



E-ISSN: 2278-4136

P-ISSN: 2349-8234

www.phytojournal.com

JPP 2021; 10(2): 1017-1020

Received: 14-12-2020

Accepted: 21-01-2021

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Effect of nutritional levels on the performance of chickpea (*Cicer arietinum* L.) varieties on growth and growth characters, their performances, production and productivity in Central Plain Zone of U.P

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Abstract

A field experiment was carried out at the Students' Instructional Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, (U.P.) during *Rabi* season of 2017-18. The trial consisted of four varieties of chickpea (KPG-59, KWR-108, KGD-1168, Avarodhi) and four nutritional levels (FYM, NPK, NPK+Bo, NPK+Bo+FYM) making 16 treatment combination which was led out in randomized block design with 3 replication. On the basis of conclusion derived from study, chickpea variety KGD-1168 with nutritional level of NPK + Bo + FYM may be recommended for Central Plain Zone of Uttar Pradesh, as this shows significantly superior results of growth and growth characters during the crop period, viz Plant population final (83.40/m²), Plant height at maturity (59.26cm), Primary branches at maturity (7.06) and secondary branches at maturity (9.48), Fresh weight of plant was recorded highest as (32.91g), Dry weight of plant (23.62 gm) at maturity, Root length was observed maximum as (7.16cm), Fresh wt & dry weight of root at maturity were recorded as (3.26 & 3.17) respectively, Nodules plant-1 (15.37) were recorded highest with this treatment followed by the treatment with NPK+Bo only varieties KGD-118 and KWR-108 were significantly superior over variety KPG-59 and should be recommended for farmers practice and state recommendations in central plain zone of U.P.

Keywords: Variety, nutritional level, treatment combinations

Introduction

Chickpea (*Cicer arietinum* L.) was first domesticated in the Middle East. It is widely cultivated in India, Australia, Pakistan, Turkey, Myanmar and Ethiopia. It is an important cool season pulse crop and is also called Bengal gram. In terms of pulse production, India contributes about 25% to the total global pulses production (Pooniya *et al.* 2015). In India, chickpea is a premier pulse crop grown on an area of 8.25 million ha during 2014-15, contributing 7.33 million tonnes to the national pulse basket with productivity of 889 kg ha⁻¹. This accounts for about 70% of the total global area with 67% of global production (Anonymous 2016) [1]. The main chickpea producing states are Madhya Pradesh, Rajasthan, Maharashtra, Andhra Pradesh and Uttar Pradesh. In Punjab, it was grown on an area of 1.8 thousand hectares with total production of 1.90 thousand tones and yield of 1056 kg ha⁻¹ during 2014-15 (Anonymous 2018) [2].

Chickpea is an important source of protein in the diets of the poor, and is particularly important in vegetarian diets and is an important substitute for animal protein. It is used in preparing snacks, sweets and condiments. Fresh green seeds are also consumed as a green vegetable. It is an excellent source of protein (18-22%), carbohydrates (52-70%), fat (4-10%), minerals (calcium, phosphorus, iron etc.) and vitamins. It is an excellent animal feed and its straw has good forage value (Prasad 2012). Fertilizer requirements depend on the nutrient status of the field, and thus, vary from field to field. Therefore, the doses of fertilizers should be determined based on the results of soil test. The generally recommended doses for chickpea include 20-30 kg nitrogen (N) and 40-60 kg phosphorus (P) ha⁻¹. If soils are low in potassium (K), an application of 17 to 25 kg K ha⁻¹ is recommended.

There will be no response to application of K in soils with high levels of available K. Total quantities of N, P and K should be given as a basal dose. Foliar spray of 2% urea at flowering has been found beneficial in rainfed crops (ICRISAT, 2018) [7].

Materials and Methods

The present investigation was conducted at student's Instructional Farm (SIF), Chandra Shekhar Azad University of Agriculture and Technology, Kanpur during *Rabi* season of 2017-18, Kanpur, which is situated at an elevation of 129.0 m, between 25° 26' and 26° 58' N latitude and 79° 31' and 80° 34' E longitude, falls in the sub-tropical zone having semi-arid climate. with average annual rainfall of 800mm, the soil samples were composited, dried, sieved and analyzed in the laboratory for their physical, physio-chemical and chemical properties.

The result pertaining to soil analysis showed that experimental soil was sandy loam in texture and slightly alkaline in nature with low organic carbon and total-N content, at the time of sowing well decomposed FYM was applied, as per treatment crop was fertilized according to treatments by supplying the Nitrogen, Phosphorus, Potash, (20:40:40 Kgha-1) and Boron (1 kg ha-1) through Di ammonium phosphate, Murate of potash, and Boron mixed in soil before sowing. Breeder seed of chickpea variety KWR - 108, KPG- 59, Avarodhi, KGD-1168, was used @ 80.0 kg ha-1, very light showers occurred at pre flowering and pod filling stages, hence one irrigation was given, One weeding was done after 50 days of sowing, crop was harvested when it attained full maturity, Since it was not possible to study the all characters in individual plants, 4 sample plants from each treatment were selected randomly and were observed, recorded regularly.

