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# Effect of bio-agents and polymer on yield and quality of chickpea seed (*Cicer arietinum* L.)

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**ABSTRACT**

*The present study was carried out atSam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad during rabi season 2011-12 to know the effect of bioagent and polymer on seed yield and seed quality of chickpea. The experiment consisted of seven treatments $T_0$: Control, $T_1$: Rhizobium @ 30 g $kg^{-1}$ seed, $T_2$: Pseudomonas fluorescence @ 30 g $kg^{-1}$ seed, $T_3$: Bacillus subtilis @ 30 g $kg^{-1}$ seed, $T_4$:Trichodermaviridae@ 10 g $kg^{-1}$ seed, $T_5$: VAM @ 15 kg/ha, $T_6$: Polymer@1.5 g $kg^{-1}$ seed. The bioagents and polymer for chickpea variety were evaluated following 11 quantitative characters viz., Days to 50% flowering, number of pods per plant, number of seeds per pod, biological yield per plant, seed index, seed yield per plant and seed yield quintal per hectare and 6 qualitative characters viz., protein content, germination %, root length, shoot length, seedling length and seedling dry weight . The present investigation revealed that the treatment $T_2$(Pseudomonas fluorescence @ 30 g $kg^{-1}$) seed was found to be significant superior in yield on the basis of mean performance of the seed yield per plant and seed yield quintal per hectare. High protein content and germination per cent were also recorded in treatment $T_2$. Thus with the present study it can be concluded thatthe $T_2$ is the best treatment for chickpea variety on basis of seed yield and seed quality.*

***Keywords***: Bio-agent, chickpea, polymer coating, protein

Chickpea (*Cicerarietinum* L.) is an important Rabi season self-pollinated legume crop having extensive geographical distribution. Chickpea is known by different names in various countries such as Gram, Chana, Bengalgram *etc*. Chickpea is a diploid species with a chromosome number 2n=16. It belongs to sub family *Papilionaceae* of the family *Leguminaceae.* Chickpea is mostly consumed in the form of processed whole seed (boiled, yeasted, parched, fried, steamed, sprouted etc) or dal and flour (besan). Gram is a good source of protein (18-22%), carbohydrate (52-70%) and 4-10% of fat (Togay *et al*., 2008).

Bioagents an insect (or micro-organisms) introduced in a controlled setting to help manage or eliminate a specific species (*e.g.*, leafy spurge or purple loosestrife) where other control mechanisms such as herbicides are ineffective or environmentally unsafe. Similarly bio-fertilizers such as Rhizobium and Phosphorous Solubilizing Bacteria (PSB) also have beneficial influence on plant growth, seed yield and quality as they fix large quantity of biological nitrogen. Rhizobium inoculation with jce-1 strain showed the maximum pod yield which was 11.16 higher than no inoculation treatment (Dutta *et al*., 2006). The application of micronutrient and bio-fertilizers through seed treatment not only economies the cost of nutrients but also are readily available to the young seedlings for their vigorous growth and this initial early benefit would help to obtain higher seed yield and quality. However, studies on influence of seed treatments with micronutrients and bio-fertilizers on plant growth, seed yield and quality in chickpea. Polymer coating is adapted from the pharmaceutical and confectionary industries for uniform application of material to seeds. The film formulations consist of a mixture of polymer, plasticizer and colorants (Halmer, 1988; Robani, 1994) that are commercially available as ready to use liquids or as dry powders. The film formed around seed act as a physical barrier, which has been reported to reduce leaching of inhibitors from the seed coverings and may restrict oxygen diffusion to the embryo (Duan and Burris, 1997).The present experiment has been carried out to assess the effect of bioagents and polymer on seed yield and seed quality and identify the best treatment of bioagents and polymer for the chickpea variety.

