Impact Of Integrated Nutrient Management On The Growth Attributes Of Chickpea (*Cicer Aritinum* L.)

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Abstract
The field operation under taken during *rabi* season (2021-2022) at crop research center (CRC), Uttaranchal University, School of Agriculture, Dehradun Uttarakhand. The current investigation entitled "Effect of integrated nutrient management on the growth of chickpea (*Cicer aritinum* L.)". There are eight treatments in chickpea T_1:100% RDF, T_2:40% RDF+PSB, T_3:50% RDF+PSB, T_4:75% RDF+Rhizobium, T_5:75% RDF+Rhizobium, T_6:75% RDF+Rhizobium+PSB, T_7:75% RDF+ Rhizobium+PSB+$ZnSo_4$@25kg ha^{-1}+Sulphur@30kg ha^{-1},RDF alone treatment T_8:Control. This experiment was taken in three replications randomized block design (RBD). Application of 75% RDF+ Rhizobium+PSB+$ZnSo_4$@25kg ha^{-1} Sulphur@ 30kg ha^{-1}(T_7) recorded at higher growth stages plant height, dry matter, number of nodules/plant, number of branches/plant.

Key words*: Chickpea, nutrient management, plant height*

Introduction

Chickpea (*Cicer arietinum*) belongs to family leguminoseae is the most important pulse crop of winter season (Rabi) grain legume in India, grown predominantly under rainfed conditions on residual moisture after harvest of Kharif crops. The establishment of the chickpea crop is significant hampered by insufficient soil moisture in the seedbed. This is due to the fact that insufficient soil moisture can inhibit seed germination, limit the growth of early seedlings, and lower yield in rainfed crops. (**Sharma 1985).** Pre-sowing irrigation or protective irrigation at critical stage of crop growth improves its productivity of crop. About 90% of the chickpea farmed worldwide is rainfed, and as a result it undergoes severe drought stress and suffers significant production losses. Especially important in vegetarian diets, chickpeas are a significant source of protein ingested as protein in dal and dal flour, as well as processed whole seeds (boiled, roasted, fried, steaming, etc.), It is used to condiments, candies and snacks, as a green vegetable, fresh green seed are also eaten. It is great source of vitamins, minerals calcium phosphorus, iron etc,) (minerals (18-22%), protein) carbohydrates (52-70%), fat (4-10%), and vitamins. It makes for great animal feed and the straw has high forage value (**Prasad 2012**). The large gap between the supply and demand for pulses can be closed by raising their production. Chickpeas have a variety of domestic, industrial, and other uses, and they can grow more successfully with less input in arid and unfavourable edaphic conditions, which makes them a crucial part of subsistence farmers' cropping systems in the Indian subcontinent *(***Verma *et al.*, 2013**) The increasing use of chemical inputs in agriculture has led to negative effects on the environment and soil fertility, making sustainability of agriculture a key topic of worldwide concern **(Laranjo *et al.*, 2014).**

The fundamental goal of integrated nutrient management is to maintain or raise soil fertility as a result of nutrient supply to the ideal level for maintaining the intended crop yield through maximising the advantages from all available plant nutrient resources in an integrated way (**Roy and Ange, 1991).** With the wise and effective application of mineral fertilisers, organic manures, biofertilizers, green manures, crop residue, etc., INM's fundamental tenet is the preservation of soil fertility, sustainable agriculture, productivity, and increasing farmer profitability. It is crucial to apply balanced fertilisation, including organic manures, N, P, and K, as well as biofertilizers like Rhizobium and PSB, to increase the yield of this crop. Rhizobium and PGPR vaccination of pulses stimulates plant growth and increases agricultural production. Farm Yard Manure (FYM) is a significant source of soil nutrients and organic matter that, after being broken down by microorganisms, becomes available to plants.

