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Research Article

EFFECT OF NUTRIENT MANAGEMENT IN GRAM UNDER CONSERVE SOIL MOISTURE CONDITION

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Abstract: A field experiment was conducted at Dry Farming Research Station, Junagadh Agricultural University, Vallabhipur, Gujarat during *Rabi* seasons of 2016-17 to 2021-22 to ascertain the nutrient management in gram under conserve soil moisture conditions. The experiment was laid out in Randomized block Design with four replication and six different treatments *viz*., T_1-Control, T_2-20 kg N/ha, T_3-20 kg N/ha+40 kg P_2O_5/ha, T_4-20 kg N/ha+40 kg P_2O_5/ha+20 kg K_2O/ha, T_5-20 kg N/ha+40 kg P_2O_5/ha+20kg S/ha and T_6-20 kg N/ha+40 kg P_2O_5/ha+20 kg K_2O/ha+20kg S/ha. The results revealed that the growth, yield attributes and seed yield of gram were significantly influenced by the varioustreatments. The application of treatment T_6 (20 kg N/ha+40 kg P_2O_5/ha+20 kg K_2O/ha+20kg S/ha)significantly increased the seed yield, plant height, number of branches/plant, number of pods/plant, number of seed/pod and maximum net returns over the four seasons studied. The pH, Electrical Conductivity, organic carbon and available potash content of soil remained unaffected after application of different treatments. Significantly higher values of available status of phosphorus and sulphur in soil were recorded with treatment T_6 20 kg N/ha+40 kg P_2O_5/ha+20 kg K_2O/ha+20kg S/ha.

Keywords: *Gram, Nutrient management, Conserve soil moisture*

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Introduction

Gram has a vital importance in our daily food and fulfils our protein requirement. Gram is one of the main sources of protein for vegetarian people. Availability of gram per capita has decreased due to continuous increase of population. As per recommendation of WHO every person should get 80 gm pulses per day for healthy life. However, every person getting only 40 gm pulses per day [1].

Among different pulses, gram is the most important *Rabi* crop with great acceptability and commonly use in diet. India is the largest producer of chickpea in the world sharing 71.08 and 71.51 per cent of total area (11.40 million hectares) and production (13.98 million metric tones), respectively [2]. Total cultivated area of gram in Gujarat is 8.2 lakh hectares. Out of, that approximately about 75% area is mostly falls under reserve soil moisture particularly in Bhal and Ghed. Panchmahal is the main gram growing zone of Gujarat. In Gujarat, when there is a good monsoon, cultivation of gram is increases and vice-versa. The average productivity of gram in Gujarat is 1.76tonnes per hectare which is approximately the double than that of the Indian average (0.84 tonnes per hectare) [3].

The nitrogen and phosphorus are the major nutrient elements, however, potash and sulphur also play significant role for improving yield and ensuring better quality of gram. Therefore, the present investigation was formulated to study the effect of nutrient management on yield and quality of gram.

Materials and Methods

A field experiment was carried out at the Dry Farming Research Station, Junagadh Agricultural University, Vallabhipur (Gujarat) during the *Rabi* seasons of 2013-14 to 2021-22. The experiment comprising of six nutrient management treatments viz., T_1-Control, T_2-20 kg N/ha, T_3-20 kg N/ha+40 kg P_2O_5/ha, T_4-20 kg N/ha+40 kg P_2O_5/ha+20 kg K_2O/ha, T_5-20 kg N/ha+40 kg P_2O_5/ha+20kg S/ha and T_6-20 kg N/ha+40 kg P_2O_5/ha+20 kg K_2O/ha+20kg S/ha were evaluated in randomized block design with four replications.

The soil of the experimental field was medium black and alkaline in reaction (pH of 8.30 and Electrical Conductivity of 0.32 dS m^{-1}). The soil was medium in organic carbon content (0.63 %), medium in available phosphorus (46.30 kg ha^{-1}), high in available potassium (533 kg ha^{-1}) and medium in available sulphur (10.09ppm).

The nutrients of N, P, K and S were applied by using sources of Urea, DAP, MOP and Gypsum, respectively. The chickpea variety "Gujarat Junagadh Gram-3" planted in month of October with 45 × 10 centimeter spacing, plot size 4.00 x 3.60 meter and seed rate of 60 kilogram per hectare. The crop was raised with all the standard package of practices and protection measures also timely carried out as required. The observation of each parameter was taken at harvest of crop. The experimental results recorded for growth parameters, yield attributes and yield parameters were statistically analyzed for level of significance. Economic was calculated based on mean of four years data and cost of inputs like urea Rs. 5.92/kilogram, DAP Rs. 24/kilogram, MOP Rs. 19/kilogram, Gypsum Rs. 1/kilogramand produced rate like seed rate was Rs. 40/kilogram.

