

Effect of GA₃ hormones on growth dynamics of Bean

*Somaye ghalandari¹, Tayeb Saki Nejad², Shahram Lack³

1- Department of Agriculture. Science and Research Branch, Islamic Azad University, Khuzestan, Iran,

2- Assistant Professor Department of Physiology, Islamic Azad University, Ahvaz branch (*Thesis Supervisor*)

3- Department of Agriculture. Science and Research Branch, Islamic Azad University, Khuzestan, Iran,

*Corresponding Arthur: somaye.ghalandar@yahoo.com

Abstract: In order to effect hormone gibberellins acid on properties such as bean plants Morphophysiology: internodes' length and stem number, plant height, leaf growth dynamics and crop growth rate research as a factorial experiment in randomized complete block design with three replications in crop year 2010 Farm Research HASHEMI located in the city HAMIDIEH province was conducted, first factor hormone gibberellins acid on four levels, respectively, treated (d₀) control (no hormone gibberellins acid) treatments and d₃, d₂, d₁, respectively, 5, 50 and 250 ppm and the second factor included three plant growth periods: (vegetative phase= s₀, Flowering phase = s₁ and pod set phase = s₂) for the hormone gibberellins spray on beans were considered. Dose 50ppm hormone gibberellins acid, more leaf area index (*LAI*) with 1.98 in comparison with other surfaces have been in the treatment group a was used Hormone gibberellins acid applied best courses in the vegetative period before flowering leaf dry weight, 752.2 kg/ha been in a treatment group were. And the flowering period to Pod set treated with 678.3 kg/ha-level statistical treatment Pod set b to aggregation with 666.6 kg/ha c level was statistically. Dose of the hormone gibberellins acid maximum height of internodes 4.07 inches compared to other hormone levels have been in statistical was. Other doses differ quite significantly with this level did not have the lower levels were. The results showed that the hormone gibberellins acid increased crop growth rate to 35 percent in d₃ = 20.15 g/m²/day treatment than control treatment was d₀ = 14.5 g/m²/day. Hormone gibberellins acid effects on bean plant stem internodes' distances showed that on average 2.2 inches were added to the internodes' length. Especially the increase in the lower internodes bean plant stems were most evident in the treated internodes' d₂S₀ height d₀S₀ than the control treatment was significant. [Somaye ghalandari, Tayeb Saki Nejad, Shahram Lack. Effect of GA₃ hormones on growth dynamics of Bean. Journal of American Science 2011;7(6):32-39]. (ISSN: 1545-1003). <http://www.americanscience.org>.

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1. Introduction

Like auxin hormone, the GA also to approximate all the physiological processes of growth and reproduction of plants are well controlled. The most obvious effect of increased gibberellins plant growth through the long distance between the nodes makes their stems (4).

This effect is normally associated with temporal pallor normally leaves the host after about 10 days are normally on. a special case of the effect of gibberellins in the plant can be Cocker (Cocker, such as types of corn, beans, peas and ornamental plants) which causes hereditary gibberellins production without sufficient power are observed(6).

Sprinkle gibberellins solution on the shoot elongation and stem caused plants to natural plant height is. Because small amounts of gibberellins (about one thousand micrograms per liter) to do it just a number Biological testing of the most important ways to encourage the growth of gibberellins based on long stems Cocker plant is built. gibberellins can be many two-year plants (without stems), which requires cold for flowering are, without seeing the cold, forced to

produce flowering stems to. how do the stem end so that the gibberellins have one hand into a cell to be intensified and the other hand, each of the cells are too large and thus the stem grows and Plant flowers sits (2).

Hormone gibberellins acid on shoot growth

Hardtke, C. (2003) Expression of gibberellins on rice shoot hormone gibberellins acid had a long shoot growth which caused a substantial impact on internodes distance is an effective host.

