# Residual Effect of Green Manure (Sesbania *Aculeata*) Decomposed with Distillery Effluent on Seed Germination and Growth of *Cicer Arietinum* L.

Ruby Rani
Research Scholar, Ph.D., C.C.S University Meerut, Environmental Science Lab.,
Department of Botany, Kisan P.G. College, Simbhaoli, Hapur, U.P., India.
Singhruby.978@gmail.com

*A study was carried to observe the effect of green manure decomposed by distillery effluent on Cicer arietinum L.cv. 256. The study revealed that 50% concentration of treated distillery effluent with green leaf manure (Sesbania aculeata) has promotory effect than 100% concentration and only green leaf manure over control. The germination percent, seedling growth, germination relative index, phytomass and vigour index were found higher in 50% concentration of distillery effluent with green leaf manure. As green manure envisages a comprehensive management approach to improve the health and underlying productivity of the soil. Therefore, it is recommended that distillery effluent has appreciable amount of plant nutrients which can be assimilated into soil for growth after proper dilution and treatment.*

**Keywords:** Distillery effluent, green manure, *sesbania aculeata*, comprehensive management, *Cicer arietinum* L.

## 1. INTRODUCTION

Chickpea (*Cicer arietinum L.*) is an important pulse crop grown in tropical, subtropical and temperate regions. In India, chickpea occupies the first position among pulses, occupying about 31% of the total area (7.29 mha) and contributing to nearly 40% (5.77mt) of the total pulse production (FAO 2004) [1].

Distilleries producing alcohol from molasses are considered to be one of the most polluting agro-based industries. The distilleries waste water is known as spent wash. Treated post methanated spent wash is characterized by its colour, high rates of bio chemical and chemical oxygen demand (BOD: 52-58 kg/$m^3$), COD: 92-100kg/$m^3$ and suspended solids (2.0-2.5 kg/$m^3$) [2]. Application of distillery effluent at 50$m^3$ $ha^{-1}$ will supply 75Kg N, 40Kg P, 500Kg K, which represent almost half the N and P and 100%K requirement of the crop [3] .The distillery effluent contains high loads of minerals, its application significantly improved the physical properties of soil [4].

Green manure (Sesbania rostrata) crop indirectly increases the phosphorus availability to the succeeding crop. They convert phosphorus applied in leguminous green manuring crop into organic form becomes more easily available after decomposition in soil [5].

The present investigation has been conducted to observe the physico-chemical characteristics of disposed distillery effluent for environmental conservation on green

manure decomposition by distillery effluent was studied and its effect on germination percentage and growth of Cicer arietinum L.cv. 256 were observed. Seeds were procured from I.A.R.I, New Delhi.

## 2. MATERIALS AND METHODS

The partially treated distillery effluent of Simbhaoli Sugar Mills Limited Unit Distillery Division, Simbhaoli (Hapur) U.P was collected for Physico-chemical examination. The effect of effluent on decomposition of green manure in soil was observed.

The green manure (Sesbania aculeata) was grown for 45 days and decomposed by distillery effluent and then crop *Oryza Sativa* was grown and harvested. Thereafter, the residual soil is used for experiment.

The *Cicer arietinum* L. cv. 256 (chickpea) was grown to observe its effect on germination and growth in petriplates. The experiment was carried out in 4 treatments in three replications as under.

$T_1$= GLM (Sesbania aculeata) + 100% Distillery effluent.

$T_2$= GLM (Sesbania aculeata) + 50% Distillery effluent.

$T_3$ = GLM (Sesbania aculeata) + water.

### Control

Seeds of *Cicer arietinum* L. var. cv. 256 were surface sterilized with 0.1% mercuric chloride ($HgCl_2$) and 95% alcohol for 1 and 2 minutes, respectively. Seed viability was tested with the help of tetrazolium chloride (TTC) test [5]. Seeds selected were uniformly healthy and viable for short term exposure experiment. Sterilized seeds were germinated in petriplates (10cm in diameter) lined with whatman No.1 filter paper disc. 10 seeds were arranged equidistantly in concentric ring in petriplates with 50gm of residual soil.

