Journal of Phytology 2009, 1(6): 369–373
© *Journal of Phytology, 2009*

ISSN: 2075-6240
Available Online: www.journal-phytology.com

REGULAR ARTICLE

EFFECT OF PLANT GROWTH REGULATORS ON ROOT NODULATION OF COWPEA (*VIGNA UNGUICULATA* L. WALP)

S. Muhammad[1], A. Tijjani[2]

[1]*Department of Biological Sciences, Usmanu Danfodiyo University, Sokoto-Nigeria*
[2]*Department of Biological Sciences,Bayero University,Kano -Nigeria*

SUMMARY

The Effects of Indole – 3 – acetic acid (IAA) and naphthalene acetic acid (NAA) on the Root Nodulation of four varieties (IT95K – 499 – 35, T93K – 452 – 1, IAR 1696 and IAR 48) of Cowpea (*Vigna Unguivulata* L. Walp) were examined. Three concentration of IAA (0.0, 0.25 and 0.50) were applied. In the field experiment Cowpea treated at 0.1 IAA experienced a higher rate of root nodulation IRA 1696 had the highest mean of root nodulation when compared to the other three varieties of cowpea treated at 0.25 NAA experienced high mean root nodulation for IAR 48 and IT95K – 499 – 35 while IT93K – 452 – 1 and IAR1696 showed greater mean root nodulation at 0.50 of NAA treated. Result of Analysis of variance (ANOVA) showed significant difference (P>0.001) in most parameters. These results indicate that plant growth regulator treatments improved root nodulation in Cowpea which improved high yield.

Keywords: Cowpea, Indole – 3 – acetic acid, Root nodulation, ANOVA.

S. Muhammad and A. Tijjani. Effect of Plant Growth Regulators on Root Nodulation of Cowpea (*Vigna unguiculata* L. Walp). J Phytol 1 (2009) 369-373
***Corresponding Author, *Email*:** samdiri@yahoo.co.uk

1. Introduction

Cowpea (*Vigna unguiculata*) L. Walp is an annual herbaceous legume belonging to the family Fabaceae and sub – family Papilionaceae (Davids, 1991). It is commonly referred to as southern pea, Black eye pea, crawder pea, lubia, Niebe, cowpea or fragile. Cowpea originated in Africa and (is widely grown in Africa, Latin America, South East Asia and in southern United States. The history of cowpea deals to ancient West Africa cereal farming, 5 to 6 thousand year ago where worldwide cowpea production has increased dramatically in the last 25 years. The plant has well developed taproots which can grow to a depth of about 1m, lateral root in the subsurface region bear numerous Rhizobium nodules. It has a climbing or winding or winding stem reaching a length of 2 to 4m. the pods (5 to 12cm long and approximately 1cm wide) are straight or slightly curved and posses a small break at the end. The seeds very considerably in size and colour (white brown and black). For forage purposes, a rainfall of 750 to 1,100mm in preferable. It will tolerate lower rainfall, but in high rainfall area disease and insect attack increase.

Cowpea, is a nutritious component in human dist and a major component of livestock feed. The cowpea grain contains about 24.8

protein, 63.6%, carbohydrate, 1.9% fat, 6.3% fiber, 0.0007% thiamine, 0.00042% Riboflavin, 0.00281% Niacin (Brassani, 1992). The protein in cowpea seed is rich in the amino acids, lysine and tryptophan, compared to cereal grains. However, it is deficient in the methionine and cystine when compared to animal proteins. Therefore cowpea is valued as a nutritional supplement to cereals. Cowpea can be used at all stages of growth as a vegetable crop. The tender green leaves are an important food source in Africa and they are prepared as a pot herb like spinach. Immature snapped pods are used in the same way as snap beans, often being mixed with other foods green cowpea seeds are bailed as fresh vegetable or may be canned or frozen. Dry mature seeds are also suitable for boiling and canning (Bressani 1992). In many area of the world, the cowpea plant is the only available how quality legume have for livestock feed. Digestibility and yield of certain cultivars have been shown to be comparable to alfalfa. Cowpea plant serves as green manure. It helps in erosion control as a cover crop (Bressani, 1992). Like other legumes, cowpea fixes atmospheric Nitrogen and thus contributes to the available Nitrogen level in the soil. When intercropped with sorghum, millet or maize, it transfers cowpea fixed Nitrogen to the cereals, faster cereals growth and increases yield. Similarly, the cereal legume rotation can reduce the density of witch weed (*Striga hermonthica*) seeds in soil the deep root systems of cowpea helps stabilize the soil and the ground cover it provides preserves moisture which is a very important in the drier regions where moisture is a premium requirement and other soil is subject to wind erosion the seeds of cowpea being free from metabolites (Rachie 1985) are used in the preparation of food such as cooked moimoi or fried bean cake (Kosai). This research is aimed to investigate the role plant growth hormone in root nodulation of Cowpea which the view to improved yield.