El- Dengawy, (2005) with effect levels and timing of application of gibberellins acid on growth and product components with conventional spraying beans hormone gibberellins acid concentrations 2.5, 5 and 7.5 mg gibberellins hormones in times of 7 and 14 and 28 days after planting the beans whole plant had a normal expression of gibberellins hormones increased the shoot length was bean plant.

Long (1965) Physiology of flowering plants in Hanna said that being taller Gibberellins acid causes stem and produce flowers in many flowering plants are long days.

Davies et al. (2002) Gibberellins on Flowering in review Hana reported that gibberellins induction of flowering by long days either in plants to both short-day plant rejections with a significant rise is shoot.

experiment with the application of three concentrations of the hormone gibberellins acid on plant beans, regular doses of 2.5, 5 and 7.5 mg at intervals of 7 and 14 and 28 days after germination beans regular stated that plant height in different times of application, had significantly increased levels of response to hormone gibberellins was linear(6).

Dolan L and Davies, J. (2004) Effect of hormone gibberellins acid on the size and height of shoot meristem capitates spike differentiation stages in the two rice varieties, the concentration of 50 ppm in two stages, early differentiation and late spike to spike differentiation control without gibberellins acid intake was concluded that other varieties of gibberellins in the early stages of differentiation was used to spike the number of side branches and Griffins 65.5 and 48.1 percent rate increased, but the application of gibberellins acid in the secondary or late stage adverse distinction spike numbers, Griffins 36.2 and 43.4 percent rate was reduced. but the other varieties used in the same amount of hormone gibberellins acid in early stage of differentiation than control spike increase in the number of fertile and strong side branches and spikelet spike rate was 92.3 and 72.7 percent, but the application of gibberellins acid late in the second stage of differentiation or a reduction in the number of spike branches and lateral spikelet's per spike were observed.

Effect of gibberellins acid on the size and height of the shoot meristem capitates spike differentiation stages in the two rice varieties, the concentration of 50 ppm gibberellins acid observed that the longitudinal growth of the shoot meristem capital due to cell elongation cell division and developed, in which both varieties of rice due to increase in height of stem cells for stem diameter was increased so the number of side branches that were correlated with stem diameter were also high(11).

Effect of application of the hormone gibberellins acid on shoot said that the Arabidopsis plant hormones have an important role in the development so that the spraying gibberellins on shoot growth and shoot high value also went up gibberellins in roots and primary root growth increased said(4).

in a study examining the effect of auxin and gibberellins acid soybean plants used and the height was missing was the performance down, they concluded that the application of gibberellins concentration 50 mg in the vegetative stage to spray soybean leaves, increased internodes length and stem thickness of the primary shoot and shoot and thus increase total dry matter is increasing (13).

during the three stages before the first leaves produced before the emergence of second leaf and the internodes is 30 days after each was 0.5 cm and the leaves were fully emerged, the hormone gibberellins acid was sprayed on leaves and observed that the number of stem nodes, number of branches and height of branches had increased(7).

2. Material and Method

This test Crop year 2010 on the farm located in the village of Sayed Hossein HASHEMI Hamidieh city was conducted.

Place testing semi arid dry climates and low temperatures are 4 - and the highest degree of temperature 51.8° C, average annual temperature in the station 23.9 ° C has been reported.

The statistical test of the factorial design are equally important in terms of factors examined in a randomized complete block design with three replications was.

D: Different concentrations of the hormone gibberellins acid.

S: Bean plant growth in different periods.

(d0 =No hormones, , d1 = 5ppm and d2 = 50ppm and d3 = 250ppm (and the second factor for three phase bean plant growth hormone gibberellins acid spraying include: (s0 =vegetative phase, s1 = flowering phase and s2 =phase Pod set)

2.1. Analysis of plant growth and seed

To review the growth and dry matter accumulation bean plants were sampled action. Sampled from all plots to 15 days away from each other during the eighth stage was performed. Three lines for the sample was determined after removal of the top 50 cm Down each line as sidelines, three plants randomly taken from each plot and the plastic bag with a label to each plot and samples were transported to the laboratory and measured the following took place on them:

2.2. LAI measurements

Determine LAI weight method was used. In this way, using standard paper (A4), which is a specific area, was used in this way that it leaves the paper had been drawn and shape, then shaped leaves that had been drawn in the oven with a temperature of 70 machine degrees Celsius for 24 hours and dry weight placed them came to be and making a fit according to standard weight paper and dry leaves of all plants sampled amount of area harvested leaves from the field in general and specific indicators leaf stage in the sample were determined.