Germination relative index (G.R.I) has been calculated as per the following equations:

G.R.I = (S) $X_n$ (K-n)

Where $X_n$ = No. of germinated seeds $n^{th}$ day

K = Total number of seeds

n = Number of days

Vigour Index were performed according to ISTA

Vigour index = Germination percent x shoot length

Phytotoxicity percentage was determined following Chou and Muller [6] as per following:

$$\text{Phytotoxicity percentage} = \frac{\text{Rootlength of control} - \text{Rootlength of test}}{\text{Rootlength of control}} \text{ x } 100$$

## 3. RESULTS AND DISCUSSION

Physico-chemical and biological characteristics of treated distillery effluent from distillery were analysed as givenin Table 1.

**Table 1**: Physico-chemical and biological characteristic of spent wash, post methanated effluent (PME) Treated distillery effluent.

| **Parameters** | **Range Values** | **PME** |
|---|---|---|
| Ph | 3.9-4.3 | 7.8 |
| EC (ds/m-1) | 30.5-45.2 | 14 |
| Biochemical Oxygen Demand (BOD) | 46100-96000 | 5000mg/L |
| Chemical Oxygen Demand (COD) | 79000-87990 | 11200mg/L |
| Total Dissolved Soild (TDS) | 1660-4200 | 28000mg/L |
| Total Solids (TSS) | | 2100mg/L |
| Nitrogen ($N_2$) | 1660-4200 | 2160 |
| Phosphorus ($P_2O_5$) | 225-3038 | 22-30 |
| Potassium ($K_2O$) | 9600-17475 | 4000-6000 |
| Calcium | 2050-7000 | 200 |
| Magnesium | 1715-2100 | 178 |
| Sodium | 92-670 | 40 |
| Sulphate | 3240-3425 | 255 |
| Chloride | 72338-42096 | 685 |
| SAR | 5.0-7.3 | 328 |
| Zinc (ppm) | 3.5-10.4 | 4.42 |
| Copper (ppm) | 0.4-2.1 | 0.52 |
| Manganese (ppm) | 4.6-5.1 | 4.38 |
| Gibberellic Acid | 3245-49443 | 0.63 |
| Indole acetic Acid | 25-61 | 0.46 |

*****All Values are in mg/L.

The plant samples for growth analysis of *Cicer arietinum* L.cv. 256 was studied on 3$^{rd}$, 5$^{th}$, 7$^{th}$, 10$^{th}$ and 15$^{th}$ days of germination . The data in residual soil of green leaf manure and distillery effluent were observed. Seed coat burst after 48 hours and showed the beginning of germination after 72 hours of treatment. Seed germination is seen on 3$^{rd}$ day ranging from 80% ($T_1$), 80% ($T_2$), 70% ($T_3$) and 70% over control.

**Table 2:** Effect of Distillery effluent on *Cicer arietinum* L. in Petriplates.

| S.No | Particulars | DAS | $T_1$ | $T_2$ | $T_3$ | Control |
|---|---|---|---|---|---|---|
| 1 | Germination % | 3 | 80 | 80 | 70 | 70 |
| | | 5 | 90 | 100* | 75 | 70 |
| | | 7 | 90 | 100* | 80 | 80 |
| | | 10 | 90 | 100* | 90 | 80 |
| 2 | Length of radical plant$^{-1}$ (cm) | 5 | 1.5 | 2* | 1.7 | 1 |
| | | 10 | 3.2 | 4.1* | 3.7 | 3 |
| | | 15 | 4.5 | 5.2* | 4.7 | 4.1 |
| 3 | Length of plumule plant $^{-1}$ (cm) | 5 | 2.7 | 3.2 | 2.8 | 2 |
| | | 10 | 4.8 | 5.3 | 5 | 4.36 |
| | | 15 | 6.5 | 7.5* | 7 | 6.2 |
| 4 | Phytomass of radicle plant $^{-1}$ | 15 | 1.2 | 1.7 | 1.3 | 1 |
| 5 | Phytomass of plumule plant $^{-1}$ | 15 | 2.25 | 2.8 | 2.5 | 2.04 |
| 6 | Phytotoxicity % of root | 5 | -0.5 | -0.1 | -0.7 | - |
| | | 10 | -6.66 | -23.33 | -36.66 | - |
| | | 15 | -9.756 | -26.829 | -14.634 | - |
| 7 | Phytotoxicity % of shoot | 5 | -35 | -60 | -40 | - |
| | | 10 | -11.627 | .23.255 | -16.279 | - |
| | | 15 | -4.838 | -20.967 | -12.903 | - |