Results and Discussion

Effect on Growth and Yield attributes

The data on the basis of four years of pooled result depicted in [Table-1] revealed that the effect of different treatments on plant height, number of primary branches/plant, number of pods/plant and number of seeds/pod of gram were found significant and 100 seed weight remained non-significant. Significantly the highest number of branches/plant (8.23) and number of pods/plant (40.40) were recorded with application of 20 kg N/ha+40 kg P_2O_5/ha+20 kg K_2O/ha+20kg S/ha (T_6). While significantly higher plant height (30.76 cm) and number of seeds/pod (1.74) were also recorded with application of 20 kg N/ha+40 kg P_2O_5/ha+20 kg K_2O/ha+20kg S/ha (T_6), but it was found at par with treatments 20 kg N/ha+40 kg P_2O_5/ha+20 kg K_2O/ha (T_4) and 20 kg N/ha+40 kg P_2O_5/ha+20kg S/ha (T_5) in respect of plant height and 20 kg N/ha+40 kg P_2O_5/ha (T_3), 20 kg N/ha+40 kg P_2O_5/ha+20 kg K_2O/ha (T_4) and 20 kg N/ha+40 kg P_2O_5/ha+20kg S/ha (T_5) in respect of number of seeds/pod.

Table-1 Effect of nutrient management on growth and yield attributes of gram (Pooled result of four years)

Treatments	Plant height (cm)	No. of branches/plant	No. of pods/ plant	No. of seeds/ pod	100 seed weight (g)
T_1- Control	27.05	6.19	29.48	1.51	25.61
T_2- N_{20}	28.23	6.35	30.69	1.58	25.72
T_3- $N_{20}P_{40}$	29.16	6.81	33.21	1.63	25.80
T_4- $N_{20}P_{40}K_{20}$	29.73	7.38	35.31	1.68	25.82
T_5- $N_{20}P_{40}S_{20}$	29.86	7.64	37.20	1.71	26.01
T_6- $N_{20}P_{40}K_{20}S_{20}$	30.76	8.23	40.40	1.74	26.08
S.Em.±	0.53	0.14	0.90	0.04	0.33
C.D. at 5 %	1.49	0.40	2.55	0.13	NS
C.V. %	7.23	8.02	10.49	10.97	5.18

Table-2 Effect of nutrient management on seed yield of gram (kg/ha)

Treatments	2016-17	2019-20	2020-21	2021-22	Pooled
T_1- Control	973	1978	1927	2078	1739
T_2- N_{20}	1035	2104	2040	2123	1826
T_3- $N_{20}P_{40}$	1057	2133	2101	2141	1858
T_4- $N_{20}P_{40}K_{20}$	1085	2297	2167	2144	1923
T_5- $N_{20}P_{40}S_{20}$	1131	2229	2174	2422	1989
T_6- $N_{20}P_{40}K_{20}S_{20}$	1182	2245	2264	2431	2030
S.Em.±	74	117	126	89	40
C.D. at 5 %	NS	NS	NS	267	113
C.V. %	13.68	10.78	11.95	7.97	8.46

Table-3 Effect of nutrient management on post-harvest soil fertility of gram at harvest

Treatments	pH (1:2.5)	EC (dS/m) (1:2.5)	OC (%)	Avail. P_2O_5 (kg/ha)	Avail. K_2O (kg/ha)	Avail. S (kg/ha)
T_1- Control	8.02	0.46	0.50	35.23	470	8.41
T_2- N_{20}	8.05	0.44	0.45	32.96	520	9.97
T_3- $N_{20}P_{40}$	8.02	0.43	0.52	50.05	521	9.01
T_4- $N_{20}P_{40}K_{20}$	8.06	0.44	0.46	50.62	548	9.97
T_5- $N_{20}P_{40}S_{20}$	8.05	0.44	0.49	52.39	508	14.41
T_6- $N_{20}P_{40}K_{20}S_{20}$	8.07	0.49	0.49	54.76	549	15.38
S.Em.±	0.20	0.02	0.02	1.89	28	0.82
C.D. at 5 %	NS	NS	NS	5.51	NS	2.47
C.V. %	5.07	8.63	9.02	7.94	10.75	14.64