Fig1. Hormone spray in field



Fig2. Different stages of plant growth in field

2.3. Process of determining dry matter accumulation in different plant organs (leaves, stems, seeds)

Measuring dry matter accumulation process in each of the different organs in each bean plant sampling was done first, after the separation of different plant organs in the laboratory, the device with the oven temperature 75 ° C for 48 hours of was that they were set to dry. SAS computer program components by increasing LAR, CGR, RGR, NAR, LWR, and SLA were calculated.

3. Result

3.1. Leaf Growth Dynamics (LAI)

Applying different doses of the hormone gibberellins acid on leaf area index of plant beans in 1 percent was significant. But applying hormone during different growth in any of the periods of growth of there was not significant. Interactions between hormone gibberellins acid in different doses and periods at 1 percent of growth were significantly different.

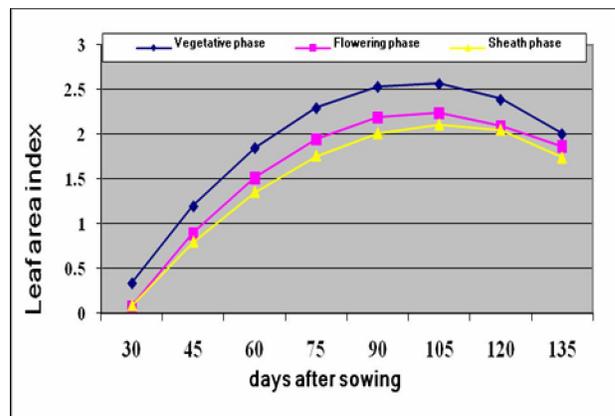


Fig3. LAI changes at different stages of growth

Dose 50ppm hormone gibberellins acid, more leaf area with 1.98 in comparison with other surfaces have been in the treatment group a was used, dosages longer much different from its impact on leaf area did not show in statistics b were.

Period, the highest growth period before flowering leaf area in comparison with other periods of growth and having 1.90 were in a statistical and other courses, flowering period to Pod set respectively 1.59 and 1.51 in the treatment group was b.

Mean comparisons with related table interaction Gibberellins acid and various periods of growth than all treatments and control have increased the concentration of 50 ppm respectively in the period before flowering and vegetative concentration of 5 ppm in the same period of highest LAI their shown in the treatment group a were, and the interaction of

gibberellins and Volume growth for the treatments of 250 ppm and control in the ranks next placed so that control treatment lowest leaf area with 1.47 and 1.36 and 1.43 ranked(Fig3).

Can be concluded that if the hormones in the vegetative period be imposed because of better plant was still young and can be influenced by the environment to be exposed, and the leaves grow more and produce more dry matter to be followed and that the higher dose The performance of the same amount of hormones is not above said high concentrations can cause hormone gibberellins acid on the growth mode is a deterrent.

the list et al stated that providing a larger leaf surface exposed to sunlight led to a fixed building dioxide uptake More carbon is, inversely, plants with lower leaf area index, carbon dioxide are less stabilized and increased leaf area can be, can stabilize carbon dioxide in the plant increased, the hormone acts in the vegetative period This positive result can be achieved (8, 5 & 11).

The effect of different doses of hormones gibberellins acid 50 ppm dose than other doses in the higher level and actually had a higher level of bean leaf in the plant is established, other doses at lower levels and control without hormone lowest LAI had the trend. (Fig4).

