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# Effect of Different Levels of Humic Acid and Salicylic Acid on Yield ParameterS and Yield of Cowpea (*Vigna Unguiculata*)

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

An investigation was carried out at Narendra Deva University of Agriculture & Technology, Faizabad (U.P.) during Kharif season of 2013 to find out the effect of different levels of humic acid and salicylic acid on yield contributing parameters and yield of cowpea. The design of the

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experiment was Randomized Block Design and comprises of six treatments replicated thrice. The maximum pod per plant was recorded with T5 (Foliar spray of humic acid (26 ml/liter water) and 0.2% salicylic acid at 35, 55 and 65 DAS) while minimum number of pods per plant recorded in T2 (Foliar spray of humic acid (26 ml/liter water) at 25 DAS and 0.2% salicylic acid 55 DAS). Maximum pod length (75.92 cm), Maximum number of seed per pod (13.67) and 100 seed weight (13.29 g) was recorded in T5, followed by T4. The maximum seed yield per plant of 13.10 g and harvest index (42.28 %) was reported with the application of humic acid @ (26 ml/liter water) and 0.2% salicylic acid at 35, 55 and 65 DAS.

*Keywords: Salicylic acid; foliar; yield parameters; humic acid; yield of cowpea; soil organic matter.*

## 1. INTRODUCTION

"Cowpea is a valuable component of farming systems in many areas because of its ability to restore soil fertility for succeeding cereal crops grown in rotation with it" (Carsky et.al., [1], Tarawali et al., [2] and Sanginga et al., [3]. "Early maturing cowpea varieties can provide the first food from the current harvest sooner than any other crop (in as few as 55 d after planting), thereby shortening the "hungry period" that often occurs just prior to harvest of the current season's crop in farming communities in the developing world. Cowpea is an excellent source of high-quality protein. Among pulses, it occupies prominent place and growing popularly by virtue of high nutritional value, short growth period, low-cost production and adoptability in the off season. In Asian countries, it is mainly used as vegetable. The nutritional content of cowpea grain is important because it is eaten in quantity by millions of people who otherwise have diets lacking in protein, minerals and vitamins. The nutritional profile of cowpea grain is similar to that of other pulses, with a relatively low-fat content and a total protein content that is two to four times greater than cereal and tuber crops. Like other pulses, the protein in cowpea grain is rich in the amino acids, lysine and tryptophan, compared to cereal grains. However, it is deficient in methionine and cystine when compared to animal proteins. It's a deep-rooted crop and does well in sandy soils and more tolerant to drought than soybean" [4]. "The crop can fix about 240 kg $ha^{-1}$ of atmospheric nitrogen and make available about 60-70 kg $ha^{-1}$ nitrogen for succeeding crops grown in rotation with it" [5].

"Humic acid is a major element of humic substances which are the main organic constituents of soil, (humus), peat, coal and ocean water. Humic Acid present a random polymeric, amorphous structure formed by polyaromatic building blocks bridged to each other by ester, ether and C links and carrying variable parts of carboxyl, hydroxyl, amino and other hydrophilic groups" [6]."Humic substances (humic and fulvic acids) constitute 65-70% of the organic matter in soils, and are the subject of study in various areas of agriculture, such as soil chemistry, fertility, and plant physiology as well as environmental sciences, because the multiple roles played by these materials can greatly benefit plant growth" (Friedel and Scheller, [7], Bohme and ThiLua, [8] reported that "humic acid had beneficial effects on nutrient uptake by plants, and was particularly important for the transport and availability of micro- nutrients". "The effects of humic acids derived from different organic wastes on seedling growth of tomato in some growth media were investigated" by Atiyeh et al., [9].

"Salicylic acid is ortho- hydroxybenzoic acid and is a secondary metabolite acting as analogous of growth regulator of Phenolic nature, with part. It helps in protection of nucleic acids and prevention of protein degradation. The salicylic acid is also known to induce many genes coding for parthenogenesis and proteins in response to biotic and abiotic stresses" [10]. "Several studies also indicated that SA distributers in a wide range of plant species which induces biotic and abiotic stress tolerance in crops" [11].

"Salicylic acid can inhibit the proteinase inhibitor synthesis induced by wounding. Salicylic acid plays as a signal in plant-microbe interaction and added that antioxidants which are considered safe to human and environment had been used successfully to control some plant" diseases. [12].

## 2. MATERIALS AND METHODS

### 2.1 Experimental Materials

In the present study, Cowpea variety "*Japani LaL dana*" was taken as experimental material to find out the response of growth regulating chemicals humic acid and salicylic acid on physiological,

biochemical and yield parameters of cowpea (*Vigna unguiculata*).

