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Ranjan Kumar
Student, Faculty of Agricultural Sciences and Allied Industries, Rama University, Kanpur Nagar, Uttar Pradesh, India

Dr. AS Yadav
Advisor, Faculty of Agricultural Sciences and Allied Industries, Rama University, Kanpur Nagar, Uttar Pradesh, India

Corresponding Author:
Ranjan Kumar
Student, Faculty of Agricultural Sciences and Allied Industries, Rama University, Kanpur Nagar, Uttar Pradesh, India

Response of different date of sowing and level of sulfur from different source on production productivity and economics of chickpea (*Cicer Arietinum* L.)

Ranjan Kumar and Dr. AS Yadav

Abstract
This experiment was carried out during *Rabi* season of 2021-22 at Agricultural Research Farm of faculty of Agricultural Sciences and Allied Industries, Rama University, Mandhana, Kanpur Nagar (U.P). The present experiment was laid out in split plot design, the experiment consists of three dates of sowing in main plot *viz;*5 October date (D_1), 25 October date (D_2), 10 November (D_3) and 4 treatments *viz*; where level of sulphur (T_1) Control, (T_2) 100% Elemental sulfur, (T_3) 100% Bentonite sulfur (5 Tonns /ha), (T_4) 50% Bentonite sulfur + 50% Elemental sulfur in sub plot with three replications in chickpea. The results of this experiment result indicate the growth parameter *viz*; plant height, number of primary, secondary and tertiary branches and yield attributing characture and yield of chickpea crop *viz*; Number of pods per plant, Number of seed per pod and 1000- seed weight of chickpea and grain and straw yield of was recorded maximum from (D_1) 5 October date of sowing of chickpea crop followed by 25 October. The least number of primary branches was estimated from 10 November date of sowing of chickpea crop. Similarly, in case of soil application of (T_3) bentonite and elemental sulfur the growth and yield attributing character and yield of chickpeas oil application of RDF + 50% Bentonite sulfur + 50% Elemental sulfur which were statistically at par with soil application of RDF + 100% Bentonite sulfur but superior than RDF + 100% Elemental sulfur. However, the least Number of seed per plant was estimated from control plot. The maximum net return was estimated from 5 October date of sowing (Rs. 73,624 ha) of chickpea crop followed by 25 October (Rs. 64,033 ha). The lowest net return was estimated from 10 November (Rs. 45,439 ha) date of sowing of chickpea crop. With regard to the application of sulphur, the maximum net return was estimated from soil application of RDF + 50% Bentonite sulfur + 50% Elemental sulphur (Rs. 68,619ha) followed by with soil application of RDF + 100% Bentonite sulfur (Rs. 64,872ha) and superior than RDF + 100% Elemental sulphur (Rs. 59,389ha). However, the least net return was estimated from control plot (Rs. 53,915ha).

Keywords: Date of sowing, sulphur, growth, yield.

Introduction
The pulses are widely grown under different range of agro-climatic conditions in India, and it's occupied a strategic position on intensively as well as subsistence agriculture. It has extraordinary source of dietary protein for most of people, nutritious feed for livestock and act as a mini nitrogen plant having exterior ameliorative effect on soil environment. The pulses play as important role in rain fed condition as well as irrigated agriculture by improving physical, chemical and biological condition of soil and which are well thought-out as most important crop for natural resources management, ecological security, crop diversification and consequently for viable agriculture system.

It is also known as the 'King' of all pulses crop and in a meeting greater than 1/3rd of area and it share 40% of the total pulse production in India. In Asian continent, chickpea is principal pulse crop of Indian sub-continent. India has chief producer and consumer of chickpea in the world level. It is also grown in area of about 6.3 million ha as well as production of 5.1 MT. The average production of chickpea is recorded 806 kg ha^{-1} (FAOSTAT 2017-18).

