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# The Effect of Phytohormones on the Morphological parameter in Pigeon Pea (Cajanus Cajan L.)

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**Abstract**

*The Response of various concentration (10, 25, 50, 100, 200, 400, 800 of bio regulates as cycocel, $GA_3$ and Ethephon on Morphological and Biochemical parameters of Cajanus cajan L. The studies were carried out at Hindu P.G. College, Moradabad, U.P. The effect of phytohormones on the length of shoot in seedling different cultivars (Cajanus cajan L.) is Cycocel N.P-16, is better of 11:10 cm and $GA_3$ is 16.00 cm Ethephon 10.25 cm and N.R.15 and N.P.-80. Effect of phytohormones sprays to 40 days old Cajanus Cajan L. plants on photosynthetic efficiency of upper and lower leaves, recorded after three weeks of spray. Effect of foliar sprays of phytohormones of flower in plants. Days required for flowering (Bud opening) plant Age (days) at which hormones were applying. The flower shapes changed from flat (disc-shaped) to slightly elongated. The Effect of Phyto hormones on the morphological parameter in Piegan Pea (Cajanus Cajan L.)*

**Keywords:** Phyto hormone, Content, Pigeon Pea

## Introduction

It is native of Africa and second most important pulse in India. The pigeon pea (Cajans cajan) or toor del is perennial legume from the family faba ceae native to the Eastern Hemisphere. The pigeon pea is widely cultivated in tropical and semitropical regions around the world, being commonly consumed in south Asia Southeast Asia, Africa, Latin America and the Caribbean. It is woody perennial shrub, 1-4 tall but grown as an annual crop. It is extensively used as deal (split pulse) or sometimes tender green pods as vegetables. Dried, husk and broken pieces of seeds are valuable feed for cattle. Green leaves and tops of plants are used as fodder. These are also used as green manure. Dirked stalk is used as fuel wood, masking basket or as thatching material. It is also grown as contour hedges controlling erosion and cover crops in plantation.

Botanical name – Cajanus cajan (L.) Huth
Hindi name- Arhar
Family- Fabaceae
Edible port- Seeds
Genus- Cajanus
species- C. cajan

Arhar dal is a nutritional power house, rich in plant-based fiber and essential mineral. A 100-gram serving of uncooked Arhar dal contains approximately. Calories 343 Kcal, Protein 22.61 gm. Carbohydrates 62.78 gm, Dietary- 21.6 KaCl, Pigeon pea, also known as Toor dal or red gram is a protein rich legume crop grown in tropical and subtropical regions. It is a versatile and resilient plant known nitrogen, which improves soil fertility.

It thrives in hot climates with temperature b/w $20^0$C and $40^0$C and is tolerant of dry periods. It can grow in a variety of soil, including sandy and clay soils, but prefers a pH b/t 5 and 7. Pigeon pea fixes atmospheric nitrogen, which enriches the soil and can be used a cover crop.