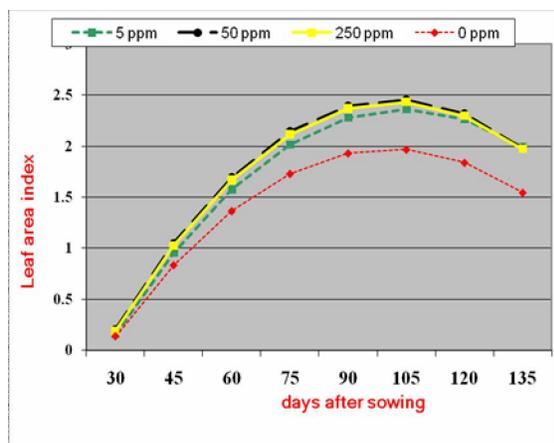


Fig4. Effect GA₃ Hormone on LAI changes

In examining the time course of growth hormone actions, vegetative growth period before flowering had the highest LAI process and during the flowering period Pod set lower level and has been in the last level.

3.2. Leaf dry weight

Leaves the factory plants are making food, whatever leaves more power plant construction will also generate high and significant impact on

performance will rise. Gibberellins acid application according to the role that cell development is the increasing role can is crucial (10).

Applying different doses of gibberellins acid on shoot dry weight in a percentage was significant..

Hormone gibberellins on different periods of growth in a significant percentage were in the interaction of hormone and duration of different developmental levels also was a significant percent.

The dose of hormone gibberellins acid on leaf dry weight concentration of 50 ppm bean leaf dry weight with 813 kg per hectare compared to other hormone levels have been in a treatment group were. A dose of 250 ppm with 750.2 kg per hectare in other doses was statistically b level c were statistically.

Hormone gibberellins acid applied best courses in the vegetative period before flowering leaf dry weight, 750.2 kg/ha been in a treatment group were. And the flowering period to Pod set treated with 678.3 kg ha-level statistical treatment Pod set b to aggregation with 666.6 kg/ha c level was statistically.

In examining the interaction hormone and growth period treatment of the hormone in the phase of eruption had received the highest amount of dry weight were treatment and the hormone gibberellins in the concentration of 50 ppm in the growth period before flowering were received with 958 kg ha In the rest of the group was a statistical interaction between the levels were lower.

Any leaves are younger and more recent actions on the hormone more effective would be the leaf during the vegetative growth hormone has received more time for growth and response to hormones and growth and development will be more.

With the above results that express hormone gibberellins acid in leaf growth and leaf development and thus its final dry weight is involved, was consistent(3).

3.3. Shoot dry weight

Bean plant stems strong and stout, smooth (glabrous) and full leaf height is 180-30 cm (4). Any power that is stronger stems will increase its maintenance. Strength stems should be so well able to keep the pods; the hormone gibberellins in these cases had positive effects on the stem (2).

Different doses of hormones gibberellins acid and time of application actions and interactions in hormone levels were a significant percent.

In between doses of 5 and 50 and 250 ppm difference very noticeably been observed but the dose of 50 ppm with 1724 kg per hectare than other hormones level were concentrations of 5 and 250 ppm respectively in 1600 and 1623 kg b Statistical acres located on the surface were treated with control 1490 kg ha shoot dry weight in Table 4-9 were statistically c.

In various periods of growth that gibberellins acid treatment at the time of eruption before flowering in the treated group had found a weight was 1627 kg ha. And flowering periods of growth and Pod set respectively in 1606 and 1522, respectively, in b and c were statistically.

The interaction of growth hormone gibberellins and vegetative period before flowering and stem dry weight most control treatment having the lowest shoot dry weight was. So that a concentration of 50 ppm gibberellins Hormones during vegetative growth before flowering with 1693 kg ha has the highest shoot dry weight. And the other treatments were next in ranking.

Younger stems much of the hormone acts on it would be more, because growth is still not complete, the most effective dose given was 50 ppm, then we can say: because the dose of 250 ppm is more work than most 50 ppm no deterrence because hormone concentrations are high.