Among pulses producing state in India, Madhya Pradesh has prime position, which share near about 23% of total pulse production. It occupied near about 32.97% area of chickpea in country and Uttar Pradesh has rank 3rd in respect of area and in production scenario. It has occupied 25.2 lakh ha cultivable land, 21.9 lakh tone and yield 86.6q ha^{-1}. Chickpea is a crucial source of energy, protein, soluble and insoluble digestible fiber and essential minerals. Among the all-various pulses, chickpea have about 60-65% Carbohydrates, 6% Fat and 12-25% Protein and amino acid. By symbiotic nitrogen fixation, the crop fulfils up to 80% of soil

nitrogen of needs, so farmers need to apply low amount N fertilizers, the remain fertilizer can use for the other non-legume next season crops.

Sulphur has significant role in formation of chlorophyll, reduction of CO_2 and production of organic compounds in plant (Scherer, 2008) [21]. There is a synergistic relationship found between P and S at low level of S application and antagonistic relationship effect observed when applied at higher level of S in wheat (Randhawa & Arora, 2000) [13] and in chickpea (Islam *et al*., 2009) [5]. Sulphur, in chickpea, mainly influences the amount of protein content. Sulphur plays a significant role in conversion of nitrogen into protein in pulse crops. Sulphur also improves the status of S containing amino acid in crop and thus enhances the protein content of seed.

Materials and Method

Geographically, Kanpur is situated in sub-tropical region at an altitude of 125.9 meter from the mean sea level and latitude ranging of 25^0 56' to 28° 58' North and longitude 79° 31' to 80° 34' East. The climate of locality is semi-arid with moderate rainfall and cold winters. The mean annual rainfall is 850 mm extending generally from the mid June to mid-October. The temperature rises maximum during May - June (45-48°C) and come down to 4-5^0C during December - January. Occasional showers are also received during winter and summer**.**

The experiment was laid out in SPD with three replication, the factors are date of sowing, October date (D_1), 25 October date (D_2), 10 November (D_3) and application of sulphur, (T_1) Control, (T_2)100% Elemental sulphur, (T_3)100% Bentonite sulphur (5 Tons /ha), (T_4) 50% Bentonite sulphur + 50% Elemental sulphur.

Result and Discussion

Initial plant population per running meter row length of chickpea crop does not show significant results due to date of sowing and soil application of bentonite and elemental sulphur.

Eventually, the interaction effect of date of sowing and soil application of bentonite and elemental sulphur does not show any significant results on initial plant population of chickpea.

The plant height at 30 DAS of chickpea crop does not show significant results due to date of sowing and soil application of bentonite and elemental sulphur. However, the plant height at 60 DAS of chickpea crop shows significant results different date of sowing of chickpea crop. The highest plant height at 60 DAS was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The lowest plant height at 60 DAS was estimated from 10 November date of sowing of chickpea crop. The highest plant height at 60DAS was estimated from soil application of RDF + 50% Bentonite sulphur + 50% Elemental sulphur which were statistically higher with soil application of RDF + 100% Bentonite sulphur and RDF + 100% Elemental sulphur. However, the lowest plant height at DAS and harvest stage was estimated from control plot. The interaction effect of date of sowing and soil application of bentonite and elemental sulphur does not show any significant results on plant height of chickpea.

The maximum number of primary branches was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The least number of primary branches was estimated from 10 November date of sowing of chickpea crop. The maximum number of primary branches was estimated from soil application of RDF + 50% Bentonite sulphur + 50% Elemental sulphur which were statistically higher with soil application of RDF + 100% Bentonite sulphur and RDF + 100% Elemental sulphur. However, the least number of primary branches was estimated from control plot. The interaction effect of date of sowing and soil application of bentonite and elemental sulphur does not show any significant results on number of primary branches of chickpea.

The maximum number of secondary branches was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The least number of secondary branches was estimated from 10 November date of sowing of chickpea crop. The maximum number of secondary branches was estimated from soil application of RDF + 50% Bentonite sulphur + 50% Elemental sulphur which were statistically at par with soil application of RDF + 100% Bentonite sulphur but superior than RDF + 100% Elemental sulphur. However, the least number of secondary branches was estimated from control plot. Eventually, the interaction effect of date of sowing and soil application of bentonite and elemental sulphur does not show any significant results on number of secondary branches of chickpea.

