Agriways 9 (1) : 12-16, June 2021
DOI:

ISSN: 2321-8614 (Print)
ISSN: 2454-2318 (Online)

Research Article

Effect of FYM and Sulphur Levels on Yield Attributes, Yield, Grain Protein and Economics of Sole and Intercropped Chickpea in Association with Mustard

Chhote Lal, Ista Dev, Gaurav Kumar Singh, Ram Pyare and Vishram Singh

C.S. Azad University of Agriculture & Technology, Kanpur (UP), India

Received: 06 April 2021/Accepted: 08 June 2021

Abstract A field experiment was carriedout during two consecutive years (2009-10 and 2010-11) at Chandra Shekhar Azad University of Agriculture and Technology, Kanpur to evaluate the efect of FYM and S levels on yield and economics of sole and intercropped chickpea with association of mustard. Treatment consisted two cropping systems (viz. sole chickpea and chickpea + mustard 4:1), three levels of FYM @ 0, 5 and 10 t/ha and three levels of sulphur @ 0, 30 and 60 kg/ha. Result revealed that intercropped chickpea reduced grain yield by 4.38 q/ha or 22.6% and yield attributes viz. pods/plant, seeds/pod, grains/plant, 1000-seed weight and seed weight/plant significantly than sole chickpea. Seed protein (18.14%) and net income (Rs. 29758/ha) were maximum in sole chickpea. Application of FYM @ 10 t/ha gave maximum grain yield (20.69 q/ha), all yield attributes, grain protein (19.71%) and net return (Rs. 34425/ha). Application of sulphur improved significantly yield attributes, seed yield, seed protein, net profit upto 30 kg S/ha beyond this dose the increased was numerical.

Key word: Grain yield, protein, yield attributes, FYM, economics?

Introduction

India is the largest producer of pulses in the world with 25% share in the global production. Chickpea, pigeonpea, mungbean, urdban, lentil and field pea are important pulse crops contributing 39%, 21%, 11%, 10%, 7% and 5% to the total productivity of pulses in the country (Singh, 2009). In India, M.P., UP, Rajasthan, Maharashtra, Gujarat, Andhra Pradesh and Karnataka are the major chickpea producing states sharing over 95% area. Chickpea occupies about 38% of area under pulses and contributes about 50% of the total pulse production of India. It is used for human consumption and feeding to animals. It is eaten both whole fried or boiled salted or split pulse which is cooked and eaten. Chickpea grains contain 21.1% protein, 61.5% corbohydrate and 4.5% fat. It is also rich in calcium, iron and niacin. It is essential to increase chickpea production for fulfill the demand of increasing population of country. FYM improved physical, chemical and biological property of soil alongwith the increasing availability of nutrients and contain, macro and minor nutrients. Sulphur ascribed to its privotal role in regulating the metabolic and enzymatic processes. Thus these helps in improving chickpea production. The intercropping of chickpea + mustard is a most popular practice during winter season in Northern India in various row combinations. Hence it is essential to increased intercropped chickpea production through inclusion of FYM and sulphur levels. With these views present investigation was under taken.

Material and Methods

A field experiment was conducted during Rabi season of 2009-10 and 2010-11 at student's Instructional Farm of the C.S. Azad University of Agriculture & Technology, Kanpur. Treatment consisted two cropping system viz. Sole chickpea and Chickpea + mustard (4:1), three levels of each FYM (@ 0, 5 and 10 t/ha) and Sulphur (@ 0, 30 and 60 kg/ha). Thus 18 treatment combination were tested in a three replicated split plot design. In which cropping system and FYM levels were kept in mainplot and S levels in sub plots. The soil of the experimental plot was sandyloam in texture having soil pH 7.4, available N (169 kg/ha), organic carbon 0.40%, available P2O5 (16.2 kg/ha), available K(180 kg/ha) and available sulphur (18.2 kg/ha). Chickpea variety KPG-59 and mustard variety 'Vardan' were used. A uniform application of 20 KgN + 40 kg P_2O_5 + 30 kg/K_2O/ha in chickpea and 120 kgN + 60 Kg P_2O_5 + 40 Kg K_2O/ha in mustard were used in all treatments. In intercropping plots fertilizers were applied row basis of actual area sown in each plot. The crops were