## MATERIALS AND METHODS

A field experiment was conducted during *Rabi* 2011-12 at Research farm Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad. This experiment was conducted to assess the effect of polymer and bio-agents on seed yield and seed quality of chickpea cv. Pusa 362. Before sowing, seeds were treated with bio-agents along with jaggery solution as an adhesive and polymer dyes. Treated seeds were dried under shade for an hour and used for sowing. The treatments consisting of $T_0$: Control, $T_1$: *Rhizobium* @ 30

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g/kg seed, $T_2$: *Pseudomonas fluorescence* @ 30 g $kg^{-1}$ seed, $T_3$: *Bacillus subtilis* @ 30 g $kg^{-1}$ seed, $T_4$:*Trichoderma viridae* @ 10 g $kg^{-1}$ seed, $T_5$: VAM @ 15 kg $ha^{-1}$, $T_6$: Polymer@1.5g $kg^{-1}$ seed. Protein content was determined by the Lowry *et al.* (1951) method.The experiment was laid out in RBD with three replications. Standard agronomic practices and plant protection measures were taken as per schedule. Observations were recorded on five randomly selected plants per replication for field emergence, plant height; number of pods $plant^{-1}$, seed index and seed yield $plant^{-1}$ and days to 50% flowering and days to maturity were recorded on plot basis.

**RESULTS AND DISCUSSION**

Polymer coating acts as temperature switch and protective coating by regulating the seed coating, intake of water until the soil has warmed to a predetermined temperature. It enables accurate and even doses of chemicals and reduces chemical wastage and also makes room for including all the required ingredients like inoculants, protectants, nutrients, herbicides, oxygen suppliers, *etc*. It also provides resistance against mechanical damage in the seed drill. Thus, improves the appearance and quality of treated seeds (Vanangamudi *et al.*, 2003).

The results estimated from the data of present investigation, which was point out to assess seed yield, quality parameters and identification of best treatment are presented and discussed. The analysis of variance for different 11 characters showed in (Table1) and 6 characters in (Table 2). The result showed significant difference for mean sum of square at 5% level for all the characters under study among 7 treatments. The present investigation revealed that the treatment $T_2$ (*Pseudomonas fluorescence* @ 30 g $kg^{-1}$) seed was found to be significant superior in yield on the basis of mean performance of the seed yield per plant and seed yield quintal per hectare, high protein content and germination per cent as compared to untreated control. Days to 50% flowering ranged from 69.67 to 86.67. $T_0$ (69.67) estimated minimum days to 50% flowering where as $T_2$ (86.67) estimated maximum.The delay in flowering may be due to non availability of plant growth promoting substances, less nutrient mobilization and low nutrient uptake. Plant height ranged from 49.13 to 78 cm. $T_2$ (78.00 cm) observed maximum plant height where as minimum value of plant height was exhibited by $T_6$ (49.13 cm).It has been reported that inoculation chickpea with both *P.fluorescence* and *Rhizobium* enhances stem height, root length and dry weight **(**Dilipkumar *et al*., 2001).Mekki and Amel (2005) also claimed that application of biofertilizer increase plant height and dry weight of soybean. Number of pods per plant ranged from 48.13 to 75.43. Treatment $T_2$ (75.43), followed by $T_6$ (70.33), $T_3$ (69.06) exhibited max number of pods per plant whereas treatment $T_0$ (48.13) estimated minimum. The effects of organic and biologic fertilizers on soybean growth and quality of seed**,** Mekki and Amel (2005) showed that the number of pods per plant was increased by applying biofertilizer. Number of seeds per pod ranged from 1.3 to 2.0. Treatment $T_2$ (2.0) exhibited max number of seeds per pod where as treatment $T_0$ (1.3) estimated minimum. However, $T_3$ (1.67) where statistically at par with treatment $T_2$ (2).These results are in confirmation with that of Karadavut and Ozdemir (2001) and Fatima et *al*., 2008 who reported that inoculation significantly increased grain yield (20% higher than control.)