The maximum number of tertiary branches was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The least number of tertiary branches was estimated from 10 November date of sowing of chickpea crop. The maximum number of tertiary branches was estimated from soil application of RDF + 50% Bentonite sulphur + 50% Elemental sulphur which were statistically at par with soil application of RDF + 100% Bentonite sulphur but superior than RDF + 100% Elemental sulphur. However, the least number of tertiary branches was estimated from control plot. Eventually, the interaction effect of date of sowing and soil application of bentonite and elemental sulphur does not show any significant results on number of tertiary branches of chickpea.

The maximum number of nodules per plant at 30 DAS was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The least Number of nodules per plant at 30 DAS was estimated from 10 November date of sowing of chickpea crop. Among soil application of bentonite and elemental sulphur was does not exhibited significant result of number of nodules per plant at 30 DAS of crop growth. Eventually, the interaction effect of date of sowing and soil application of bentonite and elemental sulphur does not show any significant results on number of number of nodules per plant at 30 DAS of chickpea.

The maximum number of nodules per plant at 45 and 60 DAS was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The least Number of nodules per plant at 45 and 60 DAS was estimated from 10 November date of sowing of chickpea crop. The maximum number of number of nodules per plant at 45 and 60 DAS was estimated from soil application of RDF + 50% Bentonite sulphur + 50% Elemental sulphur which were statistically superior with soil application of RDF + 100% Bentonite sulphur and RDF + 100% Elemental sulphur. However, the least number of nodules per plant at 45 and 60 DAS was estimated from control plot. Eventually, the interaction effect of date of sowing and soil application of bentonite and elemental sulphur does not show any significant results on number of nodules per plant at 45 and 60 DAS of chickpea.

The maximum Number of pods per plant was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The least Number of pods per plant was estimated from 10 November date of sowing of chickpea crop. The maximum Number of pods per plant was estimated from soil application of RDF + 50% Bentonite sulphur + 50% Elemental sulphur which were statistically at par with soil application of RDF + 100% Bentonite sulphur and RDF + 100% Elemental sulphur. However, the least Number of pods per plant was estimated from control plot. The interaction effect of date of sowing and soil application of bentonite and elemental sulphur does not show any significant results on Number of pods per plant of chickpea.

The maximum number of seed per plant was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The least Number of seed per plant was estimated from 10 November date of sowing of chickpea crop. The maximum Number of seed per plant was estimated from soil application of RDF + 50% Bentonite sulphur + 50% Elemental sulphur which were statistically at par with soil application of RDF + 100% Bentonite sulphur but superior than RDF + 100% Elemental sulphur. However, the least Number of seed per plant was estimated from control plot. Eventually, the interaction effect of date of sowing and soil application of bentonite and elemental sulphur does not show any significant results on Number of seed per plant of chickpea.

The 1000-seed weight of chickpea crop exhibited significant results due to date of sowing and soil application of bentonite and elemental sulphur. The maximum 1000-seed weight was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The least 1000-seed weight per plant was estimated from 10 November date of sowing of chickpea crop. The maximum 1000-seed weight was estimated from soil application of RDF + 50% Bentonite sulphur + 50% Elemental sulphur which were statistically at par with soil application of RDF + 100% Bentonite sulphur but superior than RDF + 100% Elemental sulphur. However, the least 1000-seed weight was estimated from control plot. Eventually, the interaction effect of date of sowing and soil application of bentonite and elemental sulphur does not show any significant results on 1000-seed weight of chickpea.

The maximum grain yield was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The lowest grain yield was estimated from 10 November date of sowing of chickpea crop. The maximum grain yield was estimated from soil application of RDF + 50% Bentonite sulphur + 50% Elemental sulphur which were statistically at par with soil application of RDF + 100% Bentonite sulphur and RDF + 100% Elemental sulphur. However, the least grain yield was estimated from control plot. The interaction effect of date of sowing and soil application of bentonite and elemental sulphur does not show any significant results on grain yield of chickpea.

