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EFFECT OF BENZYL ADENINE (BA) ON THE RETARDATION OF LEAF SENESCENCE AND YIELD IN GREENGRAM (*Vigna radiata* (L.) WILCZEK)

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Studies were initiated to regulate the leaf senescence in early maturing cultivar of greengram, Co 3 during monsoon 1983. Benzyl adenine (BA) was employed to retard the leaf senescence in the cultivar. The foliar spray of benzyl adenine was given at peak flowering phase. The study has brought out that Benzyl adenine spray at peak flowering has considerably delayed the senescence in early type which was associated with increased leaf chlorophyll content and photosynthetic rate and decreased soluble nitrogen and reducing sugar contents. The number of pods per plant, the total dry matter production, pod yield and seed yield were increased with the level of concentration in the cultivar. A marginal increase in harvest index was obtained in the cultivar. In general, the benzyl adenine spray was found to retard the leaf senescence in the early maturing greengram cultivar.

Senescence is often referred as the changes that provide for the endogenous regulation of growth. Senescence in plants shows a wide range of patterns indicating that it is a qualitative phenomena (Thimann, 1980). Many workers have claimed that the obvious character of leaf senescence is yellowing and the disappearance of chlorophyll has been the principal criterion for leaf senescence (Fletcher, 1969 and Leopold *et, al*., 1959). Patterns of senescence appear to differ in quite important ways, both in their causes and in the nature of senescence processes, as well as in their degree of reversibility. Some types of senescence appear to be closely correlated with developmental events in the whole plant. Senescence in monocarpic plants (those that flower only once and then die) is closely related to the process of flowering and the growth of fruits. If leaves are retained, senescence may be postponed in those cases. It is then that the senescence is not under the control of the plant in the sense that it might be influenced by internal or external stimuli. On the other hand, the rapid senescence of a leaf can be reversed and the leaf rejuvenated by the application of a cytokinin or by allowing the leaf to root. These observations suggest that there may be more then one process or casual agent of senescence characteristic of different situations or different tissues (Letham, 1967). Tetley and Thimann (1974) were of the opinion that the concentration of reducing sugars reaching maximum by hydrolysis during senescence. It was also reported that a major decline in photosynthesis occurs as senescence begins and as proteins and chlorophyll decrease (Bidwell, 1979). This experiment was undertaken to retard the leaf

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senescence in early maturing greengram cultivar by employing the foliar spray of Benzyl adenine (BA)-a cytokinin and to increase the productivity.

MATERIALS AND METHODS

Field experiments were conducted at the Millet Breeding Station, Tamil Nadu Agricultural University, Coimbatore during the Monsoon season of 1983 to study the effect of foliar application of Benzyl adenine (BA) on Co. 3 green gram. The treatments included two concentrations of BA at 20 and 40 ppm including a control (Water spray). Foliar application of BA was given at peak flowering stage of the crop. Samples were drawn at seedling, Vegetative, flowering maturity and at harvest stages. The physiological parameters namely, photosynthetic rate (Infra Red Gas Analyser) the total chlorophyll content (Yoshida *et al.*, 1971), reducing sugar (Somoghi, 1952) and soluble nitrogen (Humphries, 1956) were determined in the leaf samples at the chosen stages in control and in treated samples. Yield attributes were also recorded at harvest to study the effect of BA foliar-spray on the productivity of greengram.

RESULTS AND DISCUSSION

(i) *Photosynthetic rate* and *total chlorophyll*

(a) *Photosynthetic rate* :- It was observed that a gradual increase in leaf photosynthesis was observed upto flowering. The benzyl adenine (BA) spray has maintained a higher leaf photosynthetic rate at maturity and harvest stages as against untreated control. The concentration of 40 ppm seems to have better influence on retarding senescence by maintaining a higher carbon exchange rate (CER) of 7.81 mg CO_2 $dm.^{-2}$ $hr.^{-1}$ at harvest compared to that of untreated control wherein the carbon exchange rate was 3.18 mg. CO_2. $dm.^{-2}$ $hr.^{-1}$ (Table 1).

(b) *Total chlorophyll* :- A reduction in total chlorophyll content was noticed after flowering phase. BA has increased the total chlorophyll status with increasing levels of concentration (Table 1).

Table 1. Effect of Benzyl adenine (BA) on the photosynthetic rate and total chlorophyll content in greengram *var.* Co. 3.

Treatments (ppm)	Stages of sampling				
	Seedling	Vegetative	Flowering	Maturity	Harvest
	Photosynthetic rate ((mg. Co 2 dm^{-2} $hr.^{-1}$)				
Control (Water spray)	7.30	10.30	16.50	2.20	3.20
BA 20	—	—	—	7.90	3.20
BA 40	—	—	—	8.40	7.80
	Total chlorophyll (mg. g.-1. F. W.)				
Control (Water spray)	0.460	0.750	0.520	0.480	0.040
BA 20	—	—	—	0.870	0.090
BA 40	—	—	—	0.940	0.200

The degradation of chlorophyll might be due to proton fluctuation in the dark which ultimately lowers the pH and supplement the action of enzymes. It is also possible that the chlorophyll decline may also indicate the progress of leaf senescence. Along with chlorophyll disappearance goes the process of photosynthesis. The decline in chlorophyll during senescence and the associated decline in CO_2 fixation may account for the decreased stomatal activity. The decrease in photosynthesis occurs before the start of senescence and the chlorophyll breakdown does not occur until much later probably due to the reduced demand for photosynthate which appear to control the rate of photosynthesis some extent (Bidwell, 1979).

