INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 6, No. 3, p. 62-69, 2015

RESEARCH PAPER OPEN ACCESS

Effect of gibberllic acid (GA3) foliar on some physiological traits and mount of pigments in *Vigna radiate* L

Amirhossein Khazeh

Young Researchers and Elites Club, Shahr-e-Qods Branch, Islamic Azad University, Tehran, Iran

Key words: Mungbean, Gibberellic acid, Chlorophyll, Seedling length.

http://dx.doi.org/10.12692/ijb/6.3.62-69 Article published on February 07, 2015

Abstract

In order to study the effects of Gibberellic acid (GA3) foliar on *Vigna radiata* L. the experiment was carried out in Research Laboratory and research field of Islamic Azad University of shahr-e-Qods in 1390 randomized completely design and randomized completely block design with 3 replications and 3 treatments such as: 1: control (water), 2: (GA3, 0.0001 molar), and 3: (GA3, 0.001 molar) which seeds were foliar at 45 minutes in GA3 during these solutions. The result showed that between treatments of chlorophyll (a), chlorophyll (b), chlorophyll (t), carotenoids measure, there are significant differences at 1% level that highest said adjective was related to treatment 3. But between treatments there are not significant differences of measure in anthocyanin. In addition, said treatment increased lengths shoot and proportion length root to length shoot. However, between treatments there are not significant differences of length root. Also, the resumed result of field section showed that there was not significant distinction among treatment such as final emergence percentage but about shoot length there was significant difference at 5% level and enhance of shoot length too.

* **Corresponding Author:** Amirhossein Khazeh ✉ ah.khazeh@gmail.com

Introduction

Mungbean is dicotyledonous plant that is of Legume sp. Family which contains greatest protein and carbohydrate that author foots with high value alimentary. The use of priming method is one of the proper methods for increasing seed quality in unsuitable environments (Basra *et al.*, 2004). Which increases the seed germination and emergence of seedling (Akeson and Henson, 1980). Seed can be treatmed with different physical and chemical components such as gibberellic acid, Cytokinin, Hydrochloric acid, chloride sodium, potassium nitrate, and sulfuric acid seed cracking (soltan.and kochaki, 2007). Priming is simple, cheap and safe for environment (Igbal and Ashraf, 2006**).** It is well known that hydrolyzed enzymes are produced at germination time that can autolysis the fatty acid and carbohydrate storage and protein tissues (Moore *et al.*, 2011). Researchers reported that foliar of gibberllic acid increased the vigor of rice seeds, corn, pea seeds and that make the establishment quick, early flowering and high yield (Rashid *et al.*, 2006). It is now generally accepted that gibberllins have provocative role in germination and breaking of seed dormancy (Fathi and Esmailpour, 2000). Gibberellic acid causes increase of cell division and increase of elastic properties of the cell wall (Brown and T-H, 1986) Developing seeds are sources of gibberellic acid and are highly active in the biosynthesis of this component(Moore *et al.*, 2011). (Khan, 1971) has reported that gibberellins, Cytokinins and inhibitors are necessary growth regulators for dormancy or germination on seed and presence and absence of one of the three hormones determinant germination on physiologically active concentrations. Gibberllic acid is a plant growth regulator that has great role on growth of nodules (Hooley, 1994; Ross, Murfet & Reid. 1997; Sawin & Olszewski Neil, 1996).

Gibberllic acids are made in seed at germination time (Bewley and Black, 1982) and caused hydrolyze of storage components for seedling development (Kepczynski and Groot, 1989). Haberland, (1890)has reported that aleurone layer in *Secale cereal* L. can produce substances that could analyze starch of seeds. Brown and Escombe (1998) had similar results in *Hordeum vulgare* L. (Moore *et al.*, 2011).

paleg in Australia and yomo in Japan as a separate research, showed that when gibberellic acid is added to section of endosperm hordeum vulgareL. Seeds start to produce amilolaze enzymes inclusive Alfa amylase and sugars abandon is stimulator growth (paleg, 1965). Briges at 1963 added several hydrolyze enzymes to these observations (protease, Phosphatase, Beta Glucanase) (Moore *et al.*, 2011).
The chlorophyll of standpoint absorbent and use of light energy in the photosynthesis have basic role. In addition, regulators growth plant efficacy on biosynthesis and analyze chlorophyll are effective as a straight on photosynthesis (Fahimi**,** 1953). Chlorophyll content in plants is one important factor to retain biosynthesis capacity (Jiang and Huang, 2001). Use of Chlorophyll fluorescence is a suitable method for discussion of photosynthesis and situation of plant's physiological traits (Sthapit, Witco be and Wilson, 1995; Rizza *et al.*, 2001).