The straw yield of chickpea crop exhibited significant results due to date of sowing and soil application of bentonite and elemental sulphur. The maximum straw yield was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The lowest grain yield was estimated from 10 November date of sowing of chickpea crop. Among soil application of bentonite and elemental sulphur was significantly influencing the straw yield of crop growth. The maximum straw yield was estimated from soil application of RDF + 50% Bentonite sulphur + 50% Elemental sulphur which were statistically at par with soil application of RDF + 100% Bentonite sulphur and RDF + 100% Elemental sulphur. However, the least straw yield was estimated from control plot. The interaction effect of date of sowing and soil application of bentonite and elemental sulphur does not show any significant results straw yield of chickpea.

The maximum biological yield was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The lowest biological yield was estimated from 10 November date of sowing of chickpea crop. The maximum biological yield was estimated from soil application of RDF + 50% Bentonite sulphur + 50% Elemental sulphur which were statistically at par with soil application of RDF + 100% Bentonite sulphur and RDF + 100% Elemental sulphur. However, the least biological yield was estimated from control plot. The interaction effect of date of sowing and soil application of bentonite and elemental sulphur does not show any significant results biological yield of chickpea.

The maximum harvesting index was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The lowest harvesting index was estimated from 10 November date of sowing of chickpea crop. The maximum harvesting index was estimated from soil application of RDF + 50% Bentonite sulphur + 50% Elemental sulphur which were statistically at par with soil application of RDF + 100% Bentonite sulphur and superior than RDF + 100% Elemental sulphur. However, the least harvesting index was estimated from control plot. Eventually, the interaction effect of date of sowing and soil application of bentonite and elemental sulphur does not show any significant results harvesting index of chickpea.

The maximum B:C ratio was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The lowest B:C ratio was estimated from 10 November and date of sowing of chickpea crop. The maximum B:C ratio was estimated from soil application of RDF + 50% Bentonite sulphur + 50% Elemental sulphur followed by with soil application of RDF + 100% Bentonite sulphur ha) and superior than RDF + 100% Elemental sulphur. However, the least B:C ratio was estimated from control plot.

Discussion

Growth and development studies on crop: Date of sowing has created significant difference for plant height at 60 DAS, number of primary, secondary and tertiary branches, root nodules of the chickpea plant. The highest plant height at 60 DAS was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The lowest plant height at 60 DAS was estimated from 10 November date of sowing of chickpea crop. The maximum number of primary, secondary and tertiary branches was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The least number of primary branches was estimated from 10 November date of sowing of chickpea crop. The maximum number of nodules per plant at 30 DAS was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The least Number of nodules per plant at 30 DAS was estimated from 10 November date of sowing of chickpea crop. Early sowing of chickpea crop provides a congenial environmental condition for better growth and development of crop. Similar result has been reported by Shamsi K (2009) [19] and Kabir *et al.,* (2009) [8].

The highest plant height at 60 DAS was estimated from soil application of RDF + 50% Bentonite sulphur + 50% Elemental sulphur which were statistically higher with soil application of RDF + 100% Bentonite sulphur and RDF + 100% Elemental sulphur. The maximum number of primary, secondary and tertiary branches was estimated from soil application of RDF + 50% Bentonite sulphur + 50% Elemental sulphur which were statistically higher with soil application of RDF + 100% Bentonite sulphur and RDF + 100% Elemental sulphur. The maximum number of nodules per plant at 30 DAS was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The least Number of nodules per plant at 30 DAS was estimated from 10 November date of sowing of chickpea crop. The result also exhibited that sulphur also increase the growth rate and yield of chickpea when soil have poor soil condition, because availability of micro and macro nutrient in soil depend on soil acidity and alkalinity. Many evidence has been available that referred major roll of sulphur to enhancement of growth and yield of chickpea. It is due to because sulphur involve in different metabolic, biological and enzymatic process *viz*; photosynthesis, respiration and symbiotic nitrogen fixation in legume plant. Similar result reported by many scientists.