***Top Producer***

* India is the world's largest producer of pigeon peas. Another major producer includes Myanmer, Molawi, Kenya and Tanzania. It is a small woody shurs and not a very big tree, so it can be grown easily in small specie as well. It an excellent nitrogen fixed so it.
* Toor Dal also known as Arhar dal, significantly improve digestion due to its high fiber content fiber is essential for maintaining a healthy digestive system as it promotes regular bowel movements and supports a healthy gut flora.
* As a result, excessive consumption of Toor dal con lead to gas, bloating and flatulence some individuals may expertise digestive discomfort such as abdominal pain, diarrheas or constipation after consuming Toor dal, especially if they have a sensitivity to certain compounds present in pulse.
* Toor dal is also a great source of plant-based protein but slightly less than chana dal fiber: while high in fiber, Toor dal has a slightly lower fiber constant than chana dal. It is still beneficial for digestion and heart heal. 6-7 protein and 25-27g carbs.
* Toor dal also known as Arhar dal is a staple in the Indian cosines. Split pigeon pea is tempered with spice & herbs for a traditional. Cajanus Cajan, commonly referred to us pigeon pea is the sixth most important edible legume crop globally. It is known (A pep- 2022). While mainly grown in semi-arid tropical regions, pigeon pea do well in many typical of soil, have a strong tolerance to droughts and are able to yield well even in less favorable conditions-Pigeon pea is one of the most underutilized legumes crops, even with its benefits of a significant level of nutrients of a significant level of nutrient and strong medicinal properties.
* Pigeon pea is a short lived peremmial most often as an annual. It has a deep root network well adopted to semi-arid conditions. Plants can grow to a height of 3 to 10 feet, with slender leaves, yellow or red flowers and pods of various color's (CGIAR Genebank Platform 2019) other seed pods are long with two to nine parge seeds.
* In India, it is chiefly grown in Madhya Pradesh, Bihar, Andhra Pradesh, Maharashtra, Uttar Pradesh and Karnataka grown mostly as 'kharif" crop and used in form of 'daal'. This is the second important pulse crop of India. It is a dry crop mixed like Jowar, bajra and ragi. In the north India, how the crop is irrigated over considerable area.
* It is sown in the kharif season from May to July and is harvested in about six to eight months' time (i.e. from December to march). The area covered by it is about six million across and annual production is about 2 million tons.
* There are two main verities grown in India- (1) Cajanus cajan Var D.C. (Arhar) (II) Cajanus Cajan Var. flaxes DC (tur).
* The important types of India are- N.P.- 15, N.P.-16, N.P.-64, N.P.-80 and types 17 of U.P. Ethephon application reduced the intermodal length in Lycopersicon esculahtum L. Luffa acutangla acutangula, Momordica, charantia and Cucumis male (I waheri et al; 1968). Srivastava et al., (1977) also found that contribution of photosynthesis to seeds in sunflower was highest from top 6 to 8 leaves followed by the middle leaves and least from the leaves at the bottom. Tozani at al., 1976) reported in Phaseolus vulgaris that ethephon application decreased the number of lateral branches. Physiology and have been reviewed by Steward and Shantz (1959) and Cathey 1964).
* There are two main verities grown in India- (1) Cajanus Cajan Var. bicolor (II) Cajanus Cajan Var. flovus. DC (tur.). Arhar comprises of late maturing, large, bushy plants, bearing purple streaked, yellow flowers and dark Turan the other hand comprise early maturing and smaller plants having yellow flowers and plain pods, each containing two or three seeds.
* These constrains two globulins: Canjanin and concajanin. These leaves are used in Madagascar for reasing silk worms. Green pods are used as a vegetable. Husk makes useful fodder.

## Materials and Methods

It is depended on the research but commonly include growing the plants. Climate of Moradabad: It is placed in the interior of subtropical continental region. Its climate is typically monsoonal. The meteorological data for Moradabad for the year 2020-2021. The is seasonal rbymes of the weather. Seasonal variation in temperature and moisture

conditional governs the distribution patter, growth and phonology of plants in this region. The terrain is also characterized by heavy rain fall and periodic in unration of its vast area by the over flooding and shifting of river flowing through its. There are two well marked season i.e. summer, rainy and winter.

***Summer Season***

It begins from April and continues up to the middle of June (The month of March being intermediately b/w the cold and hot season). Summer are very hot and dry. Strong, dusty and hot winds popularly known as 'Loo' blow from the west. These scorching hot winds aided by loo humidity exerts a desiccating influence over the vegetation. Daily mean maximum temperature in the months of may rise up to $45^0$C. Mean minimum temperature from April to June range from $20^0$C to $26^0$C. Mean diurnal fluctional in temperature during the season ranges b/w $12.5^0$C to 17.5C. Relative humidity of three months is low. Strong dusty storms appear occasionally in May & June, sometimes followed by light showers.

***Winter Season***

It extends from November to February. The month of October is cold transitional period from rainy to winter season. Mean daily maximum and minimum temperatures are lowest in the month of December ($20.7^0$C and $7.0^0$C). Mean diurnal fluctuations in temperature during this season ranges from $13.7^0$C to $15.1^0$C. Relative humidity is 70.5 percent. Fog and dew occur frequently in the morning hours. Photoperiod gradually b/w longer. The Months of March recorded a arise in temperature and fall in relative humidity. Means daily maximum and minimum temperature are $32^0$C and $15.4^0$C respective relatively comes down to 56.3% percent.