3.4. Morphological characteristics of plant

3.4.1. High plant

Different doses of the hormone gibberellins acid on plant height in a bean is a significant percentage of time the hormone acts on the surface of a bean plant height percentage has a significant interaction of hormone levels during exercise is a significant percentage.

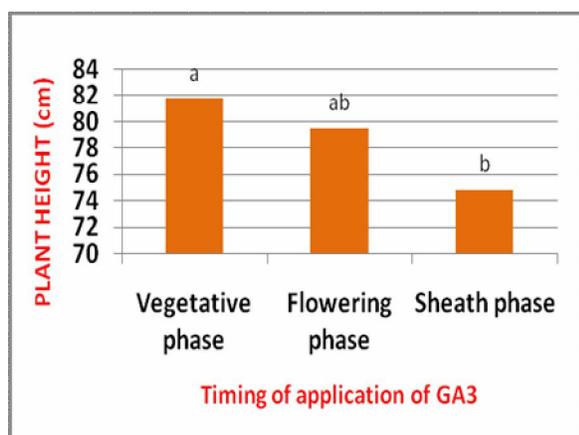


Fig5. High plant at different stages of growth

Dose hormone gibberellins acid 50 ppm maximum 85.56 cm plant height compared to other hormone levels have been in a treatment group and the doses were again placed in the next rank and control the height of the 71.23 cm All lower level d were statistically.

In between periods of growth there was no significant difference but a significant growth period

before flowering greatest height 81.72 cm was located in a statistical exercise and other times were lower in rank.

In examining the interaction term growth hormone and stem height above the vegetative growth period was such that concentrations of 50 ppm cm 46/91 vegetative period before flowering stems have the highest elevation and the elevation control or due to actions Not all hormones were lower (Fig5)

Hormone gibberellins acid hormone that is involved in cell division, the young stems than the high quality of these hormones are also concentrations of 50 ppm to 250 ppm might be more effective deterrent because high concentrations of hormone.

Daykin, Scott, Francis and Causation, 1997), Stewart (1977), Al-Khsswneh, Karam and R.A.Shibli. (2006) believed that which were generally Gibberellins acid impress with cellular processes, including stimulating cell division and cell elongation growth is increasing. Gibberellins role in increasing cell distension through its effect on the osmotic concentration of cell sap is, the somehow stimulate the enzyme activity by causing parser starch hydrolysis of starch can be accumulated by cells that ultimately cause the cells are osmotic potential. Negative intracellular osmotic potential on water exchange within and outside the cell and ultimately affect cells following the water absorption and stretching are suffering from dilated, Gibberellins acid also significantly increased cell wall is opened. This increase may be due to acidification of cell walls and thus absorption of calcium ions into the cytoplasm is, was consistent.

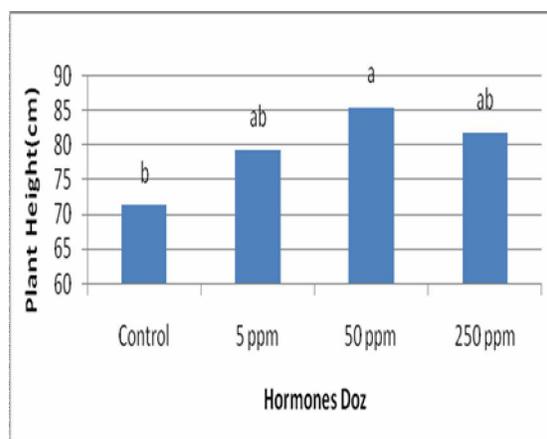


Fig6. Effect GA₃ Hormone on High plant

3.4.2. Number of nodes

Node number of morphological factors is less affected by environmental factors placed. This attribute is located less controversial, but studies done in the way