2. Material and methods

The research was conducted at international institute of tropical agriculture IITA, Kano station from August to October 2008, to analyze the effect of Plant growth regulators PGR on root Nodulation of Cowpea (*Vigna unguiculata* L. Walp). The PGRS being IAA and NAA. Cowpea seeds variety IT95K – 499 – 35, IT93K, 452 – 1, IAR1696 and IAR48 were collected from ITTA Kano. The experiment was divided into two sections, IAA tests and NAA tests. Sandy loam soil was collected from the Botanical garden of KNAP, and was used to fill of total of 240 bags and grouped par replicate which were perforated to allow free drainage of water, the bags were watered every other day. Two viable seeds were planted per bag at a depth of 2cm from the soil surface. The 200bags were labeled and arranged in a completely randomized block design.

Solution preparation

Solution of IAA and NAA used in the experiment were prepared in four (4) 100ml volumetric flask using 2ml of 95% alcohol to dissolve powder before adding 98ml of distilled water. Solution of n 2ml IAA with concentration of 0.1ppm & 0.2pmm were prepared. Solution of NAA with concentration of 0.25ppm and 0.50pmm were prepared. 1.862mg and 3.724mg of IAA powder was dissolved in 95% alcohol and then 98ml of distilled water to get 0.1 and 0.2 IAA solution concentration respectively. 4.37 and 75mg of NAA powder was dissolved in 2ml 95% alcohol and then 98ml of distilled water to get 0.25 and 0.50NAA solution concentration respectively (Forshey, 1991 and Emechebe, 1991).

IAA test

Eighty (80) plant bags were used for the IAA tests. Each variety of the cowpea used was planted in group of ten (10), 2mls of the IAA solution was applied foliarly to the plant after 3 weeks.

NAA test

Eighty (80) plant bags were used for the NAA tests each variety of the cowpea used was planted in groups of ten. Two (2) mls of the NAA solution was applied foliarly to the plant after four (4) weeks of planting. Watering of plants was done every other day.

Harvesting for Nodules Count

Harvesting commenced four (4) weeks after PGR applications for both the IAA and NAA treated plant as well as the control plants. Sand in the bags was initially broken loose before the plants were carefully uprooted. Care was taken to remove all sand particles from root of the plants and hand counting method was used.

Statistical analysis

One (1) way ANOVA was used to test for significant differences among mean observations. Results are represented in the form of tables.

3. Results and Discussion

The result of the experiment showed very low correlation ($r \geq 0.5$) in the application of IAA and NAA. However, the varieties and concentrations used differ significantly ($p \geq 0.0001$) from one another in response to auxin (IAA and NAA) application. The relationship between the root nodulation and the varying concentration of plant growth regulators of each variety are represented for both IAA and NAA in tables I and II. In the root nodulation response of cowpea to IAA at two different concentrations, IAA at 0.1 gave highest root nodulation for all four (4) varieties of cowpea.

Table 1. Table showing the mean of root nodulation of four cowpea varieties for NAA (concentration 0.5,0.25).

Variety	0.5 Mean + SE	0.25 Mean + SE
IT95K – 499 – 35	12.94 + 0.15	48.88 + 4.66
IT93K – 452 – 1	37.68 + 0.95	23.07 + 3.46
IAR 1696	52.95 + 5.39	31.29 + 1.67
IAR 48	40.44 + 2.03	70.28 + 1.10

The above table shows the mean of response in cowpea to NAA at two different concentrations. NAA at 0.25 showed highest root nodulation for two varieties IT95K – 499 – 35 (48.88) and IAR 48 (70.28) when compared with NAA at 0.5 which showed its highest root nodulation for IT93K – 452 – 1 (37.68) and IAR 1696 (52.95) when compared with same variety with 0.25 NAA solution.

Table 2. table showing the mean of root nodulation of four cowpea varieties for IAA concentration 0.2 and 0.1

Variety	0.5 Mean + SE	0.25 Mean + SE
IT95K – 499 – 35	8.44+0.36	9.59 + 1.00
IT93K – 452 – 1	7.11 + 0.68	60.53 + 7.34
IAR 1696	12. 79 + 2.39	70.82 + 0.41
IAR 48	40.73 + 2.11	47.76 + 5.18

In the root response of cowpea to IAA at two different concentrations, IAA at 0.1 gave highest root nodulation for all four (4) varieties of cowpea. Cowpea variety IAR 1696 gave the highest root nodulation at 0.1 concentrations (70.82). This was the followed by IT93K – 452 – 1 (60.53). Variety IAR 48 followed by (47.76) and finally, IT95K – 499 – 35 (9.59) showed the least response to IAA treatment at 0.1 concentrations.