***Source of Chemicals***

All chemicals employed in this investigation were of analytical grade supplied by BDH (India) unless specified otherwise. Dehydrated absolute ethyl alcohol was supplied by Bengal Chemical company, India. Etheral was supplied by Duchem, U.S.A. $GA_3$ acid supplied by CDH (Central Drug House) (P) L.T.D. Psot Box No. 7138, New Delhi-110002.

***Fertilizer and Other Chemical***

Urea single super phosphate murate of potoash (Gujrat Fertilizer) were obtain from crop research center, G.B. Pant University of Agriculture and technology Pantnagar. Diathene- N and sandoxit were also obtained from crop research Centre Pantnagar.

Apparatus

1. All glassware used was either of coming India Ltd. Or Pyrez, U.S.A.
2. Vacuum Pump (Metrex, India).
3. Spekal (Carl Zdis Jena-DDR)
4. Luxmeter (Research- Luxpmet-300, Atlantis India)
5. Blender (Metrex India).
6. Measuring Slender.
7. Air Hand Sprayer.

***Field Culture***

For exposure to estimate photosynthesis efficiency of individual leaves, a plot (19.20x12.75m) was select. A normal dose of N.P.K. was applied recommended for crops. After 10 days seedling was thin to twenty.

***Foliar Spray***

The Phytohormone at concentration 10,25 20,100, 200, 400, 800 mg/l were applied to the whole plant with a compressed air hand sprayer. At 2 to 3 leaves stages first spray was given followed by two more sprays at weekly intervals. The quantity of solution sprayed to each plant was sml to 6 ml and this was kept constant for each treatment. Twenty 20 at 0.01 percent used as surface. Distilled water along with surfactant was used for spray of control plants. In the present investigation, three replicates of 10 plants each for each treatment were taken in to consideration. Data were analyzed statistically and experimented significance was determined.

***Preparation of Hormones Solution***

To prepare stock solution of different hormones the following addition were made per liter. Deionized water was used for solution preparations.

| Hormones | Amount (mgs) | Concentration (ppm) |
|---|---|---|
| $GA_3$ | 100 | 100 |
| Cycocel | 50 | 50 |
| Ethephon(1ml. 400) | 1.25 ml. | 500 (ppm) |

Gibberellin acid and Ethephon were directly dissolved in water. Cycocel was first dissolved in a

few drops of absolute ethyl alcohol and then required volume was made by deionized water 0.22ml of "Sandavit" per litter of hormone solution was added as surfactant.

Gibberellins have been implicated in all the phases of plants development such as short, root, leaf growth, flowering, sex expressing, development of fruits, seeds and metabolism. Gupta and Gupta 2002. Bora and Sharma 2003 and single et al., (1995) have reported significant effect on the total yield in pea and onion.

## Results and Discussion

The data show that both the concentration of $GA_3$ (10 and 100ppm) brought about an early flowering by 4 and 9 days respectively, as compared to control. Cycocel (10 ppm) and ethrel (50 ppm) also has tend flowering by 3, 4 and 4 days respectively. On the other hand, cycocel (50 ppm) are ethrel (400 ppm) delayed flowering by 1 and days respectively.

***Flower Morphology***

Flowers formed in the plants receiving different treatment were normal (similar to control) in most cases. However, the flowers of plants treated with $GA_3$ (100ppm) showed the following abnormal features. The flower shape changed from flot (disc-shaped) to slightly elongated. Sepals and petals (ray-floret) because elongated (lancealate hsap).

***Photosynthetic efficiency***

Data recorded after 3 weeks of spray of on photosynthesis efficiency of lower (14$^{th}$ from top) upper (18$^{th}$ from top) levels of different treatment

Table 1: Effect of Phytohormones on Morphological parameter in Piegan Pea (Cajanus Cajan L.)