Materials and methods

The current investigation was carried out at agronomy field of School of Agriculture, Uttaranchal university, Dehradun (Uttarakhand) India during *Rabi* season 2021-2022. The climate warm and dry arid and semi arid subtropical region . minimum temperature 25^0C The soil of the experimental field is a sandy loam, sandy loam soil generally contains more nutrients, moisture, and humus than sandy soils, have a better drainage and infiltration of water and air.soil slightly reaction pH (8.0-8.5) and high in organic carban (90%) and available nitrogen (256kg/ha) and available phosphorus (25.8kg/ha) and available potassium (205.2kg/ha). T_1:100%RDF, T_2:75%RDF, T_3:50%RDF, T_4: 75%RDF+Rhizobium, T_5: 75% RDF + Rhizobium, T_6: 75%RD F+ Rhizobium + PSB, T_7: 75% RDF + Rhizobium+ PSB+ $ZnSo_4$@25kgh^1+Sulphur@30kg^1, T_8: Control. Application of FYM in 2.5 ton/ha. Sowing of chickpea crop was done using a seed rate 80kg/ha and spacing 30x10cm in sowing should be done at November and harvested in April. The recommended dose of fertilizer are applied at the time of sowing (Rhizobium+PSB each of 20ml/kg). The seed of chickpea variety PUSA 365 were sown manually using a seed rate of 80kg/ha^{-1} at 30 x 10 cm raw spacing .irrigation are not needed. Enough rain fall for chickpea crop.

Result and Discussion

Growth parameter

The experimental findings Effect of integrated nutrient management growth and of chickpea Plant height recorded at 30, 60, 90 DAS and at harvest plant height recorded in chickpea field the data presented at table **1.** The data showed that the treatment T_7 (75%RDF+Rhizobium+PSB+$Znso_4$@25kg ha^{-1}+Sulphur@ 30kg ha^{-1}) The highest plant height at 30DAS plant height (15.85cm) followed by treatment T_6 *75*% RDF+ *Rhizobium* + PSB+$ZnSO_4$ @ 25kg ha^{-1} (15.70) and T_5 *75*% RDF+ *Rhizobium* + PSB (15.40). The minimum plant hight treatment T_8 (control) (14.50). Plant height recorded at 60 DAS the data showed that the treatment T_7 (75%RDF+Rhizobium+PSB+$Znso_4$@25kg ha^{-1}+Sulphur@ 30kg ha^{-1}) .The highest plant height (32.51) followed by treatment T_6 (*75*% RDF+ *Rhizobium* + PSB+$ZnSO_4$ @ 25kg ha^{-1}) (30.20) and treatment T_5 (*75*% RDF+ *Rhizobium* + PSB) (27.65).The minimum plant height treatment T_8 (control).(22.90).Plant height recorded at 90 DAS the data showed that the treatment T_7 (75%RDF+Rhizobium+PSB+$Znso_4$@25kg ha^{-1}+Sulphur@ 30kg ha^{-1}) .The highest plant height (43.09) followed by treatment T_6 (*75*% RDF+ *Rhizobium* + PSB+$ZnSO_4$ @ 25kg ha^{-1}) (41.15) and treatment T_5 (*75*% RDF+ *Rhizobium* + PSB) (37.65). The minimum plant height treatment T_8 (control) (31.62). Plant height at harvest ,the treatment T_7 (75%RDF+Rhizobium+PSB+$Znso_4$@25kg ha^{-1}+Sulphur@ 30kg ha^{-1}) showed that the highest plant height (47.65) followed by treatment T_6 *75*% RDF+ *Rhizobium* + PSB+$ZnSO_4$ @ 25kg ha^{-1}(42.09) and T_5 *75*% RDF+ *Rhizobium* + PSB (40.86). The minimum plant height treatment T_8 control (37.35). The reason of better growth and development in the treatment due to the grater availability of nutrient in soil due to increasing fertilizer application with biofertilizer. The findings are quite similar to those **Ahmed *et al. (*2017)** and **Singh *et al. (*2018)** about how meristematic activity increases plant growth of plant height. **(Dicks *et a*l., 1980).**