## 2.2 Design of Experiment

The design of the experiment was Randomized Block Design and the treatments were replicated thrice. The area of the experimental plot was 6 sqm and the crop was sown at the seed rate was 25 kg $ha^{-1}$. Plant to plant and row to row spacing was 50 cm and 80 cm, respectively. The RDF was applied at the rate of 20 N, 40 $P_2O_5$ and 0 $K_2O$ (kg $ha^{-1}$).

## 2.3 Field Preparation

The experimental field was properly levelled followed by preparatory irrigation. After that the field was ploughed twice and later crop was sown.

## 2.4 Application of Fertilizers

Nitrogen, phosphorus and potassium were applied in the ratio of 20:60:0 kg $ha^{-1}$ as basal dose through urea, single superphosphate and muriate of potash, respectively.

## 3. RESULTS AND DISCUSSION

## 3.1 No. of Pods Per Plant

The data on number of pods per plant have been presented in Table 1. The data revealed that the maximum pod per plant was recorded with $T_5$ followed by $T_4$. On the other hand, minimum number of pods per plant recorded in $T_2$. Kuttimani et al., [13] recorded all yield parameters and economics was found by application of salicylic acid on green gram.

## 3.2 Pod Length (cm) and Number of Seed Per Pod

The data on pod length and Number of seed per pod have been presented in Table 1. The mean data revealed that the maximum pod length and number of seed per pod was recorded in $T_5$, followed by $T_4$. These results were strongly supported by Saishanker [14], Rahman et al., [15], Mandavia et al., [16]. They reported the effect of salicylic acid on different crops to improve the yield and yield components.

## 3.3 100 Seed Weight (g)

Data pertaining to 100 seed weight is given in Table 1. Maximum, 100 seed weight was recorded with $T_5$ which is superior over rest of the treatments while $T_2$ and $T_3$ treatment show at par result significantly higher over rest of the treatment.

## 3.4 Seed Yield

The maximum seed yield per plant of 13.10 g was reported with the application of humic acid @ (26 ml/liter water) and 0.2% salicylic acid at 35, 55 and 65 DAS, as given in Table 2. The minimum seed yield per plant was found in treatment $T_2$. Patel et al., [17] noted that “the

**Table 1. Effect of Humic acid and salicylic acid on No. of pod $plant^{-1}$, pod length (cm), No. of seed $pod^{-1}$ and 100 seed weight (g) of cow pea**

| Treatments | No. of pod $plant^{-1}$ | Pod length (cm) | No. of seed $pod^{-1}$ | 100 seed weight (g) |
|---|---|---|---|---|
| **$T_1$** -Control (Water spray) | 4.33 | 33.33 | 9.33 | 11.15 |
| **$T_2$ -** Foliar spray of humic acid (26 ml/liter water) at 25 DAS and 0.2% salicylic acid 55 DAS | 5.67 | 33.66 | 10.33 | 12.13 |
| **$T_3$**- Foliar spray of humic acid (26 ml/liter water) at 35 DAS and 0.2% salicylic acid 55 DAS | 5.67 | 48.33 | 11.67 | 12.12 |
| **$T_4$**- Foliar spray of humic acid (26 ml/liter water) and 0.2% salicylic acid at 25, 55, and 65 DAS | 7.67 | 65.56 | 12.67 | 12.88 |
| **$T_5$ -** Foliar spray of humic acid (26 ml/liter water) and **0.2**% salicylic acid at 35, 55 and 65 DAS | 8.33 | 75.92 | 13.67 | 13.29 |
| **$T_6$** - Foliar spray of humic acid (26 ml/liter water) at 25, 55, and 65 DAS | 6.33 | 44.32 | 11.00 | 12.28 |
| **SEm±** | 0.35 | 2.06 | 0.42 | 0.24 |
| **CD at 5%** | 1.10 | 6.50 | 1.31 | 0.77 |

**Table 2. Effect of humic acid and salicylic acid on seed yield (g) plant$^{-1}$ and harvest index (%) of cowpea**

| Treatments | Seed yield (g) plant$^{-1}$ | Harvest Index (%) |
|---|---|---|
| **$T_1$** -Control (Water spray) | 4.55 | 30.15 |
| **$T_2$ -** Foliar spray of humic acid (26 ml/liter water) at 25 DAS and 0.2% salicylic acid 55 DAS | 5.93 | 31.49 |
| **$T_3$**- Foliar spray of humic acid (26 ml/liter water) at 35 DAS and 0.2% salicylic acid 55 DAS | 6.89 | 32.19 |
| **$T_4$**- Foliar spray of humic acid (26 ml/liter water) and 0.2% salicylic acid at 25, 55, and 65 DAS | 10.83 | 38.78 |
| **$T_5$ -** Foliar spray of humic acid (26 ml/liter water) and 0.2% salicylic acid at 35, 55 and 65 DAS | 13.10 | 42.28 |
| **$T_6$** - Foliar spray of humic acid (26 ml/liter water) at 25, 55, and 65 DAS | 7.01 | 32.53 |
| **SEm±** | 0.37 | 1.95 |
| **CD at 5%** | 1.17 | 6.15 |