| Treatments | | Cpmgm$^{-1}$ dry weight | | Cpm cm$^{-2}$ leaf area | |
|---|---|---|---|---|---|
| Phytohormones | Conc. (ppm) | Lower leaf+ | Upper leaf | Lower leaf+ | Upper leaf |
| Water (Control) | - | 17.100+92.4 | 12501+79.0 | 91.2+7.5 | 77.0±7.1 |
| Cycocel | 10 | 11799±77.0 | 11199±75.0 | 67.0±6.7 | 54.0±6.2 |
| | 25 | 13500±78.0 | 12230±80.0 | 78.2±6.2 | 62.2±6.2 |
| | 50 | 15330±80.0 | 12944±81.2 | 85.5±6.6 | 70.0±7.0 |
| | 100 | 16199+95.5 | 13099±80.7 | 90.0±7.5 | 73.0±6.9 |
| | 200 | 17220±93.6 | 14000±80.6 | 92.5±7.5 | 74.2±6.8 |
| | 400 | 18150±95.3 | 14570±81.6 | 91.2±7.2 | 75.4±6.7 |
| | 800 | 18770±95.4 | 14880±83.2 | 90.6±6.6 | 76.6±6.8 |
| $GA_3$ | 10 | 14649±85.7 | 11899±77.1 | 87.0±7.4 | 69.0±6.8 |
| | 25 | 145360±86.6 | 11212±76.2 | 87.5±7.2 | 67.2±6.7 |
| | 50 | 14210±87.2 | 11050±75.1 | 88.0±7.3 | 64.3±6.5 |
| | 100 | 14149±84.2 | 10350±75.0 | 89.5±8.0 | 58.6±6.2 |
| | 200 | 14100±84.2 | 10212±70.0 | 90.2±7.9 | 57.5±6.3 |
| | 400 | 14010±83.7 | 10110±73.0 | 99.6±7.8 | 56.2±6.2 |
| | 800 | 14000±86.2 | 10000±71.0 | 92.6±7.8 | 56.2±6.2 |
| Ethephon | 10 | 18249+95.5 | 12224±78.3 | 85.0±7.2 | 68.0±6.7 |
| | 25 | 13012±96.4 | 1220±76.4 | 74.0±7.3 | 65.2±5.6 |
| | 50 | 12272±98.2 | 12210±77.2 | 70.0±7.2 | 63.4±6.2 |
| | 100 | 11077±97.4 | 12205±78.8 | 65.4±7.6 | 60.5±6.7 |
| | 200 | 10000±96.5 | 12175±76.3 | 60.6±6.2 | 50.6±7.2 |
| | 400 | 9899±70.5 | 12149±78.0 | 59.0±6.3 | 58.0±7.2 |
| | 800 | 9500±73.6 | 121270±77.7 | 58.6±6.2 | 58.0±7.2 |

* Fourteen leafs from top * Eigth leaf from top *At 40 days

Table 2: Effect of Foliar spray of phytohormones on flower in plants

| Treatments | | Days required for flowering (bud-opening) Plant Age (days) at which hormones were applied | |
|---|---|---|---|
| Phytohormones | Conc. (ppm) | 40 days | 55 days |
| Water (Conc.) (ppm) | - | 67 | 70 |
| Cycocel | 10 | 64 | 70 |
| | 25 | 67 | 71 |
| | 50 | 68 | 22 |
| | 100 | 69 | 73 |
| | 200 | 73 | 74 |
| | 400 | 75 | 76 |
| | 800 | 78 | 77 |
| $GA_3$ | 10 | 63 | 64 |
| | 25 | 62 | 64 |
| | 50 | 60 | 64 |
| | 100 | 58 | 64 |
| | 200 | 59 | 65 |
| | 400 | 58 | 65 |
| | 800 | 57 | 66 |
| Ethephons | 10 | 60 | 64 |
| | 25 | 61 | 64 |
| | 50 | 62 | 64 |
| | 100 | 63 | 65 |
| | 200 | 62 | 65 |
| | 400 | 64 | 65 |
| | 800 | 69 | 66 |

*Average value 6 plants (3 pots) each

are presented in table. Photosynthesis efficiency (expressed as cpm/gm dry wt.) was found to be higher in lower leaf than that of upper leaf in all the items except ethephon 500 ppm were the effect was just the reverse.

Photosynthetic efficiency of lower and upper leaves of plants given different treatment was not found to be significantly changed in most cases. However, photosynthesis efficiency of lower leaf of plants sprayed with 400 ppm ethephon desereared to about 42.11% of that of control. On the other photosynthetic efficiency of upper leaf of plants spray with 50 ppm $GA_3$ increased by about 43.6% comparison to that of control.