Table-4 Economics of gram as influenced by different nutrient management practices

Treatments	Seed yield (kg/ha)	Gross realization (Rs./ha)	Total cost of cultivation (Rs./ha)	Net realization (Rs./ha)	B:C ratio
T_1- Control	1739	69560	27879	41681	2.50
T_2- N_{20}	1826	73040	28346	44694	2.58
T_3- $N_{20}P_{40}$	1858	74320	30445	43875	2.44
T_4- $N_{20}P_{40}K_{20}$	1923	76920	31268	45652	2.46
T_5- $N_{20}P_{40}S_{20}$	1989	79560	30852	48708	2.58
T_6- $N_{20}P_{40}K_{20}S_{20}$	2030	81200	31623	49577	2.57

The increase in plant height, number of branches/plant, number of pods/plant and number of seeds/pod of gram with application of 20 kg N/ha+40 kg P_2O_5/ha+20 kg K_2O/ha+20kg S/ha (T_6) might be due to fulfilment of plant requirements of N-P-K-S. These findings are in close conformity with those reported by Balraj, *et al.,*(2018)[4], Bohra (2014)[5], Kumar, *et al.,*(2014)[6], Samiullah and Khan (2003)[7].

Yield

The data presented in [Table-2] indicated that the effect of different treatments on seed yield of gram was found significant during the year of 2021-22 out of four years of experimentation as well as in pooled result. Application 20 kg N/ha+40 kg P_2O_5/ha+20 kg K_2O/ha+20kg S/ha (T_6) recorded significantly higher seed yield of gram during the year of 2021-22 and in pooled result, but it was remained at par with application of 20 kg N/ha+40 kg P_2O_5/ha+20kg S/ha (T_5) in 2021-22 and 20 kg N/ha+40 kg P_2O_5/ha+20kg S/ha (T_5) and 20 kg N/ha+40 kg P_2O_5/ha+20 kg K_2O/ha (T_4) in pooled result. The increase in seed yield of gram with application of 20 kg N/ha+40 kg P_2O_5/ha+20 kg K_2O/ha+20kg S/ha (T_6) might be due to synergistic effect of N-P-K-S and fulfil the plant nutrient requirements. Similar findings are also recorded by Balraj, *et al*., (2018) [4], Bohra (2014) [5], and Samiullah and Khan (2003) [7]

Post harvest soil fertility

The data presented in [Table-3] revealed that the effect of different treatments on post-harvest soil fertility like pH, Electrical Conductivity, organic carbon and available potash were found non-significant. While, available phosphorus and sulphur were significantly affected due to different treatments. Significantly higher available phosphorus (54.76 kg/ha) was recorded under application of 20 kg N/ha+40 kg P_2O_5/ha+20 kg K_2O/ha+20kg S/ha (T_6), but it was at par with treatments 20 kg N/ha+40 kg P_2O_5/ha+20kg S/ha (T_5) and 20 kg N/ha+40 kg P_2O_5/ha(T_3).Whereas available sulphur (15.38 ppm) was also recorded significantly higher under application of 20 kg N/ha+40 kg P_2O_5/ha+20 kg K_2O/ha+20kg S/ha (T_6), which was remained at par with treatment 20 kg N/ha+40 kg P_2O_5/ha+20kg S/ha (T_5).The findings are close with findings of Meena and Ram (2013)[8] and Patel, *et al*.,(2014)[9].

Economics

The economics of different treatments was worked out on the basis of pooled results and data presented in [Table-4] indicated that the maximum net realization (Rs. 49,577/ha) was recorded under application of 20 kg N/ha+40 kg P_2O_5/ha+20 kg K_2O/ha+20kg S/ha (T_6).

Conclusion

The farmers of Bhal region growing gram under conserve soil moisture conditions are recommended to apply 20-40-20 kg N-P_2O_5-S/hectare for obtaining higher yield and better net monetary returns.

Application of research: The research work will be useful in Bhal region to increase gram yield.

Research Category: Nutrient Management

Abbreviations: Kg-kilogram, N-Nitrogen, S-Sulphur

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Study area / Sample Collection: Agricultural Research Station, Vallabhipur

Cultivar / Variety / Breed name: Gram GJG-3

Conflict of Interest: None declared

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