Dry matter accumulation/plant

Dry matter recorded at 30, 60, 90 DAS and at harvest dry matter recorded in chickpea field the data presented at table 4.2. the data showed that the treatment T_7 (75%RDF+Rhizobium+PSB+$Znso_4$@25kg ha^{-1}+Sulphur@ 30kg ha^{-1}) The highest dry matter at 30DAS dry matter (0.62) followed by treatment T_6 *75*% RDF+ *Rhizobium* + PSB+$ZnSO_4$ @ 25kg ha^{-1} (0.61) and T_5 *75*% RDF+ *Rhizobium* + PSB (0.60). The minimum dry matter recorded at treatment T_8 (control) (0.56). Dry mater recorded at 60 DAS the data showed that the treatment T_7 (75%RDF+Rhizobium+PSB+$Znso_4$@25kg ha^{-1}+Sulphur@ 30kg ha^{-1}). The highest dry matter (5.00) followed by treatment T_6 (*75*% RDF+ *Rhizobium* + PSB+$ZnSO_4$ @ 25kg ha^{-1}) (4.65) and treatment T_5 (*75*% RDF+ *Rhizobium* + PSB) (4.35) The minimum dry matter treatment T_8 (control) (3.70). Dry matter recorded at 90 DAS the data showed that the treatment T_7 (75%RDF+Rhizobium+PSB+$Znso_4$@25kg ha^{-1}+Sulphur@ 30kg ha^{-1}). Highest dry matter (15.90) followed by treatment T_6 (*75*% RDF+ *Rhizobium* + PSB+$ZnSO_4$ @ 25kg ha^{-1}) (14.20) and treatment T_5 (*75*% RDF+ *Rhizobium* + PSB) (12.50). The minimum dry matter treatment T_8 (control) (7.45). Dry matter at harvest the treatment T_7(75%RDF+Rhizobium+PSB+$Znso_4$@25kg ha^{-1}+Sulphur@ 30kg ha^{-1}) show that the highest dry matter (21.10) followed by treatment T_6 *75*% RDF+ *Rhizobium* + PSB+$ZnSO_4$ @ 25kg ha^{-1}(16.00) and T_5 *75*% RDF+ *Rhizobium* + PSB (14.20). The minimum dry matter treatment T_8 (control) (9.25). Due to increased enzyme activity brought on by Rhizobium and PSB inoculation, there is a rise in the availability of vitamins and enzymes in the soil. This increase in microbial community, which includes more bacteria and actinomycetes, recharges the soil with conditioner. Rhizobium and PSB inoculation acts as a soil conditioner to improve nutrient availability. Because PSB improves the availability of phosphorus, which has a direct impact on biological nitrogen fixation in legumes and eventually enhances the activity of microorganisms that aid in nodule development, PSB aids in the creation of nodules. The weight of the nodule grows when nodule production is sufficient. Treatment T_7 (Rhizobium + PSB + $ZnSO_4$ @ 25 kg/ha^{-1} + Sulphur @ 30 kg/ha^{-1}) had the highest increase in dry matter accumulation. Similar result reported by **Singh *et al*.,(2007**)

Number of nodules/plant

Nodules/plant recorded at 30, 60, 90 DAS and at harvest nodules per plant recorded in chickpea field the data presented at table 4.3. the data showed that the treatment T_7 (*75*% RDF+ *Rhizobium* + PSB + $ZnSO_4$ @ 25 kg ha^{-1}+Sulphur @ 30kg ha^{-1}). The number of highest nodule per plant (3.15) followed by treatment T_6 *75*% RDF+ *Rhizobium* + PSB+$ZnSO_4$ @ 25kg ha^{-1} (3.10) and T_5 *75*% RDF+ *Rhizobium* + PSB (3.05). The minimum nodule recorded at treatment T_8 (control) (2.7) Nodule recorded at 60 DAS the data showed that the treatment T_7