sown on Nov, 25, 2009 and Nov., 15, 2010 in furrows at 40 cm apart behind country plough. FYM and sulphur were applied as per treatment at sowing time. In intercropping, fifth row of chickpea was replaced by one row of mustard. Crop was irrigated twice i.e. preflowering and complete pod setting of chickpea. Remaining practices were adopted as per need of crop and harvest of chickpea on 15-04-2010 and 14-04-2011 while mustard was harvested on 01-04-2010 and 30-03-2011 in both years, respectively. All yield attributes of chickpea such as pods/plants, seeds/pod, grains/plant, 1000-seed weight and grain yield and straw yield were recorded. Harvest index was calculated. Seed protein content were estimated with the help of N content in seed. All the economic parameters such as cost of cultivation, gross return, net return and B:C ratio were workout. The recorded value of all observations were analysed statistically.

Result and Discussion

Effect on Yield Attributes of Chickpea

It is apparent from table-1 that number of pods/plant was significantly influenced by all treatment factors. Among cropping systems, sole chickpea produced significantly more number of pods/plant than intercropped chickpea. Application of FYM@ 5 and 10 t/ha increased number of pods by margins of 7.93 or 38.3% and 13.49 pods or 65.1% over no FYM, respectively. Application of 30 and 60 kg S/ha increased pods/plant by 2.47 pods and 4.51 pods/ plant or 9.7 and 17.7%, over no sulphur, respectively.

Intercropped chickpea reduced number of seeds/pod by 0.09 seeds/pod or 5.9% than sole chickpea. FYM @ 5 and 10 t/ha increased seeds/pod over no FYM by the margins of 0.18 and 0.27 seeds/pod or 13.4 and 20.1%, respectively. Similarly @ 30 and 60 kg S/ha increased seeds/pod over no sulphur by 0.07 and 0.12 seeds/pod or 4.9 and 8.5%, respectively.

Number of grains/plant was recorded significantly higher (49.82) in sole chickpea than intercropped chickpea (34.66). FYM @ 5 and 10 t/ha increased grains/plant by 15.44 and 27.23 grains/plant, respectively. Application of sulphur @ 30 and 60 kg/ha improved grains by 4.97 and 9.66 plant than no sulphur, respectively.

Result revealed that pure chickpea produced significantly higher grain weight per plant (8.58 g) than intercropped chickpea (6.87 g). Application of FYM or sulphur increased grain weight/plant significantly upto their highest level of 10 t/ha FYM or 60 kg S/ha. FYM @ 5 and 10 t/ha increased grain weight/plant by 1.93 and 3.07 g, respectively. Similarly sulphur @ 30 and 60 kg/ha increased grain weight over no sulphur by the margins of 0.47 and 1.08 g/plant, respectively.

1000-seed weight recorded signficantly higher in sole chickpea. It reduced intercropped chickpea by the margin of 10.49 g or 6.7%. FYM application increased test weight upto 5 t FYM/ha which gave 5.86 g higher test weight over no FYM. It was not increased statistically with 10 t FYM/ha over 5 t/ha. Sulphur application @ 30 kg/ha increased test weight significantly by 2.93 g and beyond this dose increase was numerical.

The reduction in yield attributes of intercropped chickpea might be due to shading effect of mustard on chickpea plants which restricted the overall growth and development of chickpea a plants. Similar results were reported by, Prasad et al. (2006) and Yadav et al. (2013). Increase in yield attributes due to increasing FYM levels may be probably improved physical condition of soil in addition to supply major and micronutrients and increased microbial activities resulted higher rate of photo synthesis. These results may be supported by the findings of Siog and Kumpawat (2003). The improvement in yield attributes of chickpea with sulphur application could be ascribed to its pivotal role in regulating the metabolic and enzymatic processes. These results are inclose accordance with findings of Singh et al. (2004) and Nehtra (2006).