Yield and yield attributes studies on crop: It is clearly understood from finding that all yield and yield attributing character *viz* number of pods per plant, number of seed per plant and thousand seed weight significantly influenced by date of sowing. The maximum number of pods per plant was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The least Number of pods per plant was estimated from 10 November date of sowing of chickpea crop. The maximum number of seed per plant was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The least Number of seed per plant was estimated from 10 November date of sowing of chickpea crop. The maximum 1000-seed weight was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The least 1000-seed weight per plant was estimated from 10 November date of sowing of chickpea crop. The maximum grain yield was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The lowest grain yield was estimated from 10 November date of sowing of chickpea crop This should be happened due to favourable temperature during crop growth period which ultimately increase the yield attributing character and yield of chickpea. The maximum harvesting index was estimated from 5 October date of sowing of chickpea crop followed by 25 October. The lowest harvesting index was estimated from 10 November date of sowing of chickpea crop. Similar result has been reported by many other researcher.

The maximum Number of pods per plant was estimated from soil application of RDF + 50% Bentonite sulphur + 50% Elemental sulphur which were statistically at par with soil application of RDF + 100% Bentonite sulphur and RDF + 100% Elemental sulphur. The maximum grain yield was estimated from soil application of RDF + 50% Bentonite sulphur + 50% Elemental sulphur which were statistically at par with soil application of RDF + 100% Bentonite sulphur and RDF + 100% Elemental sulphur. This results also concluded by Islam *et al.,* (2011) [6].

Economics

The maximum Cost of cultivation was estimated from 10 November date of sowing of chickpea crop followed by 5 October and 25 October. The lowest Cost of cultivation was estimated from 5 October and 25 October date of sowing of chickpea crop. As sowing of crop take delay, the residual soil moisture could be evaporated due to from field. This results additional irrigation should be required for maintain moisture in the field. This additional agriculture practices could increase the cost of cultivation. Similar result has been reported by Mahaveer *et al.*, (2020) [10].

Among soil application of bentonite and elemental sulphur was significantly influencing the Cost of cultivation of crop growth. The maximum Cost of cultivation was estimated from soil application of RDF + 50% Bentonite sulphur + 50% Elemental sulphur followed by with soil application of RDF + 100% Bentonite sulphur and superior than RDF + 100% Elemental sulphur. Similar finding has been reported by Rana (2007) [14].

Table 1: Effect of date of sowing and sulphur on plant height, Number of branches, and Number of nodules per plant

Treatments	Initial Population	Plant Height		Number of Branches			Number of nodules per plant		
		30 DAS	60 DAS	Primary	Secondary	Tertiary	30 DAS	45 DAS	60 DAS
(A.) Date of sowing									
5 October	23.190	10.528	30.100	4.150	10.288	14.150	9.800	14.405	27.455
25 October	23.608	10.353	27.815	3.600	8.638	11.738	8.550	11.270	20.950
10 November	23.535	10.150	27.008	3.100	7.538	10.595	7.498	10.480	18.250
C.D.	N/A	N/A	1.258	0.162	0.382	0.520	0.380	0.520	0.949
SE(m)	0.268	0.116	0.312	0.040	0.095	0.129	0.094	0.129	0.235
SE(d)	0.379	0.164	0.441	0.057	0.134	0.182	0.133	0.183	0.333
(B.) Sub plot									
Control	23.577	10.373	27.803	3.033	8.267	11.607	8.233	11.057	20.600
RDF + 100% Elemental sulfur	23.210	10.307	27.833	3.517	8.600	12.000	8.500	11.567	21.483
RDF + 100% Bentonite sulfur	23.577	10.320	28.497	3.800	9.100	12.420	8.767	12.323	22.587
RDF + 50% Bentonite sulfur + 50% Elemental sulfur	23.413	10.373	29.097	4.117	9.317	12.617	8.963	13.260	24.203
C.D.	N/A	N/A	1.23	0.175	0.422	0.579	N/A	0.590	1.099
SE(m)	0.347	0.155	0.432	0.059	0.141	0.193	0.059	0.197	0.367
SE(d)	0.491	0.219	0.611	0.083	0.199	0.273	0.191	0.279	0.519
Interaction (AxB)									
SE(d)±	0.851	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C.D at 5%	N/A	0.379	1.059	0.143	0.345	0.473	0.133	0.483	0.573