(75%RDF+Rhizobium+PSB+$Znso_4$@25kg ha^1+Sulphur@ 30kg ha^{-1}). The highest nodule recorded at (20.05) followed by treatment T_6 (*75*% RDF+ *Rhizobium* + PSB+$ZnSO_4$ @ 25kg ha^{-1}) (18.70) and treatment T_5 (*75*% RDF+ *Rhizobium* + PSB) (17.15)The minimum nodule recorded at treatment T_8 (control) (14.90). Nodule recorded at 90 DAS the data showed that the treatment T_7(75%RDF+Rhizobium+PSB+$Znso_4$@25kg ha^{-1}+Sulphur@ 30kg ha^{-1}). The highest nodule recorded at (14.05) followed by treatment T_6 (*75*% RDF+ *Rhizobium* + PSB+$ZnSO_4$ @ 25kg ha^{-1}) (13.15) and treatment T_5 (*75*% RDF+ *Rhizobium* + PSB) (12.00). The minimum nodule recorded at treatment T_8 (control) (10.40) Nodule recorded at harvest the data showed that the treatment T_7 (75%RDF+Rhizobium+PSB+$Znso_4$@25kg ha^{-1}+Sulphur@ 30kg ha^{-1}). The highest nodule recorded at (5.00) followed by treatment T_6 (*75*% RDF+ *Rhizobium* + PSB+$ZnSO_4$ @ 25kg ha^{-1}) (4.65) and treatment T_5 (*75*% RDF+ *Rhizobium* + PSB(4.25)The minimum nodule recorded at treatment T_8 control(3.72). Rhizobium, PSB, a biofertilizer, was used, and this significantly increased nodule count in comparison to control. Rhizobium and PSB injection boost the microbial population in legume crops and forms more nodules per plant. Rhizobium and PSB boosted the activity of microorganisms in the legume crop, and this Rhizobium and PSB inoculation enhanced the quantity of nodules and plants. The T_7 (75 % RDF+ Rhizobium + PSB + $ZnSO_4$ @ 25 kg/ha^{-1} + sulphur @ 30 kg/ha^{-1}) showed the greatest increase in nodulation. **Bandyoupadhay, 2002, and Tagore *et al.* (2014)** and reported similar findings.

Number of branches/plant

Branches/plant recorded at 30, 60, 90 DAS and at harvest branches per plant recorded in chickpea field the data presented at table 4.3. the data showed that the treatment T_7 (*75*% RDF+ *Rhizobium* + PSB + $ZnSO_4$ @ 25 kg ha^{-1}+Sulphur @ 30kg ha^{-1}). The number of highest branch per plant (2.35) followed by treatment T_6 *75*% RDF+ *Rhizobium* + PSB+$ZnSO_4$ @ 25kg ha^{-1} (2.33) and T_5 *75*% RDF+ *Rhizobium* + PSB (2.29). The minimum branch recorded at treatment T_8 (control) (2.15)**.** Branch/plant recorded at 60 DAS the data showed that the treatment T_7 (75%RDF+Rhizobium+PSB+$Znso_4$@25kg ha^{-1}+Sulphur@ 30kg ha^{-1}). The highest branch recorded at (10.32) followed by treatment T_6 (*75*% RDF+ *Rhizobium* + PSB+$ZnSO_4$ @ 25kg ha^{-1}) (9.68) and treatment T_5 (*75*% RDF+ *Rhizobium* + PSB) (8.89) The minimum branch recorded at treatment T_8 (control).(7.70)**.** Branch/plant recorded at 90 DAS the data showed that the treatment T_7 (75%RDF+Rhizobium+PSB+$Znso_4$@25kg ha^{-1}+Sulphur@ 30kg ha^{-1}). The highest branch recorded at (35.05) followed by treatment T_6 (*75*% RDF+ *Rhizobium* + PSB+$ZnSO_4$ @ 25kg ha^{-1}) (32.75) and treatment T_5 (*75*% RDF+ *Rhizobium* + PSB) (30.00)The minimum branch recorded at treatment T_8 (control) (26.10)**.** Branch/plant recorded at harvest the data showed that the treatment T_7(75%RDF+Rhizobium+PSB+$Znso_4$@25kg ha^{-1}+Sulphur@ 30kg ha^{-1}). The highest branch recorded at (35.50) followed by treatment T_6 (*75*% RDF+ *Rhizobium* + PSB+$ZnSO_4$ @ 25kg ha^{-1}) (33.30) and treatment T_5 (*75*% RDF+ *Rhizobium* + PSB(32.92) The minimum branch recorded at treatment T_8 control (26.92). The maximum number of branches is determined by the vegetable and plant growth, which favours taller plants, and as a result, the number of branches increases as a result of all the tall plants. The availability of vital nutrients that influence plant growth is increased when chemical fertilisers and biofertilizers are used together, and as a result, vegetable growth produces more branches. The increase in the number of branches per plant and the degree of biofertilizer and fertiliser growth might be expected to improve nutrient availability and enhance flat stretch of the chickpea by encouraging cell division in a colder environment. These results have already been reported by **Patel and Thanki, (2020) and Hussain *et al.*, (2011).**

Table 1. Effect of various treatments on plants height at different growth stages of chick pea crop.