After being dry, the harvested seed crop in the field the weight of dry seed including the respective dry plant was taken for biological yield. The mean performance of biological yield per plant ranged from 38.10 to 58.90, with a grand mean of 48.67. The maximum values for biological yield per plant were recorded in treatment $T_2$ (58.90). The minimum value recorded for biological yield per plant in $T_0$ (38.10) followed by $T_4$ (56.23) and $T_6$ (43.97). However, $T_4$ (56.23) where statistically at par with treatment $T_2$ (58.90). Data for seed index range from 18.67 gm to 29.20 g. $T_2$ (29.20g) estimated maximum seed index whereas treatment $T_5$ (18.67 gm) estimated minimum.

This increase in 100 grains weight may be due to the more availability of nutrients like nitrogen and phosphorus in the rhizosphere and less losses as compared to the broadcast method. These findings are in agreement with those of Timmons *et al*. (1973) who reported less losses of fertilizer in band placement. Similar results were reported by Alam *et al*., (1999), El-Hadi and Sheikh (1999) Meena *et al*., (2001) and Kyei-Boahen *et al*., (2002) who stated that *Rhizobium* inoculation significantly increased 100 seed weight and yield. Data for harvest index ranged from 19.72 to 30.15. $T_2$ (30.15) estimated maximum harvest index. However $T_0$ (19.72) exhibited minimum. However, $T_4$ (27.33) was statistically at par with treatment $T_2$(30.15).

Protein content of treatments ranged from 16.37 to 24.33 percent. $T_2$ (24.33) recorded for maximum protein content followed by $T_4$ (22.33) and $T_6$ (21.66) however treatment $T_0$ (16.37) exhibited less protein content. Data for seed yield per plant ranged from 10.70 to 17.03. $T_2$

**Table 1: Performance of treatments on quantitative characters of chickpea**

| Treatments | 50% flowering (Days) | Plant height (cm) | Days to maturity | Primary branches plant$^{-1}$ | No. pods plant$^{-1}$ | Biological yield plant$^{-1}$ (g) | Seed index (g) | Harvest index (%) | No. of seeds pod$^{-1}$ | Seed yield plant$^{-1}$ | Seed yield (q ha$^{-1}$) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $T_0$ | 69.67 | 72.00 | 128.3 | 7.37 | 48.13 | 38.10 | 21.87 | 19.73 | 1.30 | 14.73 | 12.66 |
| $T^1$ | 77.00 | 64.67 | 132.7 | 7.57 | 60.80 | 49.63 | 22.70 | 26.30 | 1.40 | 14.87 | 16.63 |
| $T^2$ | 86.67 | 78.00 | 137.0 | 6.43 | 75.43 | 58.90 | 29.20 | 30.14 | 2.00 | 17.03 | 19.96 |
| $T^3$ | 82.33 | 73.23 | 142.3 | 6.97 | 69.07 | 44.17 | 24.67 | 21.44 | 1.67 | 13.67 | 18.10 |
| $T^4$ | 79.00 | 67.70 | 138.7 | 5.67 | 58.93 | 56.23 | 21.33 | 27.33 | 1.50 | 10.70 | 17.47 |
| $T^5$ | 73.00 | 59.13 | 128.3 | 7.00 | 57.67 | 49.63 | 18.67 | 24.60 | 1.47 | 12.33 | 17.23 |
| $T^6$ | 83.00 | 49.13 | 147.3 | 5.33 | 70.33 | 43.97 | 26.50 | 24.94 | 1.60 | 14.66 | 18.20 |
| Average | 78.67 | 66.26 | 136.4 | 6.62 | 62.91 | 48.66 | 23.56 | 24.93 | 1.56 | 13.99 | 17.19 |
| Maximum | 86.67 | 78.00 | 147.3 | 7.57 | 75.43 | 58.90 | 29.20 | 30.15 | 2.00 | 17.03 | 19.96 |
| Minimum | 69.67 | 49.13 | 128.3 | 5.33 | 48.13 | 38.10 | 18.67 | 19.73 | 1.30 | 10.70 | 12.66 |
| **C.V.** | **7.56** | **14.68** | **5.22** | **12.81** | **14.74** | **14.96** | **14.92** | **14.11** | **14.60** | **14.49** | **13.09** |
| **LSD(0.05)** | **2.54** | **4.53** | **2.66** | **NS** | **2.18** | **4.66** | **1.70** | **3.37** | **0.39** | **1.60** | **2.10** |