(ii) *Reducing Sugars and Soluble Nitrogen*

(a) *Reducing Sugars* : The reducing sugar content in leaves was found to decrease upto flowering and thereafter increase was noticed. Till harvest in all the treatments BA spray has reduced the reducing sugars in leaves during maturity and at harvest as against water spray.

(b) *Soluble Nitrogen* : It was observed that there was a gradual reduction in the content upto flowering and thereafter it increased rapidly upto harvest. The increase in soluble nitrogen after flowering was at a slower rate with increased level of BA sprays in contrast to the untreated control indicates a possible protein degradation at a slower rate than the control (Table 2).

Table 2. Effect of benzyl adenine (BA) on the soluble nitrogen and reducing sugars in greengram *Var.* Co. 3

Treatments (ppm)	Stages of Sampling				
	Seedling	Vegetative	Flowering	Maturity	Harvest
	Soluble nitrogen (mg. g.$^{-1}$)				
Control (Water spray)	4.20	2.80	0.70	8.40	11.20
BA 20	—	—	—	5.60	8.40
BA 40	—	—	—	4.20	7.00
	Reducing sugars (mg. g.$^{-1}$)				
Contol (Water spray)	5.60	2.70	2.70	7.30	8.60
BA 20	—	—	—	4.40	6.20
BA 40	—	—	—	3.90	5.00

Goldthwaite *et al.*, (1968) and Kuraishi (1968) were of the opinion that the proteolysis has been used as a measure of senescence. Tetley and Thimann (1974) were also suggested that the concentration of reducing sugars reaching maximum by hydrolysis during senescence is a common phenomena. The increase in soluble nitrogen occurs briefly as

protein breakdown occurs as these compounds are rapidly translocated away. The losses in many polymeric substances in senescing leaves suggest that degradative activity is greatly accelerated during senescence. Fletcher (1969) indicated that if senescence was reversed by the application of cytokinins, then the amounts of degradative enzymes went up instead of down suggesting that the losses during senescence are due to decreased synthesis rather than to increased degradation.

(iii) *Yield attributes* :

The number of pods per plant, total drymatter production per plant and pod weight per plant were found to be influenced by BA spray. These attributes were increased significantly over control with increased level of BA spray. The pod and seed yield per plant were also found to be increased by the spray over untreated plots. The per cent increase over control in seed yield was about 16.7 per cent (Table 3).

Table 3. Effect of Benzyl adenine (BA) on yield attributes in greengram *Var.* Co 3

Treatment (ppm)	Number of pods per plant	Total DMP per plant (g)	Pod dry Wt. per plant (g)	Seed yield per plant (kg)	Percent increase over control
Control (Water spray)	58.90	56.60	29.90	1.530	—
BA 20	71.50	66.80	36.90	1.780	16.7
BA 40	73.80	68.00	37.10	2.180	43.3
C. D. at 1% P level	12.83**	1.48**	1.19**	0.16**	

Highly significant at 5% P level.

The effect of cytokinins which delay or prevent senescence when applied to a leaf might be to cause cell division, possibly accompanied by IAA production, which would then act to direct translocation towards the area of its production. It is also possible that increased nutrition is the immediate cause of rejuvenation and the cytokinins causes some other events to take place that result in both rejuvenation and mobilisation of nutrients. The senescence may be the result of the starvation of older leaves not only of nutrients but of cytokinins also. The addition of the cytokinin benzyl adenine has been shown to prevent senescence in older leaves of mung bean plants suggesting that the cause of senescence is indeed a lack of cytokinins.

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SEED AND SEEDLING PHYSIOLOGY OF GREENGRAM GENOTYPES (*Vigna radiata* (L.) Wilczek) IN RELATION TO YIELD

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The comparative assessment of seed and seedling physiology, water absorption rate, coefficient of velocity of germination (CVG), vigour index (VI), shoot and root characters showed high significance and reliability in the evaluation of greengram genotypes. Study of seed leachates showed that members of the low yielding group, leached more of total sugars, total amino acids and potassium as compared to medium or high yielders. Leaching out of useful substances, beyond a level as noted in low yielders is not desirable.

The object of the present study was to have a reasonable assessment of the differences in seed and seedling physiology of genotypes chosen for the study. In comparative seed and seedling physiology, 16 parameters were considered in this study. Although pulses are comparatively low yielders, among the genotypes wide range of variability is seen, not only in respect of the yield, but in the case of other characters also. Physiological studies if undertaken in a greater depth in seed and seedling will assist the plant breeders in isolating desirable material to be employed in breeding programme. Germination and attendant characters have been considered important in pulses like greengram in view of the hard seed coat characters as well as protein content. Leaching out of essential substances from the seed during soaking is another disadvantage. With the object of working a comparative assessment and evaluation, 15 genotypes of greengram were chosen for the present study and arbi-

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