Treatments	Plants height (cm)			
	30 DAS	60 DAS	90 DAS	At harvest
T_1 : 100% RDF	15.20	30.50	41.53	42.43
T_2 : *40*% RDF+Rhizobium+PSB	14.60	26.45	35.90	40.40
T_3 : *50*% RDF+Rhizobium+PSB	14.50	25.70	34.33	38.82
T_4 : *75*%RDF+*Rhizobium*	15.20	26.50	36.40	59.79
T_5: *75*% RDF+*Rhizobium* + PSB	15.40	27.65	37.65	40.89
T_6:*75*%RDF+*Rhizobium*+PSB+Zn SO_4 @ 25 kg ha^{-1}	15.70	30.20	41.15	42.09
T_7:*75*%RDF+*Rhizobium*+PSB+Zn SO_4 @ 25 kgha^{-1}+Sulphur @ 30kg ha^{-1}	15.85	32.51	43.09	47.65
T_8 :*Control*	14.50	22.90	31.62	37.35
SEm$\pm$	0.76	1.30	1.94	1.96
CD at 5%	2.35	3.95	5.80	5.95

Table 2. Effect of various treatments on Dry matter accumulation at different growth stages of chick pea crop. Effect of various treatments on number of nodules/plant in chickpea.

Treatments	Dry matter accumulation/Plant				Number of nodule/plant			
	30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At harvest
T_1 : 100% RDF	0.61	4.70	13.70	16.25	3.00	18.05	13.22	4.70
T_2:*40*%RDF+Rhizobium+PSB	0.58	4.15	9.75	14.46	2.95	16.40	11.45	4.10
T_3:*50*%RDF+Rhizobium+PSB	0.56	4.05	7.90	8.97	2.90	16.15	11.25	4.05
T_4 : *75*% RDF +*Rhizobium*	0.59	4.11	10.94	13.95	3.02	16.65	11.60	4.11
T_5: *75*% RDF+ *Rhizobium* +PSB	0.60	4.35	12.50	15.65	3.05	17.15	12.00	4.25
T_6: *75*% RDF+ *Rhizobium* +PSB+$ZnSO_4$ @ 25 kg ha^{-1}	0.61	4.65	14.20	16.00	3.10	18.70	13.15	4.65
T_7:*75*%RDF+*Rhizobium*+pSB+$ZnSO_4$ @ 25 kg ha^{-1}+Sulphur @ 30kg ha^{-1}	0.62	5.00	15.90	21.10	3.15	20.05	14.05	5.00
T_8 :*Control*	0.56	3.70	7.45	9.25	2.7	14.90	10.40	3.72
SEm$\pm$	0.02	0.19	0.65	0.57	0.10	0.72	0.42	0.17
CD at 5%	0.08	0.61	1.00	1.77	0.35	2.15	1.35	0.57

Table 4. Effect of various treatments on number of branches/plant in chickpea.

Treatments	Number of branches/plant			
	30 DAS	60 DAS	90 DAS	At harvest
T_1 : 100% RDF	2.32	9.75	32.05	33.15
T_2 : *40*% RDF+Rhizobium+PSB	2.20	8.45	28.75	29.75
T_3 : *50*% RDF+Rhizobium+PSB	2.15	8.35	28.20	28.55
T_4 : *75*% RDF+*Rhizobium*	2.22	8.57	29.05	30.50
T_5: *75*% RDF+*Rhizobium* + PSB	2.29	8.89	30.00	32.92
T_6: *75*% RDF+*Rhizobium*+PSB+$ZnSO_4$ @ 25 kg ha^{-1}	2.33	9.68	32.75	33.30
T_7 : *75*%RDF+*Rhizobium*+PSB+$ZnSO_4$ @ 25 kg ha^{-1}+Sulphur @30kg ha^{-1}	2.35	10.32	35.05	35.05
T_8 :*Control*	2.15	7.70	26.10	26.92
SEm$\pm$	0.08	0.37	1.20	1.01
CD at 5%	0.25	1.13	3.67	3.07

CONCLUSION

Experimental result it may be conducted that the application of bio fertilizer (PSB+ Rhizobium) along with treatment T_7(75% RDF+Rhizobium+PSB+$ZnsO_4$@25kg ha^{-1}+sulphur@30 kg ha^{-1}). This control is optimum higher growth attributes.

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