*CD at 5% level.

$T_1$ = GLM + 100% D.E — GLM = Green Leaf Manure (Sesbania aculeata)

$T_2$ = GLM + 50% D.E — D.E = Distillery Effluent

$T_3$ = GLM + Water

The germination on the subsequent days increased steadily upto 7$^{th}$ day. The germination emerged on 10$^{th}$ day is 90% ($T_1$), 100% ($T_2$), 90% ($T_3$) and 80% over control as tabulated in Table 2. The seed germination % is higher in $T_2$ than $T_1$ and $T_3$ over control. Goel and Kulkarni [8] observed that 25% of sugar mill effluent has been promoting effect on the *Cicer arietinum* L. Regarding, the effect of higher osmotic pressure on seed germination. Rodger et. al. [9] reported that higher osmotic pressure causes retardation of germination. The cause of higher osmotic pressure is the higher electrical conductivity, the same type of finding has been reported by Ramana et. al. [10], Soundarrajan [11]. The radical length was increased in $T_2$ (5.2cm) residual soil in comparison to $T_1$ (4.5cm) and $T_3$ (4.7cm) than control (4.1cm). The plumule length was

increased in $T_2$ (7.5cm) in comparison to $T_1$ (6.5cm) and $T_3$ (7.0cm) than control (6.2cm) as shown in Table 2. Similar results have been obtained by Rajannan [12], Sahai [13].

Experiments revealed that phytomass of radical in *Cicer arietinum* L. cv. 256 increased in $T_2$ (1.7mg) in comparison to $T_1$ (1.2mg) and $T_3$ (1.3mg) over control (1.0mg). Phytomass of plumule was highest in $T_2$ (2.8mg) and $T_3$ (2.5mg) over control (2.04mg).

Germination Relative Index (G.R.I in %), vigour index (Figure 1 and 2) and phytotoxicity percentage (Table 2) also followed the same trend and revealed that 50% concentration with green leaf manure has promotory effect in *Cicerarietinum*. Higher significance results were obtained in $T_2$ treated effluent in *Cicerarietinum* seedlings in comparison to 100% over control as in Table 2.

It is studied that increased N.P.K and S content in soil has been found increased the growth from green manure treatments. This may be described to the growth promoting properties of organic matters (compost) and biofertilizers which has also been observed by Raju et. al. [14], Amin *et. al.* [15].