Table 2: Effect of date of sowing and sulphur on Number of pods and seed per plant, 1000 seed weight, Grain yield, Straw yield, Biological Yield, Harvesting index and B:C Ratio

Treatments	Number of pods per plant	Number of seed per plant	1000 seed weight	Grain yield (Kg/ha)	Straw yield (Kg/ha)	Biological yield (Kg/ha)	Harvesting Index (%)	B:C Ratio
(A.) Date of sowing								
5 October	49.980	1.615	155.748	19.090	22.900	41.990	45.423	2.685
25 October	56.663	1.563	157.623	17.190	20.728	37.918	45.288	2.333
10 November	46.120	1.490	151.380	13.964	18.280	32.245	43.245	1.548
C.D.	2.418	0.073	2.520	1.755	0.925	1.676	1.20	N/A
SE(m)	0.600	0.018	0.329	0.187	0.229	0.416	0.503	N/A
SE(d)	0.848	0.025	0.172	0.265	0.325	0.588	0.311	N/A
(B.) Sub plot								
Control	49.083	1.413	153.503	15.207	19.787	34.993	43.330	2.113
RDF + 100% Elemental sulfur	50.363	1.520	154.387	16.220	20.477	36.697	44.113	2.163
RDF + 100% Bentonite sulfur	51.633	1.560	155.473	17.356	20.840	38.197	45.347	2.327
RDF + 50% Bentonite sulfur + 50% Elemental sulfur	52.603	1.597	156.303	18.210	21.440	39.650	45.817	2.390
C.D.	2.264	0.067	1.579	1.794	1.257	1.750	1.32	N/A
SE(m)	0.756	0.022	0.193	0.265	0.320	0.584	0.671	N/A
SE(d)	1.069	0.032	0.273	0.375	0.452	0.827	0.949	N/A
Interaction (AxB)								
SE(d)±	N/A	N/A	N/A	0.649	0.783	N/A	N/A	N/A
C.D at 5%	1.8520.143	0.055	0.373	.143	0.783	1.432	1.643	N/A

Conclusion

On the basis of our finding it is concluded that in case of date of sowing D_1 (5 October) and in case of sulphur level treatment T_3 (RDF + 50% Bentonite sulphur + 50% Elemental sulphur) was found to be best in the terms of Growth, Yield, and Economics.