when you can sub in numbers and performance is somewhat effective

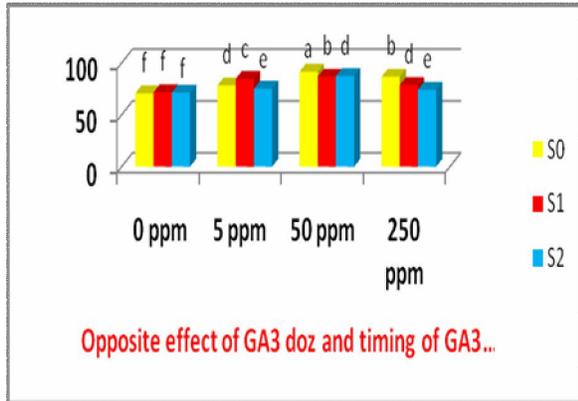


Fig7. Interaction GA3 & different stages of growth On node high plant

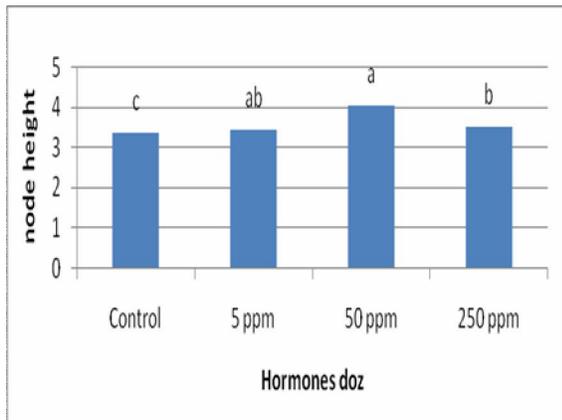


Fig8. Effect GA₃ Hormone on node High plant

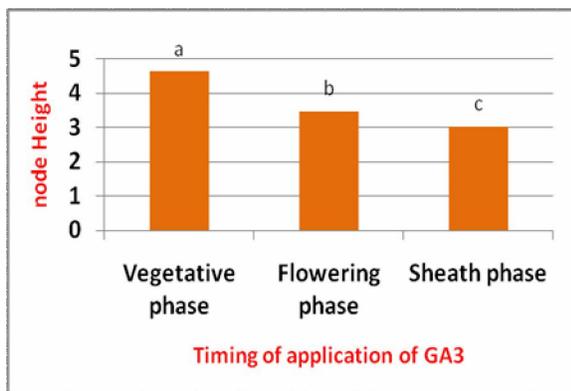


Fig9. Node High plant at different stages of growth

Dose hormone gibberellins acid level is a significant percentage. Hormone gibberellins acid applied at different growth periods as a percentage level is significant. Interaction between different doses and periods of growth hormone level is a significant percentage. Interaction hormone gibberellins acid on the number of nodes at a percentage level is significant.

Different hormones in different doses did not completely clear, but a dose of 50 ppm with number 25.89 knots were in a statistical group and the control treatment having the least number of nodes and other concentrations were located between the two doses.

Vegetative period before flowering with 25.28 count the number of nodes than most other developmental courses ranked in the treated group was a fact. Other periods of growth were the next in rank.

Interactions of gibberellins acid on growth Vdvrh vegetative growth before flowering period with 50 ppm concentration has the highest number of nodes compared to other treatments and was in a treatment group and other treatments in rank and were statistically lower.

Morphological trait is the number of nodes, hormone dose 50 ppm in the most effective growth Period before flowering has had on the number of nodes, perhaps because of this characteristic of the environment takes less tangible changes have been too. With the above results and Saeed Abdul (1997) stated that GA is effective on the trait was consistent number of nodes.

3.4.3. Internodes length

Legume genotypes during early growth of plants having a high dry mass and grain products tend to have wings. Genotypes can be appropriate and applied growth regulators like gibberellins foreign to these results can be achieved(3).

Dose hormone gibberellins acid in a significant percentage is applied in different periods of growth hormone also was significant at 1% level, and interaction different periods of growth at 1% were significant.

Dose of the hormone gibberellins acid maximum height of internodes 4.07 inches compared to other hormone levels have been in statistical was. Other doses differ quite significantly with this level did not have the lower levels were.