The main objective of this study was to evaluate the effects of Gibberellic acid (GA3) foliar on seed germination, amount of pigments and early growth of *Vigna radiate* L.

Materials and methods

In order to study the effects of Gibberellic acid (GA3) foliar on *Vigna radiate* L. experimental as a randomized complete design and randomized completely block design with 3 replication and 3 treatment as a treatment1: control (general water), treatment 2: (0.0001 m GA3), treatment 3: (0.001 m GA3) in the Research Laboratory and research field of Islamic azad university shahr-e-Qods Branch in 1390 was performed.

Experiment method

In start seeds soaked in said treatment solution for duration 45 minute, therefore in each replication put 100 number seed between two layers of leach paper, and then irrigated with general water for all treatment for duration 8 days after germination.

Therefore, from each replication selected 10 normal seedlings and their shoot length, root length and proportion root length to shoot length measured. Also, the amount of samples chlorophyll (a), chlorophyll (b), chlorophyll (t), anthocyanin, carotenoids has been measured.

In addition, in the field section the mounts of final emergence percentage and shoot length were measured.

Statistical analysis

Finally, information is analyzed by static software's SPSS16 and SAS and instance scrutiny and comparison with Duncan test.

Results and discussion

The Result resumed of trial showed that between treatments of shoot length there are significant differences at 1% level (table 1). That Pursuant to comparison of means (table 2) highest shoot length was related to treatment 3(0.001 m) and least was related to treatment control (general water). That showed Gibberellic acid (GA3) has high effect on shoot growth and its cause may be known in stimulating of more cell division and cell enlargement. Also judging from resumed Result of Proportion root length to shoot length there was significant distinctions at 5% level(table 1), that lease was related to treatment 3(0.001 molar) (table 2) but between treatments of root length, there was not significant differences (table 1).

Table 1. Analysis of variance for effect of Gibberellic Acid (GA3) foliar on some physiological features in Mungbean.

MS				
Root/shoot	Root length	Shoot length	df	S.O.V
0.0512*	ns 2.190	41.203**	2	Treatment
0.0057	0.896	0.4755	9	Error
16.34	15.86	5.12	-	C.V %

**Significant at 1% level, *Significant at 5% level , ns, non Significant.

In addition judging from resumed results of the field section, there was no significant difference among treatment, such as final emergence percentage (table 3) but of shoot length there was significant difference at 5% level among treatments (table 3) that Pursuant to comparison(table 4) of means highest was related to treatment 3(0.001 Molar).

Table 2. Comparison of mean effect of Gibberellic Acid (GA3) foliar on some physiological features in Mungbean.

Root/shoot	Root length	Shoot length	Treatment Gibberellic acid (M)
0.530 A	5.42 A	10.16 C	1 Control
0.550 A	6.95 A	12.72 B	2 (0.0001M)
0.314 B	5.52 A	17.47 A	3 (0.001M)

Mean followed by similar in each column are not significantly different.

The hormones of plant like Gibberellic acid have the important role in growth of plants (Ritchie and Gilroy, 1998). In one trial that performed in bean seedling (phaseolus) it was found that both parameters, cell division and cell enlargement, are stimulated by external GA3 but it is assumed that has been highest effect on cell enlargement (Moore *et al.*, 2011). In general stem enlargement in all plants that was treated by external GA3 dependency to hormone effects on cell division and cell enlargement that effects one, is more than effect two(Moore *et al.*, 2011).

Table 3. Analysis of variance for effect of Gibberellic Acid (GA3) foliar on some physiological features in Mungbean.