*Note: GM = Grand Mean, LSD = Least signifcant difference, CV = Coefficient of variance. Legends: -$T_0$ –Control, $T_1$-Rhizobium, $T_2$-Pseudomonas fluorescence, $T_3$-Bacillus subtilis, $T_4$-Trichoderma viridae, $T_5$-VAM, $T_6$-Polymer*

**Table 2: Effect of treatments on qualitative characters of chickpea**

| Treatments | Protein content (%) | Germination (%) | Root length (cm) | Shoot length (cm) | Seedling length (cm) | Seedling dry wt. (mg) |
|---|---|---|---|---|---|---|
| $T_0$ | 16.37 | 83.33 | 11.33 | 6.60 | 17.95 | 1490.00 |
| $T_1$ | 16.75 | 89.00 | 19.67 | 9.93 | 29.60 | 140.67 |
| $T_2$ | 24.33 | 96.33 | 16.50 | 9.67 | 26.17 | 165.4 |
| $T_3$ | 19.67 | 94.67 | 14.67 | 9.07 | 23.73 | 189.67 |
| $T_4$ | 22.33 | 92.33 | 18.43 | 9.33 | 27.76 | 170.00 |
| $T_5$ | 18.50 | 91.00 | 16.67 | 7.67 | 24.33 | 176.00 |
| $T_6$ | 21.66 | 89.00 | 15.67 | 5.67 | 21.33 | 155.67 |
| Average | 19.94 | 90.80 | 16.13 | 8.27 | 24.41 | 163.77 |
| Maximum | 24.33 | 96.33 | 19.67 | 9.93 | 29.60 | 189.67 |
| Minimum | 16.37 | 83.33 | 11.33 | 5.67 | 17.95 | 140.67 |
| **C.V.** | **18.73** | **5.67** | **19.66** | **17.45** | **18.95** | **10.85** |
| **LSD (0.05)** | **1.72** | **5.95** | **1.64** | **0.92** | **1.70** | **3.89** |

(17.03) exhibited maximum seed yield per plant. Treatment $T_1$ (14.87) and $T_0$ (14.73) are statically at par with $T_2$ (17.03). However treatment $T_3$ (10.70) exhibited minimum. Bacteria had beneficial effect on plant growth and seed yield, because they fix atmospheric nitrogen and release auxins to the root zone to enhance growth (Rees *et al*.,2009). Addition of biofertilizer promotes bacterialresponse to nitrogen fixation and soil fertility. Higher rates of atmospheric nitrogen fixation promote growth and yield (El-Desuki *et al*., 2010).Data for seed yield ranged from 12.67 to 19.96. $T_2$ (19.96) exhibited maximum seed yield. However, treatment $T_0$ (12.67) exhibited minimum. It might be due to the availability of plantnutrients in the vicinity of rhizosphere and less losses of nutrient due to fertilizer banding. These results are in conformity with those of Din *et al.,* (1999) who recorded maximum yield in band placement. Seed inoculation also significantly affected the grain yield of chickpea.Germination (%) ranged from 89.00 to 96.33. $T_0$ and $T_1$, (89.00) estimated

minimum Germination (%) where as $T_2$ (94.33) estimated maximum.The higher germination percent may be due to release of growth promoting substance and antagonistic property of *Trichoderma viridae, Pseudomonas fluloscence* against seed borne pathogen.

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