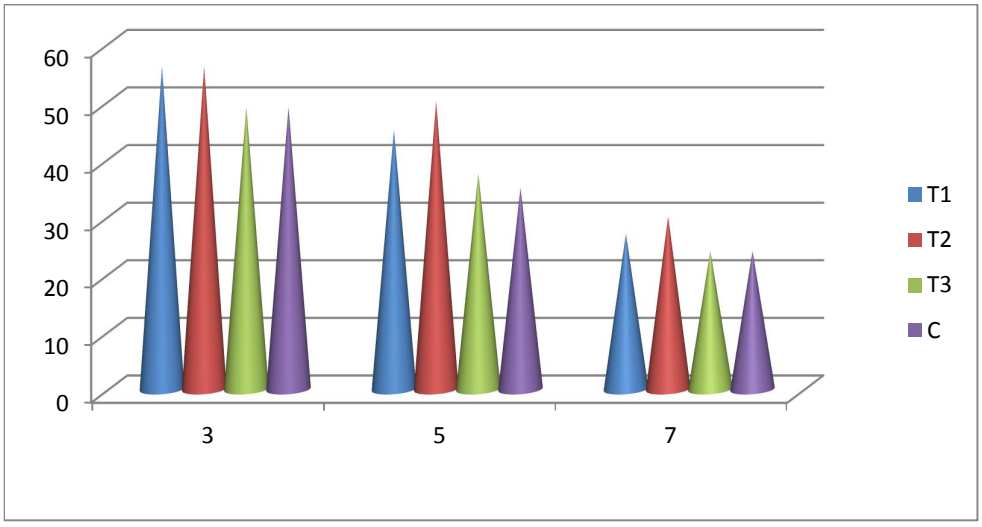


**Fig. 1:** Effect of green leaf manure with distillery effluent on germination relative index (G.R.I.) of *Cicer arietinum* L. cv.256.

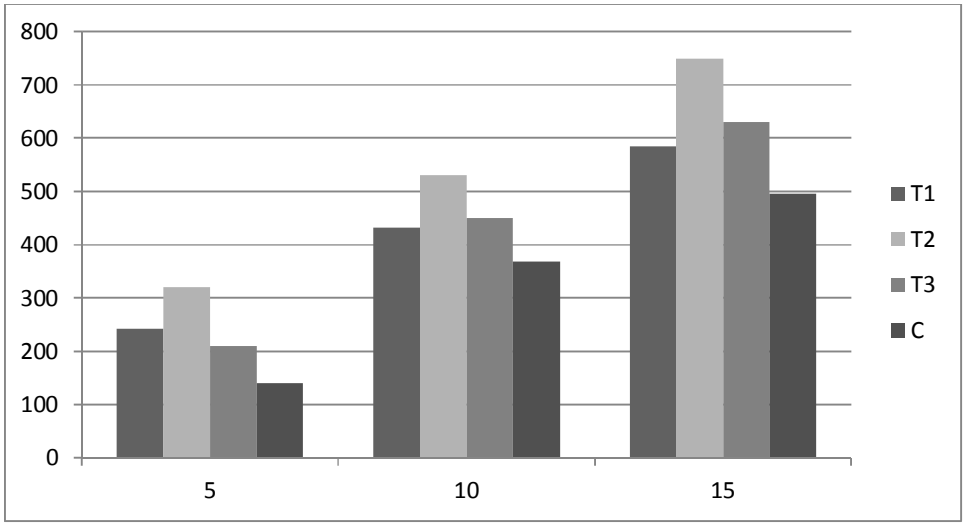


**Fig. 2:** Effect of green leaf manure with distillery effluent on vigour index (V.I.) of *Cicer arietinum* L.cv.256.

## 4. CONCLUSION

Thus, it is concluded that effect of distillery effluent on decomposition of green manure (Sesbania aculeata) in (GLM + 50% D.E) revealed enhanced growth and germination in residual soil on test crop *Cicer arietinum* L. As green manure is a controlled microbiological process where microorganisms reduce solid waste and convert raw materials into humus like material that provides an amendment for soil fertility and treated distillery effluent has appreciable amount of plant nutrients which can be assimilated into soil for growth after proper dilution [16].

## ACKNOWLEDGEMENT

I am grateful to Mr. I.S. Bhatia GM of S.S Mills, Simbhaoli (Hapur) and Members of Environmental Science Laboratory Department of Botany, Kisan (P.G) College, Simbhaoli and research scholars, who helped me in present investigation, without which it was not possible to gratinate it.

## REFERENCES

[1] L.S. Rao, P.S. Deshmukh, P.U. Rani and P.A. Kumar; “Genotypic variability among chickpea cultivars (*Cicerarietinum L.*) in salinity tolerance to NaCl and selection of salinity tolerant cultivar at germination stage”, Crop Res., Vol. 32(3), pp. 542-547, 2006.

