studied on certain growth parameters and yield of *Glycine max* L.

Materials and Methods

The experiment was conducted to find out the effect of foliar spray of different concentrations of urea on growth parameters of soybean. Certified seeds of soybean were surface sterilized with 0.1 % (W/V) $HgC1_2$ for one minute and washed well in running water. Water soaked seeds were then sown in the first week of October in earthen pots (12") containing 5 kg mixture of garden soil. The pots were placed in such a manner that all the plant parts could intercept light. Watering was done at regular intervals. Different concentrations of urea (1%, 2% & 3%) were sprayed at four stages of growth *viz.* V_2, V_6, R_2 and R_8 stage. Leaf samples were collected after 4 days of foliar treatment for biochemical analysis at each stage. No. of seeds/pod and weight per 100 seeds ware estimated after pod maturation.

Results and Discussion

Urea treatment increased the chl 'a', chl 'b' and total chl at V_2, V_6 and R_2 stage over the control. The percentage increase in chl 'a', chl 'b' and total chl for V_2, V_6, R_2 stages were 29.80 %, 43.99 %, 31.11%, 51.17%, 56.05%, 45.34%, 59.19%, 56.69%, 62.0% respectively at 3% urea concentration. At R_8 stage chlorophyll found to decrease with respect to control as plant senescised at this stage and foliar treatment of urea does not affect chlorophyll concentration (figs. 1, 2, 3, 4).

Pod size of soybean found to increase maximum 15.14% (3% urea) V_6 stage and 24.35% at R_2 stage with respect to control (fig. 5). Urea increased weight per 100 seeds at V_6 stage it increased to maximum

Table 1 : Showing chlorophyll contents (mg g^{-1}) and percentage increase/decrease over the control in *Glycine max* L. during different growth stages under different treatments of urea.

Urea con.(%)	V_2			V_6			R_2			R_8		
	Chl a	Chl b	Total Chl	Chl a	Chl b	Total Chl	Chl a	Chl b	Total Chl	Chl a	Chl b	Total Chl
Control	0.993±.003	0.306±0.009	1.398±0.017	1.960±0.050	0.660±0.008	2.781±0.023	2.203±0.005	0.695±0.004	2.969±0.043	0.23±0.010	0.024±0.004	0.334±0.006
1 %	1.005±.003 (1.208%)	0.326±0.004 (6.53%)	1.40±0.004 (0.14%)	2.432±0.077 (24.08%)	0.917±0.052 (38.93%)	3.171±0.036 (14.34%)	2.957±0.56 (34.22%)	0.892±0.010 (28.34%)	4.038±0.018 (36.005%)	0.203±0.005 (-11.73%)	0.024±0.004 (0.00%)	0.314±0.013 (-5.08%)
2 %	1.021±.005 (2.31%)	0.397±0.031 (29.73%)	1.50±0.016 (7.29%)	2.60±0.56 (32.65%)	1.000±0.008 (51.51%)	3.833±0.039 (37.02%)	3.157±0.047 (43.30%)	1.076±0.010 (54.82%)	4.38±0.0761 (47.52%)	0.22±0.022 (-4.34%)	0.028±0.002 (16.66%)	0.288±0.04 (-13.77%)
3 %	1.289±0.044 (29.80%)	0.44±0.012 (43.79%)	1.833±0.050 (31.11%)	2.963±0.045 (51.17%)	1.030±0.007 (56.06%)	4.042±0.042 (45.34%)	3.507±0.050 (59.19%)	1.089±0.007 (56.69%)	4.810±0.050 (62.00%)	0.255±0.016 (10.86%)	0.022±0.001 (-8.33%)	0.272±0.055 (-18.56%)

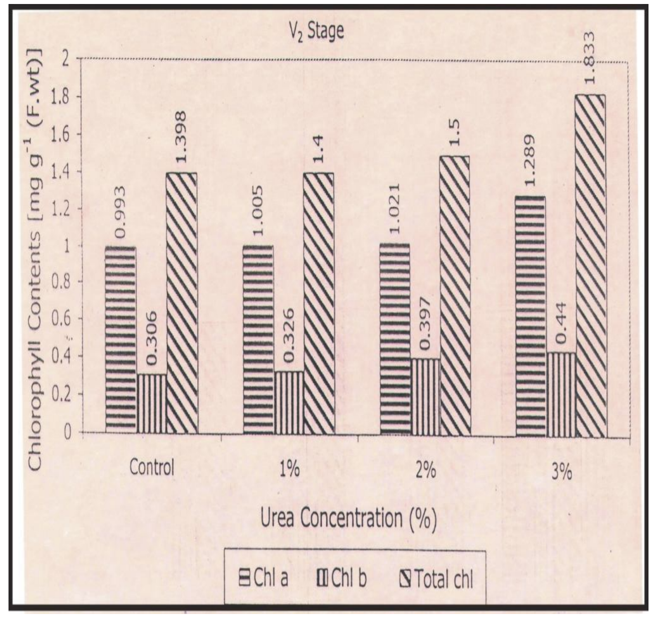

Fig. 1 : Effect of urea on chlorophyll contents in *Glycine max* L. at V_2 stage.