References

1. Ali A, Zia MS, Rahmatullah Shah A, Yasin M. Nodulation in Sesbania bispinosa as affected by nitrogen application. Pakistan Journal of Soil Science. 1998;15:183-185.
2. Das SK, Chopra P, Chatterjee SR, Abrol YP, Deb DL. Influence of Sulphur fertilization on yield of maize and protein quality of cereals. Fert. News. 1975;20(3):30-32.
3. Dhote PP, Thaokar A, Gawali KA, Sarda A, Nagmote A. Effect of different sowing dates on growth and yield of chickpea (*Cicer Arietinum* L.) under irrigated condition, Journal of Pharmacognosy and Phytochemistry. 2019;8(5):1864-1867.
4. Hafeez-ur-Rehman, Rafi Qamar, Atique-ur-Rehman, Farhan Ahmad. Effect of different sowing dates on growth and grain yield of chickpea (*Cicer Arietinum* L.) cultivars under agro-environment of Taluka Dokri Sindh, Pakistan. American Journal of Experimental Agriculture. 2015;8(1):46-53, Article no. AJEA.2015.145, ISSN: 2231-0606, Science domain international.
5. Islam M, Ali S, Hayat R. Effect of integrated application of phosphorus and sulphur on yield and microutrient uptake by chickpea (*Cicer arietinum* L.). Int. J. Agric. Biol. 2009;11:33-38.
6. Islam M, Mohsan S, Afzal S, Ali S, Akmal M, Khalid R *et al*. Phosphorus and sulphur application improves the chickpea productivity under rainfed conditions. Int. J. Agric. Biol. 2011;13:713-718.
7. Islam M, Akmal M, Khan MA. Effect of P and S application on nutrient balance under chickpea (*Cicer arietinum L*) monocropping. Romanian Agril Res. 2013a;30:223-32.
8. Kabir Fazlul AHM, Bari MN, Md. Abdul Karim./ Effect of sowing time and cultivars on the growth and yield of chickpea under rain fed condition. Bangladesh J. Agril. Res. 2009;34(2):335-342.
9. Kumar Sunil M, Martin Luther M, Ch Pulla Rao, Narasimha Rao KL, Ratna Prasad P. Effect of Different Dates of Sowing and Irrigation Levels on Growth and Yield of Chickpea (*Cicer Arietinum* L.) The Andhra Agric. J. 2018;65(4):795-800.
10. Mahaveer ML, Reager, Shri Rakesh. Effect of Sowing Dates and Weed Control Measure on Growth and Yield of Chickpea in Western Rajasthan. Int. J. Curr. Microbiol. App. Sci. 2020;9(05):2638-2645. DOI: https://doi.org/10.20546/ijcmas.2020.905.302
11. Patil BP, Jadhav MS. Effect of fertilizer and Rhizobium on yield of green gram on medium black soils of Konkan, J. Indian Soc. Coastal Agric. Phy Siological Res. 1992;12(1&2):103-104.
12. Prasad Dasharath, Bangarwa AS, Satish Kumar, Asha Ram. Effect of sowing dates and plant population on chickpea (*Cicer Arietinum*) genotypes. Indian Journal of Agronomy. June 2012;57(2):206-208.
13. Randhawa PS, Arora CL. Phosphorus-sulphur interaction effects on dry matter yield and nutrient uptake by wheat. J. Indian Soc. Soil Sci. 2000;48:536-544.
14. Rana. Integrated nutrient management in chickpea (*Cicer Arietinum* L.). Journal of Farming Systems Research & Development. 2007;13(2):288-289.
15. Ray Kripanidhi, Devendra Singh, Jat Bhanwar Lal. Effect of sowing time and seed rate on growth and yield of chickpea cultivars. Adv. Res. J. Crop Improv. 2017;8(1):1-16. DOI : 10.15740/HAS/ARJCI/8.1/1-16.
16. Sahu Vedhika, Mishra VN, Shrivastava LK, Purnendra Kumar Sahu. Effect of different levels of sulphur and fym on yield and soil nutrient status of chickpea. Plant Archives. 2015;15(2):1187-1189.
17. Sangwan A, Duhan BS, Sangwan PS. Effect of different sources of sulphur on yield and nutrient uptake by wheat. Journal of Pharmacognosy and Phytochemistry.

2018;7(6):2686-2691.
18. Srinivasarao Ch, Masood Ali, Venkateswarlu S, Rupa TR, Singh KK, Sumanta Kundu *et al*. Direct and residual effects of integrated sulphur fertilization in maize (*Zea mays*)- chickpea (*Cicer Arietinum*) cropping system on Typic Ustochrept. Indian Journal of Agronomy. Dec 2010;55(4):259-263.
19. Shamsi K. Effect of sowing date and row spacing on yield and yield components of chickpea under rain fed conditions in Iran. Journal of Applied Biosciences. 2009;17:941-947. ISSN 1997–5902.
20. Singh S, Saini SS, Singh BP. Effect of irrigation, sulphur and seed inoculation on growth, yield and sulphur uptake of chickpea (*Cicer Arietinum*) under late sown conditions. Indian J. Agron. 2004;49(1):57-59.
21. Scherer HW. Impact of Sulphur on N2 Fixation of Legumes. In: Khan, N.A. (ed.), Sulphur Assimilation and Abiotic Stress in Plants. Kluwer academic publications, The Netherlands, 2008, 51.
22. Srivastav V, Kushwaha HS. Optimization of Sulphur Dose for Chickpea (*Cicer Arietinum* L.) Cultivars in Kymore Plateau of Madhya Pradesh, India International Journal of Current Microbiology and Applied Sciences ISSN: 2319-7706. 2017;6(7):2567-2570.