Result and Discussion

Plant population (m²)

In this experiment, an attempt has been made to ascertain the degree of variation is exhibited by the chickpea crop at different stages of growth due to influence of different treatments like Plant population, Plant height, Primary and secondary branches, Fresh weight of plant, Dry weight of plant, Root length, Fresh and of root, dry weight of root, Nodules plant-1. The initial & final plant population was not received significantly due to nutritional levels. The initial and final plant population were numerically more upto NPK+B+FYM (83.01 & 82.96) and lowest at FYM in nutritional levels.

Table 1: Effect on initial and final plant population (m²)

Treatments	Plant population (m ²)	
	Initial	Final
A: Varieties		
KPG-59	82.70	81.67
KWR-108	82.36	81.09
KGD-1168	83.40	82.12
Avarodhi	82.01	81.02
SE (d)	0.76	0.71
CD (P=0.05)	N.S.	N.S.
B: Nutritional levels		
FYM	81.90	81.24
NPK	82.48	81.98
NPK+Bo	82.81	82.46
NPK+Bo+FYM	83.01	82.96
SE (d)	0.76	0.69
CD (P=0.05)	N.S.	N.S.
Interaction	N.S.	N.S.

Plant height (cm)

Nutritional levels produced market varieties on plant height at

all stages crop growth when it increased significantly upto NPK+B+FYM level in present trial. The interaction effect on height of plant at all stages of crop growth was found to be non-significantly in study year.

Table 2: Effect on plant height at 30, 60, 90 DAS and at maturity (cm)

Treatments	Plant height (cm)			
	30 DAS	60 DAS	90 DAS	At maturity
A: Varieties				
KPG-59	5.18	39.90	53.41	55.10
KWR-108	5.34	41.76	56.19	57.75
KGD-1168	5.39	43.08	57.95	59.26
Avarodhi	5.12	38.47	51.43	52.75
SE (d)	0.10	0.82	1.09	1.19
CD (P=0.05)	0.20	1.68	2.23	2.44
B: Nutritional levels				
FYM	4.53	37.05	50.14	50.37
NPK	5.40	40.66	54.24	55.75
NPK+Bo	5.50	41.92	56.16	58.13
NPK+Bo+FYM	5.60	43.59	58.45	60.61
SE (d)	0.10	0.82	1.09	1.19
CD (P=0.05)	0.20	1.68	2.23	2.44
Interaction	N.S.	N.S.	N.S.	N.S.

Primary and Secondary Branches

The data showed that primary and secondary branches of plant at all stages are significantly increased at KGD-1168 compared to rest varieties of chickpea but at par from KWR-108 variety of chickpea. Nutritional level produced market variation on primary and secondary branches of plant at all stages of crop growth when it increased significantly upto NPK+Bo+FYM level in present trail. Singh *et al.* (2012) also could not observed significant differences in the total number of branches plant-1 among the varieties.

Table 3: Effect on primary & secondary branches at 30, 60, 90 DAS and at maturity (cm)

Treatments	Primary branches				Secondary branches		
	30 DAS	60 DAS	90 DAS	At maturity	60 DAS	90 DAS	At maturity
A: Varieties							
KPG-59	2.34	5.98	6.71	6.30	7.28	8.07	8.40
KWR-108	2.39	6.19	6.68	6.47	7.51	8.35	8.74
KGD-1168	2.41	6.52	7.04	6.70	7.88	8.64	9.04
Avarodhi	2.33	5.70	6.30	5.91	6.72	7.59	8.03
SE (d)	0.08	0.16	0.19	0.18	0.21	0.21	0.25
CD (P=0.05)	N.S.	0.34	0.39	0.38	0.44	0.44	0.52
B: Nutritional levels							
FYM	1.97	4.99	6.53	5.11	5.62	6.53	7.06
NPK	2.45	6.14	6.48	6.43	7.54	8.29	8.55
NPK+Bo	2.49	6.49	6.72	6.79	7.96	8.75	9.12
NPK+Bo+FYM	2.55	6.76	7.00	7.06	8.28	9.10	9.48
SE (d)	0.08	0.16	0.19	0.18	0.21	0.21	0.25
CD (P=0.05)	0.17	0.34	0.39	0.38	0.44	0.44	0.52
Interaction	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

4. Fresh weight (g) & Dry weight (g)

Nutritional levels produced market variation on dry weight of plant at all stages of crop growth when it increased significantly upto NPK+Bo+FYM level in present trial. The interaction effect on dry weight of plants at all stages of crop growth was found to be no significant in study year. Similar findings were also reported by Saeed Reza *et al.* (2018), Raheleh Rahbarian *et al.* (2011).