Hormone actions in the period before flowering vegetative internodes length with maximum height of 4.62 inches were followed and the course gave a statistical level, other courses at the next level were b and c.

The interaction of hormones in exercise time and height difference between nodes, but not quite obvious all doses 50 ppm hormones before flowering

vegetative period of the node with the highest (3.78 cm) were.

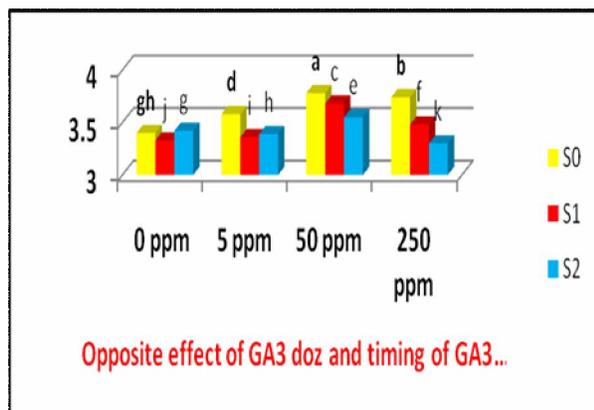


Fig10. Interaction GA3 & different stages of growth On number High plant

Because of the obvious differences of hormone gibberellins acid on internodes length were observed can be said that this morphological trait is less than the effect of the environment, but such a dose of 50 ppm during the vegetative growth before flowering than other levels and courses Top of the node created is better to say that external plant hormones at the time of eruption to get better.

The hormones in cell division and cell elongation is effective and sub-branches of the nodes there are, whatever nodes have more and more space are perhaps counting the number of nodes that are affecting the performance increase was consistent(11).

4. Discussion

Production, solar energy received by the practice and transforms it into food and other usable materials. Agronomic practices generally, are designed to get some kind of light through the cover to completely change the density of ground vegetation, and spacing of plants and spread rapidly increasing Leaf, drawn up(2, 3).

LAI is a measure of the total surface of the leaves in a unit area regardless of leaf age, position, angle and thickness and other characteristics such as leaf color, fluffy and degree of the tube to be calculated. Increase the speed of LAI is important because it determines the rate of plant photosynthesis capacity expansion is considered the beginning of bean vegetation growth was very slow so that the growth of nearby weeds will not compete was the need for weeding will be done in time if the reproductive period of plant photosynthesis and transport materials for construction materials up to a maximum of their pay, LAI is a good bean yield will also increase (12, 14).

4.1. Process of leaf area changes

LAI important factor in plant production and performance is what the plants ability to absorb carbon dioxide is more efficient in producing dry matter also will be a larger share, at the beginning of the growing trend of increased plant leaf area is small but quiet, near Flowering time the process reached its peak and then everything that the aging of plant leaves near the bottom because we lost production and the consumer will somehow be decreasing trend (12) Height, stem length or in other words one of the main and important criteria for plant quality is expressed. Strength stems should be able to partially weight of flowers, pods and seeds inside the pods to tolerate, given the role that stem remobilization photo assimilate to other organs such as root and requires that the terminal buds, shoot length specified is important, so that it surrounds the ability to shoot up the environment and can have a good competitor for weeds is grown (18, 19).

Test Hardtke, (2003) Effect of gibberellins on the shoot outside the plant height were observed, this increase in shoot length due to the effect of this substance in plant growth is facilitated, so that gibberellins acid stimulates cell division and accelerates a length and cell enlargement it provides.

