

COMPARATIVE EFFECT OF SELECTED BACTERIAL CONSORTIA ON YIELD AND YIELD ATTRIBUTES OF CHICKPEA (*CICER ARIETINUM* L.)

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(Received 1 November, 2020; Accepted 2 January, 2021)

Key words : PGPR, *Rhizobium*, Chickpea.

Abstract – The use of PGPR for sustainable agriculture has increased very much in various parts of the world. Complex interactions between the root and associated microorganisms also improve plant growth parameters and yield. The present investigation was conducted in the Department of Agricultural Microbiology at IGKV, Raipur, (C.G.) during the rabi year 2018-19. It comprised of 10 treatments to assess the performance of chickpea under influence of individual microbes and their consortia. The maximum number of grain was observed due to the inoculation of T6 (C1+75% NPK + Chickpea *Rhizobium*) 134.31 grain per plant followed by the T7 (GmR8 + 75% NPK + Chickpea *Rhizobium*) 117.33 grain per plant and least was recorded in control 44.67 grain per plant. The highest grain yield was recorded in 2240 kg/ha followed by 2220 and 2200 kg per ha, due to seeds inoculated with T6 (C1+*Rhizobium*+75% NPK), T10 (ASL4 +75 % NPK+ Chickpea *Rhizobium*) and T8 (AZO137+ 75% NPK+ Chickpea *Rhizobium*) respectively. The lowest grain yield was 1726.67 kg per ha associated with control. The highest straw yield was noticed in 2533.30 kg/ha followed by 2466.70 kg per ha, by inoculated with T6 (C1+*Rhizobium*+75% NPK) and T8 respectively, and lowest 1980 kg per ha under control. These results show the potential to use PGPR in order to improve yields in Chickpea crop in fields.

INTRODUCTION

The chickpea (*Cicer arietinum* L.) is a pulse crop in the winter season as well as the people also use it as a green vegetable. In global terms, chickpea is the third most significant pulse crop after French beans (*Phaseolus vulgaris* L.). Chickpea content 18-22% protein, 52-70% carbohydrate, 4-10% fat, 3% fiber, minerals (phosphorus, calcium, magnesium, zinc, iron) and vitamins. Chickpea is the most significant pulse crop in India and the maximum growth rate was recorded during 2016-17 with a growth rate of 14 %. The highest area (10.57 million ha.) and production (11.16 million tonnes) were recorded in 2016-17 (Annual Report-2017-18). In Chhattisgarh, the chickpea is grown in an area of 349.81 thousand ha and average productivity of 1116 kg ha⁻¹ (Anon.2018-19).

In Chhattisgarh, the chickpea is cultivated throughout the district but is mainly cultivated in Bemetara, Kabirdham, Mungeli, Bilaspur, Raipur,

Baloda Bazar, Bhatapara, Durg, and Rajnandgaon. Farmers who have good irrigation facilities are mainly chickpeas grown in the winter season.

The use of PGPR is steadily increased in agriculture and offers an attractive way to replace chemical fertilizers, pesticides, and supplements. Preparations of live microorganisms utilized for improving plant growth and crop productivity are generally referred to as microbial inoculants (Subba Rao and Dommergues, 1998; Vessey, 2003) helps to promote growth by increasing the supply or availability of primary nutrient to the host plant (Narula *et al.*, 2005). The direct promotion of plant growth by PGPR involves the supply of chemicals that promote the plant growth that is produced by bacteria or facilitate the absorption of certain nutrients from plant from the soil. The indirect support of the plant growth occurs through PGPR due to the prevention of the harmful effects of phytopathogenic microorganism. On the other hand, the discovery, selection, and application of

crop beneficial microorganism can increase the options for dealing with growth problems and may even be eco- friendly In the present research work Rhizobial & other microorganism were used to study their effect on yield and yield attributing characters of Chickpea (*Cicer arietinum* L.).

MATERIALS AND METHODS

This experiment was conducted at the Department of Agricultural Microbiology, Instructional cum research farm at Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) during the rabi period 2018-19.

The rhizobacterial culture was procured here in the pure slant of media from the departmental repository then the culture was maintained and revived during this experiment, Rhizobial & other microorganisms were compared along with consortia and compare with the un-inoculated control (Table 1). A total of 10 treatments with 3 replicates were taken for field experiments. Randomly block design (RBD) was planned to evaluate the performance of chickpea test variety

Table 1. Experiment details

Details of experiment	
Treatments	: 10
Design	: RBD
Replication	: 3
Total No of Plots	: 30
Distance between replication	: 50 cm
Crop Variety	: JG-130
Season	: 2018-19
Date of Sowing	: 06/12/2018
Date of harvesting	: 01/03/2019
Recommended dose of fertilizer	: N:P:K::20:60:20

Table 2. Detail for field experiment-

S.NO.	Treatment	Name of Isolate
1	T1	Control
2	T2	75% NPK
3	T3	100% NPK
4	T4	100% NPK+ Chickpea <i>rhizobium</i>
5	T5	75% NPK + Chickpea <i>rhizobium</i>
6	T6	C1 + 75% NPK + Chickpea <i>rhizobium</i>
7	T7	Gmr8 +75% NPK + Chickpea <i>rhizobium</i>
8	T8	AZO-137 +75% NPK + Chickpea <i>rhizobium</i>
9	T9	ASL-3 + 75% NPK + Chickpea <i>rhizobium</i>
10	T10	ASL-4 + 75% NPK+ Chickpea <i>rhizobium</i>

100% NPK = Recommended Dose of Fertilizer (NPK)-20:60:20

C1 = *GmR8 - Rhizobium*, AZO137 – *Azotobacter*, ASL3 – *Azospirillum*, ASL4- *Azospirillum*.