Treatments with IAA at 0.2 concentrations also showed some level of increased root nodulation, through not as much as with IAA at 0.1 concentration with IAA treatment at o.2

concentrations, IAR 48 gave the highest root nodulation (40.73). this was followed by IAR 1696 (12.79), IT95K – 499 – 35 was next (8.44) and IT93K – 452 – 1 showed the west response (7.11).

From the results above, the general observation that plants exposed to high auxin concentration have lower rate of vegetative growth in terms of shoot biomass (plant height, leaf area) and root nodulation then those exposed to lower concentration of auxin is in line with expectation that high auxin concentration with inhibit, reduce or increase in not very significant rate the root nodulation of plants (Forshey,1991 and Emechebe, 1991).

Generally, the higher the concentration of the applied IAA, the lower the significant increase in the root nodulation of cowpea. (Forshey,1991 and Emechebe, 1991). Cowpea variety treated with IAA at 0.2 concentration record lower root nodule formation when compared to the same cowpea variety when treated with IAA at 0.1 concentrations. (Purseglove, 1974 and Ogbuinya, 1997).

However, a contrasting result was recorded when same cowpea variety was treated with NAA at two varying concentrations. Two (2) varieties, 1T95K – 499 – 35 and IAR 48 showed higher root nodulation response with NAA concentration at 0.25 when compared response of same variety to NAA at 0.50 concentration, but varieties IT93 – 452 – 1 and IAR 1696 showed higher concentration with NAA at 0.50 concentration when compared to the response of same varieties to NAA at 0.25 concentration. Treatments of same cowpea variety with NAA show same deviation from the expectation that at lower concentration treatments with auxins, root nodulation and plant growth are enhanced.

Differential root nodulation response of cultivars may be due to the ability of each cultivar to tolerate certain physiological stress such as temperature which cause adverse effects in the plant (Sachs and Thinman, 1969). Differences in the peak of rook nodulation of cowpea may be due to differential response of the cultivars, differences in each plants physiological and developmental stages, differences in nutritional stages and differences in nutritional status and with substances in the plant interact with applied growth substances (Robert 1972). Plant growth regulator such as auxins and giberalenis affects nodule formations (Armsol, 1998 and Rapport,1957).

Therefore, synthesized auxin can be used in the enhancement of root nodule formation which consequently increase yield of cowpea.

In conclusion the result of this study indicated that cowpea plant varieties (IT95 – 499 – 35, IT93 – 4512 – 1, IAR 1692, IAR 48) treated with IAA (at 0.2 concentration) experienced a lower rate of root nodulation as compared with IAA (at 0.1 concentration) probably due to the effect of IAA in reducing cell elongation and expansion at high concentration.

Treatment of the cowpea plant variety showed a mixed result with same varieties showing better nodulation at higher concentration and some at lower concentration.

These result indicate hat auxin treatment improves root nodulation and consequently plant yield because all results obtained were greater than those of controls. It is recommend that auxin particularly IAA and NAA should be foliarly applied to cowpea plants to enhance root nodulation cowpea and this improved yield.

Reference:

Armsol, S.D, (1998), IAA, A Redox Regulator, physiology of plant 713(6): 121 – 126

Brent; L.A and Peter, S (1987) cell proliferation Response of water melon Hyopcotyl to IAA (Biol. Dept. Univ. west India Bredgetonia

Banbades) Journal of Experimental Botany 39(207) 44 – 450.

Bressani; (1992) Nutritive value of cowpea. In; sign S.R and K.O Rachie (eds). Cowpea Research, production and U.K

Davids N.L. (1991); Alternative field crops manual center for alternative plant and animal products. Minnesote Extension Service. Pp65

Emechebe (1991) Cowpea – *Striga* problem Research in Nigeria. In Kim S.K (Ed) 1991. Combating *Striga* by ITTA, ICRISAT and IDRC, 22 – 24 August 1988, ITTA Ibadan Nigeria. PP 18 – 28

Forshey, C.G (1991) Measuring growth in complex systems; how do growth Regulator Alter Growth? American society for Horticultural Science 2:53-59

Ogbuinya, P.A (1997). Advances in Cowpea Research Biotechnology and Development Monitor No 33 P. 1012

Purseglove, J.W (1974). Tropical Crops Dicotyledons Longman group London 791pp

Rachie, K.O (1985). Introduction; In Sing and Rachie K.O (Eds) Cowpea Research production and utilization pp xxi – xxv ITT John Wiley and Sons Ltd 460pp.

Rapport, L (1957). Effect of Gibberallin on growth flowering and fruting of the early park Tomato (*Lycopersicum esculentum*) Journal of Experimental Biol 32, 440 – 444

Sachs, T and Thinman, K.V (1969) IAA induced Elongation of Internodes in Pea plants Nature London 203, 956 – 960.

Soding, N (1940). Hormonal Effect of Vascular Bundle Formation Journal of Experimental Biol, 365 – 368