Effect on Grain and Straw Yield of Chickpea

It is apparent from Table-2 that sole chickpea produced significantly higher grain during both years and in pooled than intercropped chickpea. On pooled basis the reduction in grain yield was found 4.38 q/ha or 22.6% compared to sole chickpea. Grain yield increased significantly with upto 10 t/ha FYM and with upto 30 kg S/ha during 2009-10, 2010-11 and in pooled. FYM@ 5 and 10 t/ha increased grain yield by 3.76 and 7.13 q/ha over no. FYM, respectively. Sulphur application increased grain yield by the margins of 1.43 and 2.14 q/ha over no sulphur, respectively.

Result showed that sole chickpea recorded significantly higher straw yield during both years. On pooled basis intercropped chickpea reduced straw yield by the margin of 7.54 q/ha or 22.7% than sole chickpea. Increasing levels of FYM increased straw yield significantly upto 10 t/ha during both years and in pooled (36.97 q/ha). Sulphur application increased straw yield with upto 60 kg/ha in all years of experimentation.

The grain and straw yields reduction in intercropped chickpea might be attributed to reduction in plant stand per unit area and also to reduced yield attributes (due to

shading effect of mustard). These result corroborate with findings of Prasad et al. (2003), Kumar et al. (2006), Yadav et al. (2013). FYM increased strain and straw yield due to better yield attributes as FYM improved soil health and improvising nutrient availability. These results are in consonance with these of Arya et al. (2007) and Tanwar et al. (2010). Increase grain and straw yield due to sulphur might be better yield attributes as sulphur improve nutrient absorption and provide strong sink strength. These results are in accordance with those reported by Singh et al. (2004) and Nehra et al. (2006).

Effect on Harvest Index and Protein Content in Grain

It is clear from from table-2 that harvest index of chickpea was not influenced significantly by cropping system either in years or in pooled. FYM application increased harvest index upto 10 t/ha FYM (39.31%) and sulphur application upto 60 kg/ha (37.40%) on pooled basis but beyond 30 kg S/ha (36.86%) was not found significant. The higher harvest index under FYM and sulphur treatment might be due to better translocation of photosynthesis from source to sink.

Protein content in grain was significantly higher in sole chickpea than intercropped chickpea during both years and in pooled value. Application of FYM upto 10 t/ha and sulphur upto 60 kg/ha increased grain protein significantly during all years. On pooled basis, application of 5 and 10 t/ha FYM increased grain protein content over no FYM by 1.17 and 2.47 unit percent, respectively. Sulphur @ 30 and 60 kg/ha increased grain protein by 0.33 and 0.66 unit percent, respectively. Reduction in grain protein content in intercropping might be due to uptake of lesser amount of nitrogen and its accumulation in grain. Result of Chand and Tripathi (2005) supported the findings. Increase in grain protein due to FYM and sulphur might be attributed to higher N content in grain because of better nitrogen nutrition of chickpea with FYM application and positive effect of sulphur on N content in grain. Ram and Dwivedi (1992) and Raju et al. (1991) also observed similar findings.

Effect on Economics of Chickpea

Gross income (Table-3) computed significantly higher under sole chickpea and reduced intercropping by Rs. 12554/ha or 22.6% in pooled results. The gross income increased significantly upto 10 t/ha FYM (Rs. 59226/ha) sulphur application increased gross return significantly upto 60 kg/ha (Rs. 52003/ha). It was lowest under no FYM (Rs. 39062/ha) and without sulphur (Rs. 23668/ha). It was attributed to grain and straw yield of chickpea which is main source of income.