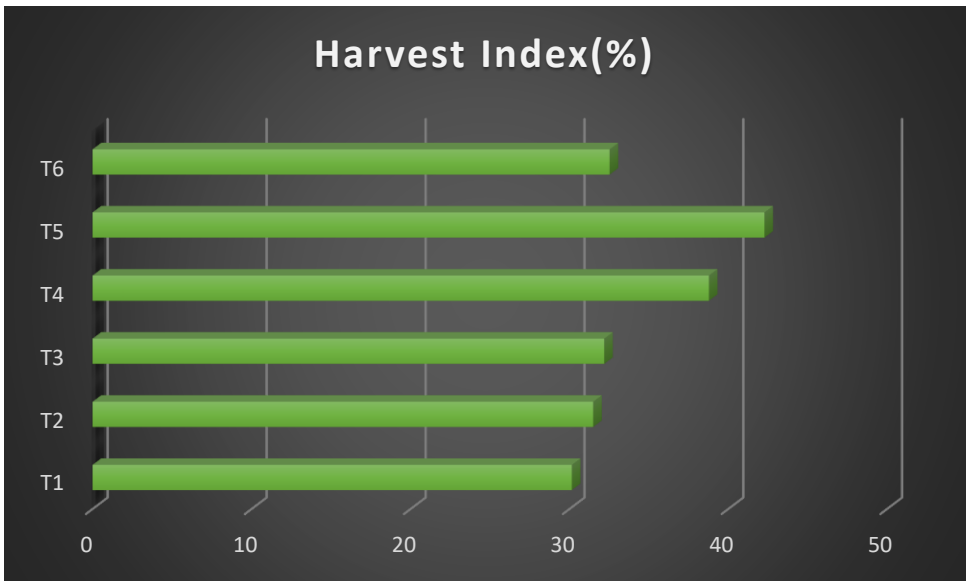


**Fig. 1. Harvest index (%)**

yield was increased by the application of salicylic acid on chickpea". Sharif et al. [18] found that "addition of 0.5-1.0 kg ha$^{-1}$ humic acid resulted in increased wheat grains yield by 25-69% over control. However, HA was better when applied singly". Khan and Mir [19] emphasize "significant effect of lignite humic acid on yield and yield components of wheat using different phosphate fertilizers". Duplessis and Mackenzie [20] found that "the grain yield of legumes, such as mung bean (mash bean=moong) (Vigna radiate L.), soybean (Glycine max L.) and pea (*Pisum sativum* L.) increased by the use of these humic substances". Similar results reported by, El-Hefny [21], Iswaran et al., [22] and Magdi [23] in cowpea.

### 3.5 Harvest Index (%)

The data pertaining to harvest index is given in Table 2, Fig 1. The maximum harvest index of 42.28% was found in treatment $T_5$ with the application of humic acid @ (26 ml/liter water) and 0.2% salicylic acid at 35, 55 and 65 DAS.

## 4. CONCLUSION

The investigation revealed significant insights into the impact of different levels of humic acid and salicylic acid on cowpea yield parameters. The results underscore the efficacy of the combined treatment with foliar spray of humic acid (26 ml/liter water) and 0.2% salicylic acid at

specific stages, particularly at 35, 55, and 65 DAS (Days After Sowing). This treatment not only maximized pod per plant but also enhanced pod length, seed number per pod, 100-seed weight, seed yield per plant, and harvest index. These findings suggest a promising approach to optimize cowpea production and contribute to agricultural advancements, highlighting the potential benefits of strategic nutrient management strategies in crop cultivation.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES


1. Carsky RJ, Sanginga N, Schulz S, Vanlauwe B. Promising practices for sustainable intensified systems in the savannah zone of West Africa. In Savanes africaines: des espaces en mutation, des acteurs face à de nouveaux défis. Actes du colloque, Garoua, Cameroun Cirad-Prasac. 2003;10
2. Tarawali SA, Singh BB, Gupta SS, Tabo R, Harris F, Nokoe S, Odion EC. Cowpea as a key factor for a new approach to integrated crop–livestock systems research in the dry savannas of West Africa; 2003.
3. Sanginga N, Dashiell KE, Diels J, Vanlauwe B, Lyasse O, Carsky RJ, Ortiz, R. Sustainable resource management coupled to resilient germplasm to provide new intensive cereal–grain–legume–livestock systems in the dry savanna. Agriculture, Ecosystems & Environment. 2003;100(2-3):305-314.
4. Dadson RB, Hashem FM, Javaid IQBA. L., Joshi JAGMOHAN, Allen AL, Devine TE. Effect of water stress on the yield of cowpea (*Vigna unguiculata* L. Walp.) genotypes in the Delmarva region of the United States. Journal of Agronomy and Crop Science. 2005;191(3):210 -217.
5. Aikins SHM, Afuakwa JJ. Growth and dry matter yield responses of cowpea to different sowing depths. ARPN Journal of Agricultural and Biological Science. 2008;3 (5-6):50-54.
6. Andreux F. Humus in world soils. In Humic substances in terrestrial *ecosystems* Elsevier Science BV. 1996;45-100
7. Friedel JK, Scheller E. Composition of hydrolysable amino acids in soil organic matter and soil microbial biomass. Soil Biology and Biochemistry. 2002;34(3):315-325.
8. Böhme M, Thi Lua H. Influence of humic acid on the growth of tomato in hydroponic systems. In International Symposium on Growing Media and Hydroponics. 1999; 548:451-458).
9. Atiyeh RM, Lee S, Edwards CA, Arancon NQ, Metzger JD. The influence of humic acids derived from earthworm-processed organic wastes on plant growth. Bioresource Technology. 2002;84 (1):7-14.
10. Enyedi AJ, Yalpani N, Silverman P, Raskin I. Localization, conjugation, and function of salicylic acid in tobacco during the hypersensitive reaction to tobacco mosaic virus. Proceedings of the National Academy of Sciences. 1992;89(6):2480-2484.
11. Javid MG, Sorooshzadeh A, Moradi F, Modarres Sanavy SAM, Allahdadi I. The role of phytohormones in alleviating salt stress in crop plants. Australian Journal of Crop Science. 2011;5(6):726-734.
12. Elad Y. The use of antioxidants (free radical scavengers) to control gray mould (*Botrytis cinerea*) and white mould (*Sclerotinia sclerotiorum*) in various crops. Plant Pathology. 1992;41:417-426
13. Kuttimani R, Velayutham A. Foliar application of nutrients enhances the yield attributes and nutrient uptake of greengram. Agricultural Science Digest-A Research Journal. 2011;31(3):202-205.
14. Saishankar S. Influence of plant growth regulators, chemicals and nutrients in greengram [*Vigna radiata* (L.) wilezeak]. M.Sc. (Agri.) Thesis, Univ. of Agric. Sci., Dharwad, Karnataka (India); 2001.
15. Rahman MS, Tahar NIMA, Karim MA. Influence of GA3 and MH and their time of Spray on Dry Matter Accumulation and Growth Attributes of Soybean; 2004.
16. Mandavia MK, Karkar C, Mandavia C, Khasiya V. Effect of salicylic acid and brassinolide on yield and quality traits of chickpea seeds. Indian Journal of Agricultural Biochemistry. 2006;19(1):29-31.
17. Patel PK, Hemantaranjan A. Salicylic acid induced alteration in dry matter partitioning, antioxidant defence system and yield in chickpea (*Cicer arietinum* L.)

under drought stress. Asian Journal of Crop Science. 2012;4(3):86-102.
18. Sharif M, Khattak RA, Sarir MS. Effect of different levels of lignitic coal derived humic acid on growth of maize plants. Communications in soil Science and Plant Analysis. 2002;33(19-20):3567-3580.
19. Khan AR, Mir S. Plant growth stimulation of lignite humic acid part-ii effect of lig nite derived ammonium humate on wheat (*Triticum aestivum*-V) C rop using different levels of phosphate fertilizer. Biological Sciences-PJSIR, 2002;45(4):273-276.
20. Duplessis GL, Mackenzie AF. Effects of leonardite applications on phosphorus availability and corn growth. Canadian Journal of Soil Science. 1983;63(4):749-751.
21. El-Hefny EM. Effect of saline irrigation water and humic acid application on growth and productivity of two cultivars of cowpea (*Vigna unguiculata* L. Walp). Australian Journal of Basic and Applied Sciences. 2010;4(12):6154-6168.
22. Iswaran V, Jauhri KS, Sen A. Effect of charcoal, coal and peat on the yield of moong, soybean and pea. Soil Biology & Biochemistry. 1980;12(2):191-192.
23. Magdi TA, Selim EM, El-ghamry AM. Integrated effect of bio mineral for and humic substance on growth yield and nutrient contents of fertigation Cowpea (*Vignaunui culata* L.) grown on sandy soils. J Agron. 2011; 10.



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