Table 4: Effect on fresh weight & dry weight at 30, 60, 90 DAS and at maturity (g)

Treatments	Fresh weight (g)				Dry weight (g)			
	30 DAS	60 DAS	90 DAS	At maturity	30 DAS	60 DAS	90 DAS	At maturity
A: Varieties								
KPG-59	7.31	51.40	55.43	29.75	2.15	13.83	20.32	21.13
KWR-108	7.64	53.92	57.16	31.66	2.18	14.20	21.22	21.94
KGD-1168	7.70	56.23	59.70	33.07	2.21	14.96	22.18	23.02
Avarodhi	7.24	48.50	51.93	28.97	2.12	12.93	19.07	19.86
SE (d)	0.23	1.12	1.37	0.94	0.08	0.38	0.58	0.72
CD (P=0.05)	N.S.	2.29	2.80	1.93	N.S.	0.78	1.19	1.47
B: Nutritional levels								
FYM	5.74	46.59	49.13	27.47	1.94	11.40	17.74	18.20
NPK	7.93	51.78	55.50	30.67	2.22	14.11	20.60	21.46
NPK+Bo	8.04	54.68	58.56	32.40	2.24	14.90	21.76	22.66
NPK+Bo+FYM	8.18	56.99	61.03	32.91	2.27	15.52	22.69	23.62
SE (d)	0.23	1.12	1.37	0.94	0.08	0.38	0.58	0.72
CD (P=0.05)	0.48	2.29	2.80	1.93	0.17	0.78	1.19	1.47
Interaction	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Root length (cm)

The data revealed that root length of plant at all stages of crop growth were significantly increased at KGD-1168 compared to rest varieties of chickpea at par KWR-108 variety of

chickpea. Nutritional level produced market on root length of plant at all stages of crop growth, when it increased significantly upto NPK+Bo+FYM level in present trial.

Table 5: Effect on root length at 30, 60, 90 DAS and at maturity (cm)

Treatments	Root length (cm)			
	30 DAS	60 DAS	90 DAS	At maturity
A: Varieties				
KPG-59	3.68	5.86	6.26	6.40
KWR-108	3.82	6.09	6.49	6.57
KGD-1168	3.84	6.33	6.74	6.83
Avarodhi	3.67	5.53	5.86	6.03
SE (d)	0.04	0.22	0.24	0.26
CD (P=0.05)	0.09	0.45	0.49	0.54
B: Nutritional levels				
FYM	3.09	4.93	5.10	5.27
NPK	3.91	5.98	6.42	6.52
NPK+Bo	3.97	6.32	6.78	6.88
NPK+Bo+FYM	4.04	6.58	7.05	7.16
SE (d)	0.04	0.22	0.24	0.26
CD (P=0.05)	0.09	0.45	0.49	0.54
Interaction	N.S.	N.S.	N.S.	N.S.

Nodules plant-1

Nutritional levels produced marked variation on nodules on plants roots at all stages of crop growth when it increased significantly upto NPK+Bo+FYM level in present trial. The

interaction effect on nodules on plants roots at all stages of crop growth was found to be non-significant in study year, Chand Mukesh *et al.* (2010), Chaturvedi, S.K. and Nadarajan, N. (2010) [4].

Table 6: Effect on nodules plant⁻¹ at 30, 60, 90 DAS and at maturity (cm)

Treatments	Nodules plant-1			
	30 DAS	60 DAS	90 DAS	At Maturity
A: Varieties				
KPG-59	4.40	12.13	13.63	13.95
KWR-108	4.57	12.56	14.11	14.44
KGD-1168	4.60	13.12	14.74	15.09
Avarodhi	4.41	11.45	12.86	13.16
SE (d)	0.06	0.16	0.40	0.42
CD (P=0.05)	0.13	0.33	0.83	0.86
B: Nutritional levels				
FYM	4.39	10.90	12.24	12.53
NPK	4.46	12.17	13.67	13.99
NPK+Bo	4.52	12.83	14.42	14.75
NPK+Bo+FYM	4.60	13.35	15.01	15.37
SE (d)	0.06	0.16	0.40	0.42
CD (P=0.05)	0.13	0.33	0.83	0.86
Interaction	N.S.	N.S.	N.S.	N.S.

Summary and Conclusion

The interaction shown in this experiment using 4 different varieties with different nutritional doses shows significantly superior results including all the characters, viz., the plant height at all stages of crop growth, The primary branches & Secondary branches of plant at 60 DAS, 90 DAS and maturity, The fresh weight, dry weight of plant at 60 DAS, 90 DAS and maturity were significantly increased at KGD-1168 compared to the rest variety of chickpea but at par KWR-108 variety of chickpea. The root length of plant, fresh weight of root, dry weight of root, nodules on plant roots, these factors showed significant increase in their values by these experiment.

On the basis of conclusion derived from study year a chickpea variety KGD-1168 with nutritional level of NPK + Bo + FYM may be recommended for Central Plain Zone of Uttar Pradesh.

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