Photosynthesis efficiency (expressed as cpm/$cm^2$ leaf area) was found to be higher in lower leaf than that of upper leaf in all the treatment and ethereal 400 ppm in which no difference in Pho synthetic efficiency.

## References

Abd El-Al and Faten, S. (2009). Effect of urea and some organic acids on plant growth, fruit yield and its quality of sweet pepper (Capsicum annum) Res. Jour. of Agri. and Biological Sci., 514: 372-379.

Agricultural Prices Commission: Agricultural Res. And Edn. Approach to the sixth plan. ICAR.

Bora, R.K. and Sarma, C.M. (2003). Effect of plant growth regutars on growth yield and protein content of PEA (CV. A zad P-I). Indian J Plant Physical. Pp: 672-676.

Table 3: Effect of phytohormones on the length of shoot in seedling of different cultures of Cajanus Cajan (L.)

| Treatments | | Length (cm) | | |
|---|---|---|---|---|
| Phytohormones | Conc. (ppm) | N.P.-15 | N.P.-16 | N.P.- 80 |
| Control | D.W. | 10.30 | 13.50 | 11.15 |
| Cycocel | 10 | 8.70 | 11.70 | 9.25 |
| | 25 | 8.45 | 11.40 | 9.10 |
| | 50 | 8.30 | 11.20 | 9.00 |
| | 100 | 8.20 | 11.00 | 8.90 |
| | 200 | 8.00 | 10.80 | 8.70 |
| | 400 | 7.90 | 10.65 | 8.55 |
| | 800 | 7.40 | 10.10 | 8.30 |
| $GA_3$ | 10 | 10.45 | 13.70 | 12.65 |
| | 25 | 10.80 | 14.10 | 12.90 |
| | 50 | 10.90 | 14.55 | 13.00 |
| | 100 | 11.00 | 15.90 | 13.45 |
| | 200 | 11.15 | 15.20 | 13.45 |
| | 400 | 11.25 | 15.60 | 13.70 |
| | 800 | 11.55 | 16.00 | 14.00 |
| Ethephon | 10 | 7.80 | 10.25 | 8.00 |
| | 25 | 7.60 | 10.00 | 8.70 |
| | 50 | 7.15 | 9.75 | 8.60 |
| | 100 | 7.00 | 9.60 | 8.15 |
| | 200 | 6.75 | 9.00 | 7.80 |
| | 400 | 6.55 | 8.70 | 7.30 |
| | 800 | 6.30 | 8.35 | 7.10 |
| C. D. at 5% | | 1.90 | 01.70 | 01.75 |

Cantilffe and Shared C. Phatak (1975). Response of cucumber to soil and foliar application of ethphon Hort. Sci., 9(5): 465-466.

Cathey, H.M. (1964). Physiology of growth retarding chemical. Ann. Rev. Plant Physical. 15:271-299.

Gupta, P.K. and Gupta, A.K. (2002). To studies the effect of plant growth regulators on growth, yield and quality of Okra. Advances in plant sci. 15(2): 485-485.

Jawahari, S.; Yehoshua Ben and Lyons, J.M. (1970). Maturation and quality of tomatoes with pre-harvest treatment s of 2 chloroethyl phosphonic acid. Jour. Amer. Soc. Hort. Sci. 95(1): 88-91.

Srivastava, G.C.; Peshmukh, P.S. and Tomar, D.P.S. (1977). Significance of leaf orientation and bract bract in seed yield in sunflowers. IInd J.P.I. Physiol. 20: 151-155.

Tozani, R.; Robitoille, H.A.; Villira, C, and Sediyamna C.S. (1976). Effects of five growth regulators on the growth and development of the bean (Phasecelars Vulgaris). Plants Rivsta Ceres. 23(125):7175.

Zade, V.R.; Pardey, V.O. and Kangirwar, R.R. (2007). Effect growth regulator for fruit honing in MRG BAHAR of Mandarin. Plant Physiol 21(1):132-133.

Steward, F.C. and Shantz, E.M. (1959). The Chemical regulation of growth some substance and extracts which induce growth and morphogenesis. Ann. Rev. Plant. Physiolog 10:399-404.

Iwahori, S.; Yehoshua Ben and Lyons, J.M. (1968). Ethect of 2-chloroethane phosphonic acid in tomato fruits development and ripening. Biosciences. 19:49-50.