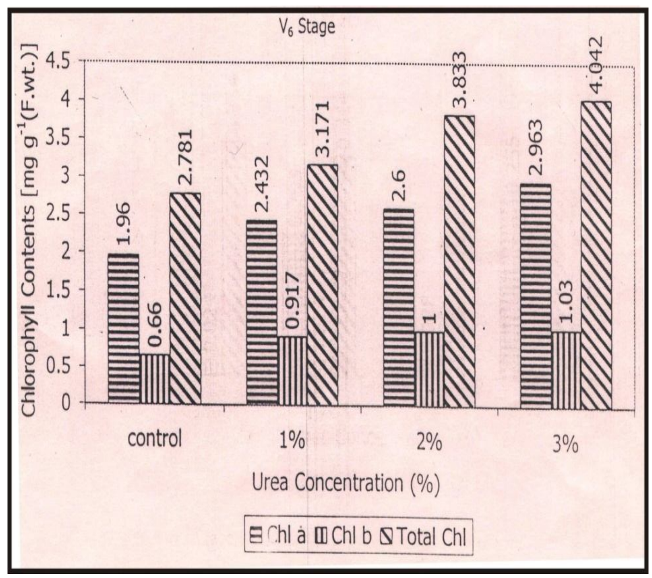

Fig. 2 : Effect of urea on chlorophyll contents in *Glycine max* L. at V_6 stage.

18.07% and 19.86% at R_2 stage (table 3).

At R_2 stage foliar treatment of urea caused maximum increase in growth parameters. In monocarpic plants maximum nutrient accumulation occurs at leaf development and after this the nutrients are transported to reproductive organ and vegetative parts get senescence.

In soybean, Abu-shakra *et al*. (1978) reported that at first day of flowering there is an increase in nitrogen assimilation (both N_2 and Nitrate), but this assimilation quickly diminished at the latest steps of seed development.

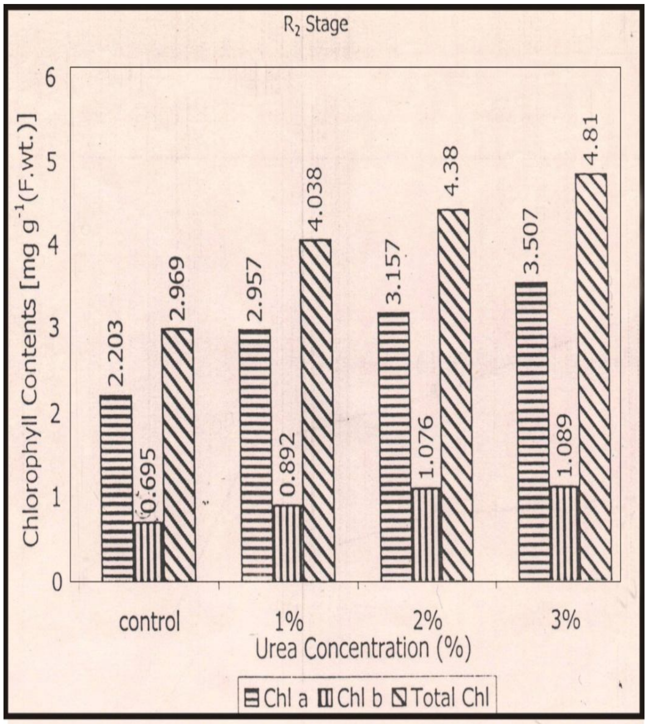

Fig. 3 : Effect of urea on chlorophyll contents in *Glycine max* L. at R_2 stage.

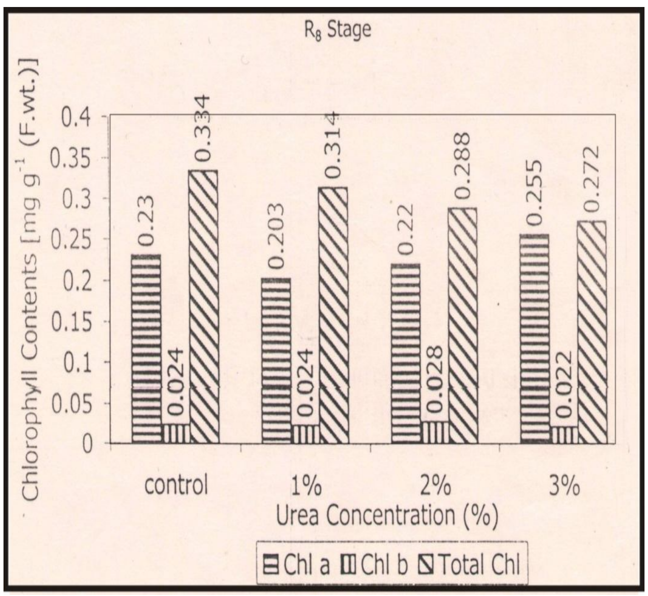

Fig. 4 : Effect of urea on chlorophyll contents in *Glycine max* L. at R_8 stage.