Net income computed significantly higher under sole chickpea than in intercropping. Inter cropped chickpea reduced net income by the margin of Rs. 7405/ha or 24.9% compared to sole chickpea. Net income increased with increasing levels of FYM @ 10 t/ha. It increased net income by Rs. 8793/ha @ 5 t/ha and Rs. 16950/ha (10 t/ha) over control. Sulphur application @ 30 60 kg/ha increased net income over No. sulphur by Rs. 2482/ha and Rs. 3015/ha, respectively. It was attributed to increased higher gross return than cost of cultivation.

Benefit: Cost ratio was significantly high under sole chickpea than intercropped chickpea (Pooled) which might be attributed to higher gross income. Increasing levels of FYM increased B:C ratio significantly upto highest level of 10 t/ha (2.39). Hover, sulphur application had no significant effect on B:C ratio of chickpea but numerically 30 kgs/ha registered highest ratio (2.12). These results corroborate to be findings of Kumar et al. (2006).

Table-1: Effect of treatments on number of pods/plant, no. of seeds/pod, no. of grains/plant, 1000 seed weight (g), grain weight per plant of sole and intercropped chickpea.

Treatments	No. of pods/plant			No. of Seeds/pod			No. of grains/plant			100-grain Weight (g)			Grain weight/plant (g)		
	2009-10	2010-11	Pooled	2009-10	2010-11	Pooled	2009-10	2010-11	Pooled	2009-10	2010-11	Pooled	2009-10	2010-11	Pooled
Cropping System															
Sole chickpea	31.52	32.49	32.00	1.51	1.55	1.53	48.42	51.21	49.82	167.23	167.91	167.57	8.47	8.70	8.58
Chickpea + Mustard (4:1)	23.22	24.17	23.70	1.43	1.45	1.44	33.79	35.53	34.66	156.95	157.21	157.08	6.78	6.96	6.87
S.Ed. ±	**0.49**	**0.59**	**0.38**	**0.02**	**0.02**	**0.01**	**0.55**	**0.70**	**0.44**	**0.44**	**0.54**	**0.35**	**0.12**	**0.13**	**0.09**
CD (P=0.05)	**1.08**	**1.31**	**0.80**	**0.04**	**0.04**	**0.02**	**1.21**	**1.57**	**0.93**	**0.98**	**1.20**	**0.72**	**0.27**	**0.28**	**0.18**
FYM (t/ha)															
0	20.22	21.19	20.71	1.33	1.35	1.34	27.14	28.89	28.01	157.81	158.63	158.22	5.96	6.16	6.06
5	28.14	29.14	28.64	1.51	1.52	1.52	42.49	44.40	43.05	163.94	164.23	164.08	7.90	8.08	7.99
10	33.75	34.65	34.20	1.58	1.63	1.61	53.67	56.82	55.24	164.54	164.82	164.68	9.02	9.24	9.13
S.Ed. ±	**0.60**	**0.72**	**0.47**	**0.02**	**0.02**	**0.01**	**0.67**	**0.82**	**0.39**	**0.54**	**0.66**	**0.43**	**0.14**	**0.16**	**0.11**
CD (P=0.05)	**1.33**	**1.60**	**0.97**	**0.04**	**0.04**	**0.02**	**1.49**	**1.92**	**0.80**	**1.19**	**1.47**	**0.89**	**0.33**	**0.35**	**0.23**
Sulphur (kg/ha)															
0	25.04	25.99	25.52	1.41	1.44	1.42	36.29	38.44	37.36	159.74	160.35	160.05	7.12	7.30	7.21
30	27.45	28.54	27.99	1.47	1.51	1.49	40.96	43.70	42.33	162.83	163.13	162.98	7.58	7.78	7.68
60	29.61	30.45	30.03	1.53	1.55	1.54	46.06	47.98	47.02	163.71	164.19	163.95	9.18	8.40	8.29
S.Ed. ±	**0.82**	**0.98**	**0.90**	**0.02**	**0.03**	**0.02**	**0.94**	**1.19**	**1.08**	**0.69**	**0.82**	**0.76**	**0.20**	**0.21**	**0.20**
CD (P=0.05)	**1.68**	**2.03**	**1.79**	**0.05**	**0.06**	**0.06**	**1.95**	**2.47**	**2.13**	**1.42**	**1.71**	**1.50**	**0.41**	**0.44**	**0.41**

Table-2: Effect of treatments on grain yield (q/ha), straw yield (q/ha), harvest index (%) and grain protein content(%) of chickpea in sole and intercropping.