Mean square (MS)			
Shoot length	Final emergence	df	Sources of variation (SOV)
0.11444444 ^{ns}	12.0 ^{ns}	2	Replication
0.15444444 *	61.0 ^{ns}	2	GA
0.02111111	44.5	4	Error
4.60	7.04		CV (%)

*Significant at 5% level , ns, non Significant.

Cell division does not cause growth lonely and cell division stimulation may be with normal speed or more speed of cell enlargement speed than growth done back external gibberellic acid. Be meant to that gibberellic acid is not necessary for roots growth. Do not turn out that gibberellic acid is stimulating roots growth or inhibits or whereas gibberellic acid is effective on cell division or cell enlargement in root (Moore *et al*., 2011). Seed pre treatment before germination is said to let the seeds establish root, but not appears (Basra, Pannu and Afzal, 2003) The Use of external gibberellic acid in plants species is that plants has rather early growth and also has shorter growth period that this affair become to economize in expenditures especially in greenhouse plants and also better weed control that these consideration coincide with trial that is performed by Jones, and Hanks, (1985), they by soaking bulb of chilling tulips in different gibberellic acid consistency concluded that treatment with gibberellic acid can decrease greenhouse period 7-11 days than bulbs untreated.

In addition, in other trial that is performed (Hasanpoorasil, Roien and Rabie, 2010) in daffodil German digit cultivate gibberellic acid treatment effect caused boughs growth and (quality of leaf and stem) and shorter growing period. Lockhart at 1957 volunteered early document about station of gibberellic acid biosynthesis with the use of potato seedling, he showed that used GA3 can be replaced with shoot apex as a perfect in pea below stem station enlargement and the result is that has produced natural gibberellic acid product in stem apex (Lockhart, 1957). In 1961, researchers used halfed seeds without embryo hordeum that showed added gibberellic acid causes increase in Alfa amylase activity (Moore *et al*., 2011).

Table 4. Comparison of mean effect of Gibberellic Acid (GA3) foliar on some physiological features in Mungbean.

Shoot length (cm)	Final emergence (%)	Treatments
2.90 b	90.0 a	control
3.23 a	99.0 a	GA (0.0001 M)
3.33 a	95.0 a	GA (0.001 M)

Mean followed by similar in each column are not significantly different.

Inter cellular biosynthesis dependent gibberellic acid submitted for protease, Alfa amylase and 1&3-βGlucanase and Ribonuclease and nearly 1&3,4-β Glucanase , Acid phosphatase and Dnase(Brown and T-H. 1986).

Also, of the amount of chlorophyll (a), chlorophyll (b), chlorophyll (t) and carotenoids, judging from Result resumed of statically analyzed among treatments observation significant differences at 1% level (table 5)were monitored, that Pursuant to comparison of means (table 6) highest was related to treatment 3(0.001 molar) and least was related to treatment1, control (general water).

In addition in this trial the amount of anthocyanin was measured that there was no significant difference among treatments (table 5). Chlorophylls are macromolecules that vulnerability in stress conditions and are the most important light absorbent pigment in Chlorophylls Tilakoid membrane. In addition, Chlorophylls Tilakoid membranes have secondary light absorbent pigments (tributary pigments) mean Karotenoids**.** Karotenoid pigments absorbes light in wavelength that is not absorbed by other pigments also Karotenoids are complementary light receiver (Hopkins, 1999).

Table 5. Analysis of variance for effect of pre treatment Gibberellic Acid (GA3) on amount of pigments in Mungbean.

M S						
anthocyanin	karotenoid	Total Chl	Chl (b)	Chl (a)	df	S.O.V
1.2633 ns	0.00127 **	0.01435 **	0.00024 **	0.00040 **	2	Treatment
0.8713	0.000030	0.00098	0.00001	0.000018	9	Error
7.75	1.18	4.49	3.35	1.20	-	C.V %

**Significant at 1% level , ns, non Significant.

Abdel wahid and Sweify, (2009) on Beaucarnea recurvata showed the effective role of gibberellic acid in increasing Karotenoid content.