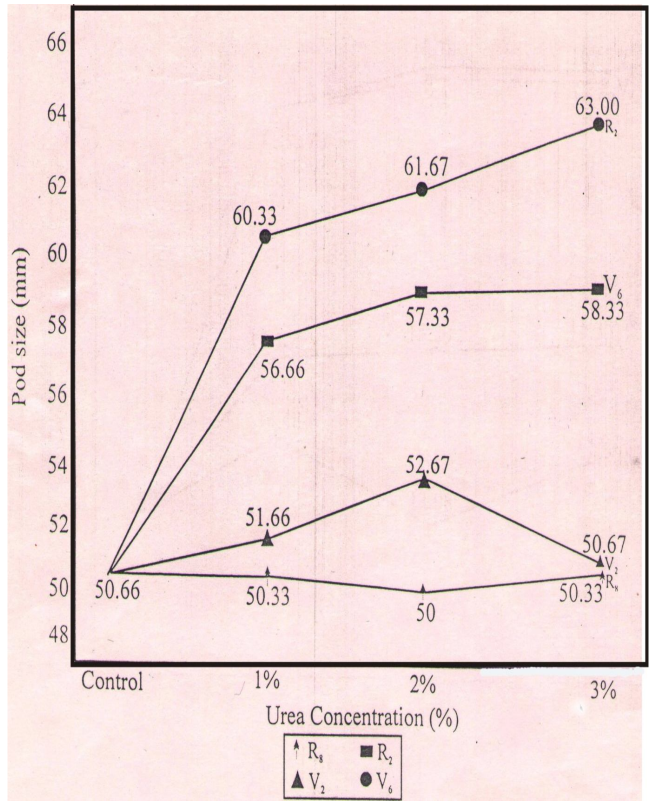

Fig. 5 : Effect of urea on pod size (mm) in *Glycine max* L. during different growth stages.

Abu-shakra *et al*. (1978) suggested the potential use of soybean variants with delayed leaf senescence in improving the yield. Urea is mainly the source of nitrogen, which can be used as soil application or foliar application and it is commonly used as the source of nitrogen in foliage spray. Such foliage sprays have been show to be effective on citrus (Albrigo and Syvertsen, 2001; El-Otmani *et al*., 2001; Khan *et al*., 2009; Akbari *et al*., 2010); on apple (Khamira *et al*., 1999; Dong *et al*., 2002; Cheng and Ranwala, 2004); on coffee, coco and banana (Van Der Vossen, 2005; Biswas and Kumar, 2010); spring wheat (Rong *et al*., 2017; Seyed Sharifi, 2017) and Olive (Zivdar *et al*., 2016).

Protein degradation determines or at least in parallel with a domination of the photosynthetic capacity of the leaf and with ability of the leaf to export carbohydrates. Carbohydrates are also required as energy source and

Table 2 : Showing pod size (mm) and percentage increase/decrease over the control in *Glycine max* L. under different treatments of urea.

Urea concentration (%)	V_2	V_6	R_2	R_8
Control	50.66±0.942			
1 %	51.66±1.247(1.97%)	56.66±1.247(11.84%)	60.33±1.247(19.08%)	50.33±1.247(-0.65%)
2 %	52.67±1.247(3.96%)	57.33±0.942(13.171%)	61.67±1.247(21.73%)	50.00±1.632(-1.30%)
3 %	50.67±1.70(0.020%)	58.33±0.471(15.14%)	63.00±1.414(24.35%)	50.33±1.247(-0.65%)

Table 3 : Showing weight per 100 seeds (gm) and percentage increase/decrease over the control in *Glycine max* L. under different treatments of urea.

Urea concentration (%)	V_2	V_6	R_2	R_8
Control	**14.00±0.57**			
1 %	15.13±0.419(8.07%)	16.42±0.209(17.28%)	16.42±0.538(17.28%)	14.48±0.155(0.034%)
2 %	15.20±0.572(8.57%)	16.52±0.327(18.00%)	16.78±0.397(19.86%)	13.98±0.084(-0.142%)
3 %	15.35±0.502(9.64%)	16.53±0.332(18.07%)	16.67±0.232(19.07%)	14.42±0.129(0.03%)

as carbon precursors for biosynthesis in reproductive structures. When the nitrogen supply is sub-optimal ammonia assimilation increases protein content, leaf growth and correspondingly the 'Leaf Area Index' (LAI). As long requirement of carbon skeletons for ammonia assimilation does not substantially depress other biosynthetic pathway related to carbohydrates (sugar, starch, cellulose etc.), storage lipids or oils. Exogenous supply of nitrogen compounds increased the level of protein at optimal concentration.

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