Treatments	Grain yield (q/ha)			Straw yield (q/ha)			Harvest index (%)			Protein content in grain (%)		
	2009-10	2010-11	Pooled	2009-10	2010-11	Pooled	2009-10	2010-11	Pooled	2009-10	2010-11	Pooled
Cropping System												
Sole chickpea	19.10	19.66	19.38	34.27	32.22	33.24	35.64	37.55	36.59	18.47	18.61	18.54
Chickpea + Mustard (4:1)	14.78	15.22	15.00	24.46	24.95	25.70	35.66	37.60	36.63	18.26	18.46	18.36
S.Ed. ±	**0.30**	**0.33**	**0.27**	**0.34**	**0.27**	**0.36**	**0.22**	**0.22**	**0.22**	**0.09**	**0.09**	**0.07**
CD (P=0.05)	**0.67**	**0.73**	**0.57**	**0.76**	**0.59**	**0.76**	**NS**	**NS**	**NS**	**0.21**	**0.21**	**0.14**
FYM (t/ha)												
0	13.40	13.73	13.56	25.55	28.24	26.89	34.36	32.57	33.46	17.71	17.31	17.24
5	16.85	17.78	17.32	30.45	28.39	29.42	35.61	38.49	37.05	18.27	18.55	18.41
10	20.58	20.81	20.69	35.09	29.13	32.11	36.97	41.65	39.31	19.66	19.75	19.71
S.Ed. ±	**0.37**	**0.40**	**0.27**	**0.42**	**0.33**	**0.44**	**0.27**	**0.27**	**0.22**	**0.11**	**0.12**	**0.08**
CD (P=0.05)	**0.82**	**0.89**	**0.57**	**0.93**	**0.73**	**0.93**	**0.60**	**0.60**	**0.46**	**0.25**	**0.27**	**0.17**
Sulphur (kg/ha)												
0	15.87	16.14	16.00	29.02	28.17	28.59	35.15	35.98	35.56	18.06	18.18	18.12
30	16.99	17.86	17.43	30.53	28.68	29.61	35.61	38.12	36.86	18.40	18.51	18.45
60	17.96	18.32	18.14	31.54	28.91	30.22	36.18	38.61	37.40	18.64	18.91	18.78
S.Ed. ±	**0.51**	**0.57**	**0.76**	**0.56**	**0.47**	**0.61**	**0.41**	**0.34**	**0.37**	**0.16**	**0.17**	**0.12**
CD (P=0.05)	**1.05**	**1.18**	**1.51**	**1.16**	**NS**	**1.21**	**NS**	**0.70**	**0.74**	**0.34**	**0.36**	**0.23**

Table-3: Effect of treatments on gross return (Rs./ha) net return (Rs/ha) and B:C ratio of sole and intercropped chickpea.

Treatments	Gross return (Rs/ha)			Net return (Rs/ha)			Benefit: cost ratio		
	2009-10	2010-11	Pooled	2009-10	2010-11	Pooled	2009-10	2010-11	Pooled
Cropping System									
Sole chickpea	54860	56329	55594	29007	30509	29758	2.10	2.16	2.13
sa120Chickpea + Mustard (4:1)	42450	43629	43040	21762	22944	22353	2.03	2.09	2.06
S.Ed. ±	**413**	**565**	**350**	**430**	**426**	**303**	**0.04**	**0.04**	**0.03**
CD (P=0.05)	**920**	**1260**	**730**	**958**	**949**	**631**	**NS**	**NS**	**0.05**
FYM (t/ha)									
0	38543	39580	39062	16931	18018	17475	1.77	1.82	1.80
5	48398	50929	49664	25002	27534	26268	2.06	2.17	2.12
10	59024	59428	59226	34221	34628	34425	2.38	2.39	2.39
S.Ed. ±	**506**	**692**	**429**	**527**	**521**	**371**	**0.05**	**0.04**	**0.03**
CD (P=0.05)	**1127**	**1543**	**894**	**1173**	**1077**	**773**	**0.10**	**0.10**	**0.07**
Sulphur (kg/ha)									
0	45609	46319	45964	23868	24577	24223	2.07	2.10	2.09
30	48799	51168	49984	25465	27945	26705	2.07	2.17	2.12
60	51557	52450	52003	26820	27657	27238	2.06	2.10	2.08
S.Ed. ±	**796**	**993**	**636**	**604**	**611**	**429**	**0.06**	**0.06**	**0.04**
CD (P=0.05)	**1644**	**2049**	**1280**	**1345**	**1261**	**864**	**NS**	**NS**	**NS**