In one trial that was performed by majidian.m *et al*, pre treatment of calla lily corms, white flower digit with gibberellic acid causes the increase in leaves of Chlorophyll content and is significant in 1 percent (Majidian *et al*., 2009).

In one examination, it is showed that there are very high and significant correlation between chlorophyll a, chlorophyll b and chlorophyll t (Enferad, 204). There are acceptable explanations for presence of anthocyanins in plants. Even so, production of anthocyanins in result of environmental stress (Chalker-Scott, 1999) existence of red leaves at foregone time of year and in special leaves growth phase and also special environmental condition (Lee, Lowry and Stone, 1979) some of researchers coerced that in order to determinate leaves anthocyanin roles, performed necessary examinations. In recent years provided concepts of anthocyanin function in plant that may mention to: 1-balance of quantity and quality light reception 2- protection of UV-B destroying effects 3- protection of plant to herbivore animals 4- protection of light stay and 5- Broomer of oxygen actives radicals in environmental stress condition. Also any one of suggested functions does not exclude anthocyanins. Other materials in leaves may carry out these functions as efficiency. For example presence of Karotenoids and chlorophylls distribution may compensate light catch of outstanding and terpen and other secondary metabolites do as anti Herbivores defensive materials in a few of plants.

Table 6. Comparison of mean effect of pre treatment Gibberellic Acid (GA3) on amount of pigments in Mungbean.

anthocyanin [mg/g (FW)]	karotenoid [mg/g (FW)]	Total Chl [mg/g (FW)]	Chl (b) [mg/g (FW)]	Chl (a) [mg/g (FW)]	Treatment Gibberellic acid (M)
12.52 A	0.447 C	0.662 C	0.104 C	0.342 C	1 Control
12.17 A	0.468 B	0.665 B	0.113 B	0.355 B	2 (0.0001M)
11.42 A	0.482 A	0.765 A	0.119 A	0.362 A	3 (0.001M)

Mean followed by similar in each column are not significantly different.

Therefore it is possible that anthocyanins haven't special function in leaves, but researches show that anthocyanins may be in coordination with protection molecules in plant tissues does self function and for defect reparation in molecules density during stress period get to work.

So there are concepts that says, anthocyanins in special station in leaves can cause improvement in efficiency of plant to get to work. Accumulation of anthocyanins is possible by implantation of different environmental motivations like UV (Reddy *et al.*, 1994), low temperature (Christie, Alfenito and Walbot, 1994), Pathogenic ingredients attack (Harrison, and R.G, 1980; Heim *et al.*, 1983; Hipskind, Wood and Nicholson, 1996) and a regulator growth like Cytokinin (Deikman and Hammer, 1995), gibberellins (Mealem *et al.*, 1997), ethylene (Woltering and Somhorst, 1990), gibberellic acid (Akinwunmi, 2001).

Of course these metabolites like Karotenoids and anthocyanins by Broom of free radicals Broom bring protection of plant to oxidative stresses (Sairam, Deshmukh and Saxena, 1998; Woodson and Lawton, 1988). Karotenoids may catch high energy of short wavelength, change only singularity to triplet and by catching oxygen radicals produces and performs its anthocyanin role (Qinghua and Zhujun, 2008).

Acknowledge

Many thanks to Dr.Morteza.E and Dr.Jabari.H that have helped me in doing this research.

References

Abdel-Wanid SMK, Sweify SG. 2009. Enhancement of Beaucarnea recurvata LEM.growth by some growth regulators. Bulletin of Faculty of Agriculture, Cairo University **60(2),** 188-196.

Akeson WR, Henson MA. 1980. Sugar beet fruit germination and emergence under moisture and temperature stress. Crop Science **20,** 732-739.

Akinwunmi O. 2001. The Plant Defense Activator Acibenzolar-S-Methyl Primes Cowpea [Vigna unguiculata (L.) Walp] Seedlings for Rapid Induction of Resistance, Physiologycal and Molecular Plant Pathology **58,** 199-208.
http://dx.doi.org/10.1006/pmpp.2001.0327

Basra SMA, Ashraf M, Iqbal N, Khaliq A, Ahmad R. 2004. Physiological and biochemical aspects of pre- sowing heat stress on cottonseed. Seed Science and Technology **32,** 765-774.