[2] T. Nandy, S. Shastry and S.N. Kusul; “Waste water management in a cane molasses distillery involving bioresourse recovery”, J. Environ Manage., Vol. 65(1), pp. 25-38, 2002.

[3] K. Rajukkannu, T.S. Manickam, K. Shanmugam, A. Chandrasekaran and R. Gladis; Proceedings of National Symposium on use of distillery and sugar industry wastes in agriculture. 28th and 29th October, 1996. AC and RI, Trichy. pp. 30-39, 1996.

[4] H.C. Joshi, A. Chaudhary, H. Pathak, N. Kalra, R. Chaudhary and S. Kumar. Proceedings of National Symposium on use of distillery and sugar industry wastes in agriculture. 28th and 29th October, 1996. AC and RI, Trichy. pp. 97-107, 1996.

[5] R.K. Hundal and J.S. Brar; "Green manuring cost effective practice", Agrobios, Vol. 4(12), 2005.

[6] A. Thakur, R. Mehta and P.S. Thakur; "Germination, Viability and Vigour of fresh and Aged seeds of some endangered medicinal plant species of Western Himalayas", J. Plant Physiol., Vol. 9(3), pp. 247-254, 2004.

[7] C.H. Chou and C.H. Muller; "Allelopathic mechanisms of Archrostaphylous glandulosa var. zaraensis", Am. Mid. Nat., Vol. 88, pp. 324-347, 1972.

[8] P.K. Goel and S.M. Kulkarni; "Effects of sugar factory waste on germination of gram seeds (*Cicerarietinum* L.)", International Journal of Environment and Pollution, Vol. 1(1), pp. 35-53, 1994.

[9] J.B.A. Rodger, G.G. Williams and R.L. Davis; ''A Rapid method for determining winterhardiness in Alfalfa'', Agronomy Journal, Vol. 49(2), pp.88-92, 1957.

[10] S. Ramana, A.K. Biswas, S. Kundu, J.K. Saha and R.B.R. Yadav; "Effect of distillery effluent on seed germination in some vegetable crops", Bioresource Technology, Vol. 82(3), pp. 273-275, 2002.

[11] M. Soundarrajan, G.J. Pitchaiames and T.S. Kumar; "Effect of distillery spentwash on seed germination, seedling growth and yield of Bhendi *Abelmaschus esculentus* (L.) monech", J. Ad. Plant Sci., Vol. 20(1), pp.141-143, 2007.

[12] G. Rajannan, L. Devarajan, J. Prabhakaran and G. Oblisami; "Assessment of impact on the use of distillery effluent as irrigation water to banana crop", In National Seminar of application on treated effluent for irrigation, held at R.E.C. Trichy, March, Vol. 23, pp. 24-31, 1998.

[13] N. Srivastav and R. Sahai; ''Effects of distillery waste on the performance of *Cicer arietinum L.*'', Environ. Pollut., Vol. 43(2), pp. 91-102, 1987.

[14] R.A. Raju and B. Gangwar; "Utilization of potassium-rich green leaf manures for rice (*Oryza sativa*) nursery and their effect on crop productivity", Indian Journal of Agronomy, Vol. 49(4), pp. 244-247, December 2004.

[15] M. Amin, H.R. Jamshid, E.A. Khan and M. Ramzan; "Comparative response of diverse rice varieties to green manuring (*Sesbania aculeata*)", Journal of Research (Science), Bahauddin Zakariya University, Multan, Pakistan, Vol. 16(1), pp. 39-43, 2005.

[16] N.M. Zalawadia, S. Raman and R.G. Patic; ''Influence of diluted spent wash of sugar industries application on yield and nutrient uptake by sugarcane and changes in soil properties'', J. Indian Soc. Soil. Sci., Vol. 45(6), pp. 767-769, 1997.