References

Prasad K, Singh KK and Pyare Ram. 2006. Studies on intercropping of mustard varieties with chickpea. Indian Journal of Pulses Research, 19(1):73-75.

Yadav, P.K.; Vishram, Ram; Singh, D.A.P. and Ram Ruchi 2013. Effect of row ratio and phosphorus fertilizers in chickpea (Cicer arietinum L.) and mustard (Brassica Juncea L.) intercropping system. Indian Journal of Agronomy, 58 (2): 198-202.

Nehra, K.C.; Kumawat, P.D. and Singh, B.P. 2006. Response of fenugreek (Trigonella foenum graecum) to phosphorus, sulphur and plant growth regulators under semi-arid eastern plains zone of Rajasthan. Indian Journal of Agronomy, 51(1): 73-76.

Kumar, A.; Prasad, S. and Kumar, S.B. 2006. Effect of boron and sulphur on performance of gram (Cicer arietinum L.). Indian Journal of Agronomy, 51 (1): 57-59.

Prasad, Kedar; Rawat, S.K. and Pyare, Ram 2003. Performance of mustard varieties with association of chickpea under limited irrigations. Farm Science Journal, 12(20): 157-158.

Chand, S. and Tripathi, A.K. 2005. Effect of phosphorus fertilization on yield, quality, nutrient uptake and energetic of chickpea + Indian mustard intercropping system. Haryana Journal of Agronomy, 21(20): 164-168.

Raju, M.S.; Verma, S.C. and Ramaish, N.V. 1991. Effect of phosphorus in relation to fYM v/s Rhizobium inoculation on nutrient uptake by chickpea (Cicer arientnum L.) under rainfed condition. Indian Journal of Agricultural Research¸ 25 (1): 43-48.

Ram, H. and Dwivedi, K.N. 1992. Effect of source and level of sulphur on yield and grain quality of chickpea (Cicer arietinum L.), Indian Journal of Agronomy, 37(1): 112-114.

Singh, S.; Saini, S. S. and Singh, B.P. 2004. Effect of irrigation, sulphur and seed inoculation on growth, yield and sulphur uptake of chickpea (Cicer arietinum L.) under late sown conditions. Indian Journal of Agronomy,49 (1): 57-59.

Tanwar, S.P.S.; Rakodia, P. and Singh, A.K. 2010. Productivity, nutrient balance and economics of Kabuli chickpea (Cicer Kabulium L.) as influenced by integrated nutrient management. Indian Journal of Agronomy, 55(1): 51-55.

Arya, R.L.; Varshney, J.G. and Lalit Kumar 2007. Effect of integrated nutrient application in chickpea + mustard intercropping system in the semi-arid tropics of North India. Soil Science and Plant Analysis, 38(2): 229-240.

Siage, R.K. and Kumawat, P.D. 2003. Response of chickpea to FYM, P and Zinc fertilization in sandyloam soil. Haryana Journal of Agronomy19(2): 8-11.

Singh, K.K. 2000. Study of different sowing dates and row ratio of mustard in intercropping with chickpea. Ph.D. thesis, CSAUA&T, Kanpur.