Basra SMA, Pannu IA, Afzal I. 2003. Evaluation of Seedling Vigor of Hydro and Matriprimed Wheat (Triticum aestivum L.) Seeds. International Journal of Agriculture & Biology **5(2),** 121–123.

Bewley JD, Black M. 1982. Physiology and biochemistry of seeds in relation to germination. Springer Verlag, New York. Scientia Horticulturae. **28,** 110-127.
http://dx.doi.org/10.1016/0304-4238(86)90113-5

Brown PH, Dho TH. 1986. Barley aleurone layers secrete a nuclease in response to gibberelic acid. American Society of Plant Biologists **82(3),** 801–806.

Chalker Scott L. 1999. Environmental Significance of Anthocyanins in Plant Stress Response. Journal of Photochemistry and Photobiology **70,** 1-9.
http://dx.doi.org/10.1111/j.1751-1097.1999.tb01944

Christie PJ, Alfenito MR, Walbot V. 1994. Impact of Low-Temperature Stress on General Phenylpropanoid and Anthocyanin Pathways: Enhancement of Transcript Abundance and Anthocyanin Pigmentation in Maize Seedlings.international journal of biology (Planta). **194,** 541-549.
http://dx.doi.org/10.1007/BF00714468

Deikman J, Hammer PE. 1995. Induction of Anthocyanin Accumulation by Cytokinin in Arabidopsis thaliana. American Society of Plant Biologists **108(1),** 47-57.
http://dx.doi.org/10.1104/pp.108.1.47

Enferad A, Poustini K, Majnoun Hosseini N, Taleei A, Khajeh-Ahmad-Attari A. 2004. Physiological responses of Rapseed (Brassica napus L.) varieties to salinity stress in Vegetative Growth Phase. Journal of Science and Technology of

Agriculture and Natural Resources. **4(7)**: 103-114. (In Farsi).

Fahimi H. 1953. Plants *growth regulators*. tehran university.iran **172.**

Fathi GH, Esmailpour B. 2000. Plant growth regulator, fundamental and application. Mashad jahad e Daneshgahi Press. **288** p. (Translated in Persian)

Harrison BJ, Strickland RG. 1980. Precursors and Genetic Control of Pigmentation V. Initiation of Anthocyanin Synthesis in Antirrhinum majus by Botrytis cinerea, Heredity **44,** 103-109. http://dx.doi.org/10.1038/hdy.1980.9.

Hasanpoorasil M, Roien Z, Rabie B. 2008. Effect of low temperature and gibberellic acid on the quality of shoots obtained from Been premature bulbs (.Narcissus spp). Journal of Horticultural Science and Technology **9,** 129-138.

Heim D, Nicholson RL, Pascholati SF, Hagerman AE, Billet W. 1983. Etiolated Maize Mesocotyls: A Tool for Investigating Disease Intractions. American Society of Plant Biologists **73,** 424-428.

Hipskinda J, Woodb K, Nicholson RL. 1996. Localized stimulation of anthocyanin accumulation and delineation of pathogen ingress in maize genetically resistant to *Bipolaris maydis*race O. Physiological and Molecular Plant Pathology **49,** 247-256**.**

Hooley R. 1994. Gibberellins: perception, transduction and responses. Plant Molecular Biology **26,** 1529-1555. http://dx.doi.org/10.1007/BF00016489

Hopkins, William G. 1999. Introduction to plant physiology. John Wiley and Sons, Inc., New York City.

Igbal M, Ashraf M. 2006. Wheat Seed Priming in Relation to Salt Tolerance: Growth Yield and Levels of Free Salcylic Acid and Polyamines. Annales Botanici Fennici **43,** 250-259.

Jiang Y, Huang N. 2001. Drough and heat stress injury to two cool-season turf grasses in relation to antioxidant metabolism and lipid peroxidase. Crop Science **41,** 436-442. http://dx.doi.org/10.2135/cropsci2001.412436x

Jones SK, Hanks GR. 1985. Gibberellic acid soak treatments for fully-cooled. Tulips. Scientia horticulturae **26,** 87-96. http://dx.doi.org/10.1016/0304-4238(85)90105-0

Kepczynski J, Groot SPC. 1989. Key role for endogenous gibberellins in the germination of lettuce. Plant Physiology **32,** 314-319.

