Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(2): 1532-1537
Received: 13-01-2018
Accepted: 14-02-2018

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Farm yard manure and dalweed improve the growth and yield in soybean (*Glycine max* (L.) Merill)

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Abstract
A pot experiment was carried out at SKUAST-Kashmir, Srinagar during two consecutive *Kharif* seasons to study the "Farm Yard Manure and Dalweed improve the Growth and Yield in Soybean (*Glycine max* (L.) Merill)". The experiment was laid out with 18 treatment combinations viz., three levels of each of recommended doses of inorganic fertilizers (50, 75 and 100% RD) and organic manures (control, FYM 10 t ha^{-1} and Dalweed 10 t ha^{-1}) and two levels of biofertilizers (control and dual inoculation with *Rhizobium* + PSB) in Randomised Complete Block Design with three replications. The results revealed that grain and straw yield increased significantly with increase in the recommended inorganic levels. Application of FYM @ 10 t ha^{-1} showed significantly superior results over other organic treatments. Dual inoculation with Rhizobium and PSB showed significantly superior results over no inoculation. Yield attributing characters viz. 100-seed weight and number of nodules showed significant increase with increasing levels of recommended inorganic fertilizers. Application of 75% recommended inorganic fertilizer level showed highest 100-seed weight over other levels. Among organics, FYM (10 t ha^{-1}) was found superior over Dalweed (10 t ha^{-1}) for yield attributes. Oil and lysine content was found superior with application of 75% recommended inorganic fertilizers over other levels, Protien content increased with increasing levels of recommended inorganic fertilizers. Among organics FYM (10 t ha^{-1}) yielded significantly superior results for seed quality than dalweed (10 t ha^{-1}).

Keywords: soybean; farm yard manure; dalweed; yield and quality

Introduction
Soybean, being an important pulse as well as oilseed crop, needs special mention to overcome crisis in edible oil production in the country. It is also called as "Gold of Soil". Soybean (*Glycine max* (L.) Merill) with its 40-42% protein and 20-22% oil has already emerged as one of the major oilseed crop in India. Inspite of its high yielding potential, soybean productivity is much less in India. Among the factors responsible for low productivity, inadequate fertilizer use and emergence of multiple-nutrient deficiencies due to poor recycling of organic resources and unbalanced use of fertilizers are important (Chaturvedi *et al*., 2010) [4]. Soybean is an energy rich crop and hence the requirement of major nutrients including secondary and micronutrients is high (Singh *et al*., 2006) [15]. The soils although being rich in nutrients but still unfortunately only a small portion of it becomes available to plants especially under temperate climatic conditions. Its availability also differs as it is related to physical and chemical structure of soil minerals. It has been established that continuous use of high analysis chemical fertilizers leads to deficiency of secondary and micronutrients, soil salinity and environmental pollution. There seems a wide potential to upgrade efficiency of these nutrients through better agronomic practices.

In recent years, a concept of integrated nutrient supply involving use of organic manures and inorganic fertilizers has been developed to obtain sustained agricultural production (Gaikwad and Puranik, 1996) [6]. Integration of organic and inorganic sources of nutrients alongwith biofertilizers is found found to give higher productivity and monetary returns in soybean (Singh and Rai, 2004; Bhattacharyya *et al*., 2008) [14, 3]. Further the organic sources unlike inorganic ones have substantial residual effect on succeeding crops (Duraisami and Mani, 2001; Shivakumar and Ahlawat, 2008) [5, 13].

Integrated nutrient management (INM) involves the use of manures, biofertilizers and chemical fertilizers to achieve sustained crop production and maintain better soil health. INM is best approach for better utilization of resources and to produce crops with less expenditure.