Abdul (1984) Gibberellins acid, as has the increase in stem length and diameter of plant seedlings has been

Reference

- 1 Abdul, K. S. and Said, M. M. 1984. Effects of cycocel and gibberellins acid on growth of broad bean (*Vicia faba*) seedlings. Iraqi Journal of Agricultural Sciences 2: 45-47.
- 2 Al-Khsswneh, N.M., N.S. Karam and R.A.Shibli. 2006. Growth and flowering of black iris (*Iris nigricans* Dinsm.) flowering treatment with plant growth regulators. Sci. Hort. 107:187-193.
- 3 Azizbekova, N. Sh., E. L. Milyaeva, N. V. Lova and M. Kh. Cheilakhyan. 1978. Effects of gibberellins and kinetin on formation of flower organs in saffron. Soviet Plant Physiol. 25(3): 471-476.
- 4 Charles, F. et al.,1969.Gibberellin and CCC Effect on Flowering and Growth in the Long-day Plant *Lemna gibba* G3.
- 5 Chrungoo, N. k. and Farooq, S.1984.Influence of GA and NAA on the yield and growth of saffrn.Indian Journal of Plant Physiology, 27:201-205.

- 6 Coleman, W. K., D. J. Donnelly and S. E. Coleman .2001.Potato Microtubers as research tools: a review. *Am. J. Potato Research*. 78:47-55.
- 7 Chunsheng, M.et al. 2001. Effect of Gibberellins Acid Application on Panicle Characteristics and Size of Shoot Apex in the First Bract Differentiation Stage in Rice.*Plant Prod. Sci* 4(3) : 227-229.
- 8 Dalessandro, G. and L. W. Roberts.1971. Induction of xylogenesis in pith parenchyma explants of *Lactuca*. *ibid* 58: 378-385.
- 9 Davies, L. J., I. R. Brooking, J.L. Caly and E.a. Halling. 2002. Effects of day/night temperature differential and irradiance on the flower stem quality of *Sandersonia aurantica*. *Sci. Hort.* 95:85-89.
- 10 Daykin, A., Scott, I. M., Francis, D. and Causation, D. R. 1997. Effects of gibberellins on cellular dynamics of dwarf pea internode development. *Planta* 203:526-535.
- 11 Destro, D., Arias. E.R.A., Miglioranza. E., & Toledo. J.F.F.1993. Development stages suitable for the application of male sterility inducing phytohormones in sunflower. *Pestquisa Agro. Brasileira* 28:5,593-596.
- 12 Diethelm, R., Keller, E.R. and Bangerth, F.1986. Interractions between the application of growth regulators, yield components, and content of phytohormones in the fruit of *Vicia faba*. No14, 12-17. L. FABIS Newsletter, Faba Bean Information Service, ICARDA.
- 13 Dolan,L and Davies, J.2004. Cell expansion in roots.*Current Opinion in Plant Biology*.7:33-39.
- 14 Eid, S.M.M., Abbas, H.H. and Abo-Sedera, F.A.1992. Effects of GA₃ foliar spray on plant growth, chemical composition, flowering, pod yield and chemical composition of green seeds of pea plant griwn under salinity stress.*Annals of Agricultural Science, Moshtohor* 30 :1443-145.
- 15 El-Dengawy, E.F.A. 2005. Promotion of seed germination and subsequent seedling growth of loquat *Eriobotrya japonica* by moist-chilling and GA₃ applications.*Scientia Horticulturae*, 105: 331-342.7.
- 16 Phillips, A., 1998 Gibberellins in *Arabidopsis*. *Plant Physiol. Biochem.* 36: 115-124.
- 17 Fosket, D. E. and J. G.Torrey. 1969. Hormonal control of cell proliferation and xylem differentiation in cultured tissues of *Glycine max* var Biloxi. *Plant Physiol.* 44: 871-880.
- 18 Giuseppe, D. 1973. Interaction of auxin, cytokinin, and gibberellins on cell division and xylem differentiation in cultured explants of Jerusalem artichoke. *Plant Cell Pysiol.* 14: 1167-1176.
- 19 Hardtke, C. 2003. Gibberellin signaling:Grass growing roots. *Current Biology*, 13:366-367.
- 20 Hassaballa I.A., E.Y. Youssef, M.A. Ibrahim and S.E. Khalifaa. 1984. Effect of som growth regulators on Yield and physical characteristics of Zaghlood data fruits. *Annual of Agricultural Science, moshtohor*, 20: 316-332.

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