(JG-130). Other details are given in Table 2.

Healthy seeds of chickpea (JG-130) were taken for experimentation. Just Before sowing, healthy seeds of chickpea were treated with Thiram @ 3 gm/kg of seed. Rhizobacteria inoculated separately in 25 mL of nutrient broth in 50 ml conical flask and incubated at $28 \pm 2^\circ$ C for 24-48 hours. It was used for seed inoculation in the seeds at the time of sowing. The final observations of the morphological growth parameters, the absorption, and nodulation of biomass and nitrogen uptake from the shoot and grain of chickpea plants were statistically analyzed using ANOVA for the design of randomized blocks (RBD) (Panse and Shukhatme, 1978).

RESULTS AND DISCUSSION

A field experiment was designed with *alfisols* for the influence of a combination of (PGPR) different growth parameters of chickpea at field conditions of Department of Agricultural Microbiology, IGKV, Raipur, Chhattisgarh, during the year 2018-19. During this experiment, rhizobacteria isolates were compared alone and in combination with PGPR and absolute control. The number of treatments was ten, replicated thrice in Randomized Block Design (RBD). Chickpea (JG- 130) was taken as a test variety.

The number of pods increases significantly variation. Shown in Table 3. The highest number of pods was recorded in treatment T6 (C1+75% NPK + Chickpea *Rhizobium*) (79.00 pods per plant) followed by T7 (GmR8 + 75% NPK + Chickpea *Rhizobium*) (66.00 pods per plant) and the minimum was recorded in inoculated treatment T5 (75% NPK+Chickpea *Rhizobium*) (43.00 pods per plant). All the treatment shown significance as compared

Table 3. Effect of Bacterial consortia on Grain and straw yield of chickpea under field condition.

Name of Isolate	No. of Pod At harvest	No. of grain per plant	Test weight 100 seeds/gm	Grain yield kg/ha	Straw yield kg/ha
Control	23.67	44.67	18.66	1726.67	1980.0
75% RDF NPK	36.33	68.67	23.43	1886.67	2180.0
100% NPK (20:60:20)	38.33	76.33	25.37	2020.00	2273.3
100% NPK + Chickpea <i>Rhizobium</i>	61.33	108.33	27.37	2066.67	2333.3
75% NPK + Chickpea <i>Rhizobium</i>	43.00	73.33	24.78	2040.00	2226.7
C1+75% NPK + Chickpea <i>Rhizobium</i>	79.00	134.31	28.54	2240.00	2533.3
GmR8 + 75% NPK + Chickpea <i>Rhizobium</i>	66.00	117.33	26.23	2066.67	2133.3
AZO137+ 75% NPK+ Chickpea <i>Rhizobium</i>	51.67	98.66	24.37	2200.00	2466.7
ASL3+75% NPK+ Chickpea <i>Rhizobium</i>	49.67	72.67	25.37	2000.00	2093.3
ASL4 +75 % NPK+ Chickpea <i>Rhizobium</i>	52.00	97.33	26.13	2220.00	2446.7
CD	11.93	11.27	2.61	244.89	213.86

to 100% NPK except the treatment number T5 and T9. Treatment T6 was recorded significant variation. This finding was supported by (Singh *et al.*, 2014)

The maximum number of grain was observed due to the inoculation of T6 (C1+75% NPK + Chickpea *Rhizobium*) (134.31 grain per plant) and least was recorded in control (44.67 grain per plant). All the treatment recorded significance variation as compare to control except. The treatment number T5 (75% NPK + Chickpea *Rhizobium*) and T9 (ASL3 + 75% NPK + Chickpea *Rhizobium*). In the case of 100% NPK along with *Rhizobium* all the treatment at par except treatment T6 (C1+75% NPK + Chickpea *Rhizobium*) showed significance variation.

Maximum test weight was recorded in T6 (C1+75% NPK + Chickpea *Rhizobium*)(28.54 gm/ 100 seed) and the least test weight was recorded in control in (18.66 g/100 seed). Inthe case of 75%, NPK along with *Rhizobium*as compare to all other treatments were at par only T6 was showed significant variation.

The highest grain yield was recorded in T6 (C1+75% NPK + Chickpea *Rhizobium*)(2240.00 kg/ ha) The lowest grain yield was 1726.67 kg/ha associated with control. But in the case of *Rhizobium* inoculation along with other PGPR, they do not show significant variation except the treatment T6 (C1+75% NPK + Chickpea *Rhizobium*). The result of the present investigation conforms by Kouzuma *et al.* (2015).

The highest straw yield was noticed is 2533.30 kg/ha and the lowest 1980 kg per ha under control. Results of the present investigation confirmed by several scientists likewise Kouzuma *et al.* (2015), Singh *et al.* (2014)

CONCLUSION

Keeping in observation of above mentioned in conclusion accomplished that treatment T6 (consortia C1+75% NPK + Chickpea *Rhizobium*) was most effective among all the combination taken under this study.

ACKNOWLEDGMENT

The author RS also wants to acknowledge CGCOST, Chhattisgarh, to financially support this research.

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