Khan AA. 1971. Cytokinins: permissive role in seed germination. Science **171,** 853-859. http://dx.doi.org/10.1126/science.171.3974.853

Lee DW, Lowry JB, Stone BC. 1979. Abaxial Anthocyanin Layer in Leaves of Tropical Rain Forest Plants: Enhancer of Light Capture in Deep Shade. The Association for Tropical Biology and Conservation **11,** 70-77.

Lockhart JA. 1957. Studies on the organ of production of the natural gibberllin factor in higher plants. Plant Physiology **32,** 2.1.207.

Majidian N, Naderi R, Khalighi A, Majidian M. 2012. Effect of growth regulators, gibberellin and banzill adenine on calla lily, white flower digit. Horticultural Science Agricultural Science and Technology **8,** 361-368.

Mealem D, Beno G, Tamari YL, Leitner- Dagan A, Borochov, Weiss D. 1997. Suger-Dependent Gibberellin- Induced Chalcone Synthase Gene Expression in Petunia corollas. Plant Physiology **113,** 419-424.

Moore, Thomas C. 2011. Biochemical and physiological of plant hormones. Ferdowsi University of Mashhad, Iran **359,** 344-352.

Paleg LG. *1965.* Physiological effects of gibberellins. Annual Review. Plant physiology **16,** 291-322. http://dx.doi.org/10.1146/annurev.pp.16.060165.001451

Qinghua SH, Zhujun Z. 2008. Effect of exogenous salicylic acid on manganese toxicity, element contents andantioxidative system in cucumber. Environmental and Experimental Botany **63,** 317-326.

Rashid A, Hollington P, Harris D, Khana P. 2006. On-farm Seed Priming for Barley on Normal, Saline and Saline–Sodic Soils in North West Frontier Province, Pakistan. European Journal of Agronomy. **24,** 276–281. http://dx.doi.org/10.1016/j.eja.2005.10.006

Reddy VS, Gould KV, Sharma R, Reddy AR. 1994. Ultraviolet-B-Responsive Anthocyanin Production in Rice Is Associated with a Specific Phase of Phenylalanine Ammonia Lyase Biosynthesis. Plant Physiology **105,** 1059-1066.

Ritchie S, Gilroy S. 1998. Gibberellins: regulating genes and germination. New Phytologist. **140:** 363–383.

Rizza F, Pagani D, Stanca AM, Cattivelli L. 2001. Use of chlorophyll fluorescence to evaluate the cold acclimation and freezing tolerance of winter and spring oats. South African Journal of Botany **120,** 389–396.

Ross JJ, Murfet IC, Reid JJ. 1997. Gibberellin mutants. Plant Physiology **100,** 550-560.

Sairam RK, Deshmukh PS, Saxena DC. 1998. Role of antioxidant systemes in wheat genotype tolerance to water stress. Biologia Plantarum **41(3),** 387-394. http://dx.doi.org/10.1023/a:1001898310321

Sawin SM, Olszewski Neil E. 1996. Genetic analysis of Gibberellin signal transduction. Plant Physiology **112,** 11-17.

soltan A, Kochaki A. 2007. Effect of priming on seeds germination parameter and seedling growth cotton in welter stress condition. Agronomy science and naturalresources, n:5, case **14,** 8-15.

Sthapit B, Witco be J, Wilson J. 1995. Methods of selection for chilling tolerance in Nepalese rice by chlorophyll fluorescence analysis. Crop Science **35,** 90–94.

Woltering EJ, Somhorst D. 1990. Regulation of Anthocyanin Synthesis in Cymbidium Flowers: Effects of Emasculation and Ethylene, J. Plant Physiology **136,** 295-299.

Woodson WR, Lawton KA. 1988. Ethylene-induced gene expression in carnation petals. Plant Physiology **87,** 498-503.