Material and Methods

The Field experiment "Farm Yard Manure and Dalweed improve the Growth and Yield in Soybean (*Glycine max* (L.) Merill)" was conducted during kharif seasons of 2009 and 2010 at Krishi Vigyan Kendra, Shuhama, Srinagar, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir. The soil of the experimental field was silty clay loam having pH 7.8 was medium in organic carbon (0.70%), available Phosphorus (15.36kg ha^{-1}), available Potassium (120.62 kg ha^{-1}) and was low in available Nitrogen (125.52 kg ha^{-1}). The experiment was laid out in 3 x 3 x 2 factorial randomized block design with 3 levels of inorganic fertilizer, 3 levels of organic manure and 2 levels of biofertilizers. Chemical fertilizer comprised of three levels C_1(50% RD of N,P,K,Zn),C_2(75% RD of N,P,K,Zn),C_3 (100% RD of N,P,K,Zn)

Recommended dose = 40:60:20:05 ($N:P_20_5:K_20$:Zn)

Farmyard manure (0.58% N, 0.34% P, 0.60% K) at the rate of 10 t ha^{-1} and Dalweed (0.35% N, 0.23% P, 0.40% K) at the rate of 10 t ha^{-1} were incorporated treatment-wise in the soil 15 days before sowing of seeds. Slurry of *Rhizobium* and PSB inoculant was made in concentrated Gur solution (20 per cent) which was prepared by boiling and subsequent cooling before adding *Rhizobium* culture and PSB. The seeds to be treated with *Rhizobium* and PSB inoculants, as per the treatments, were thoroughly mixed with inoculant slurry in such a way that all the seeds were uniformly coated with *Rhizobium* and PSB inoculant, respectively and then allowed to dry in the shade before sowing. The *Rhizobium* and PSB were applied at the rate of 5 g kg^{-1} seed.

Five plants were carefully uprooted along with soil from each plot at flowering stage of the crop and were kept in running water just to remove soil from the roots of the plant. The roots were then washed thoroughly and the number of nodules counted. The crop was harvested from net plot by 3 pickings of matured pods which had turned yellowish brown in color. At final picking, plants were removed along with pods and the harvested crop of each plot was placed separately on canvas tarpaulin on the concrete floor, sundried and beaten with the stick. The Stover was removed and seed winnowed to make it clean. The picked pods were also threshed treatment-wise. The grain yield obtained from each plot was cleaned, sundried and weighted separately. The net plot yield was then expressed as q ha^{-1}.After harvesting the plants from each plot were tied into separate bundles. The weight of each bundle was recorded and then the stover yield was expressed as q ha^{-1}. After the harvest of the crop and threshing was done and grain produce was collected, 100 seeds were randomly selected from the whole lot of seed and were weighed to get a representative sample weight. The protein content in seed was determined by Lowry's method (1951) [11]. The Lowry method is extension of biuret method except for this method is 10 times more sensitive than biuret method. In this method protein reacts with Folin-Ciocalteu reagent (FCR) to give blue color complex which is formed due to reaction of alkaline copper with protein as in biuret test and reduction of phosphomolybdic-phosphotungstic components in Folin-Ciocalteu reagent (FCR) by amino acids present in protein. The intensity of blue colour is measured colorimetrically at 660nm.Oil content in the soybean seed was estimated by ether extraction method using soxlet apparatus.

Results and Discussion

Growth and yield attributes

Growth parameters i.e., no. of nodules and 100-seed weight differed significantly due to different treatments (Table 1). With increase in recommended inorganic fertilizers increased number of nodules. Highest number of nodules (34.97) was recorded with 100 per cent of recommended inorganic fertilizers. Application of FYM @ 10 t ha^{-1} was found superior. FYM @ 10 t ha^{-1} recorded the highest (33.02) number of nodules followed by Dalweed and over no manure. Inoculation with Rhizobium and PSB showed significantly superior results over no inoculation. Inoculation with Rhizobium and PSB recorded highest (35.62) number of nodules which was significantly superior over no inoculation. Integrated application of inorganic fertilizers along with application of FYM @ 10 t ha^{-1} and inoculation with Rhizobium and PSB showed significantly superior results over other treatments. The interaction effect of inorganic fertilizers, organic manures and bio fertilizers in relation to number of nodules/plant was significant. The data pertaining to number of nodules/plant of soybean revealed that with increase in dose of recommended inorganic fertilizers the number of nodules/plant increased significantly (Singh *et al.*, 2006) [15]. These results are in conformity with the findings of Shivakumar and Ahlawat, 2008 [13]. The maximum number of nodules/plant was recorded at 100 per cent of recommended inorganic fertilizers. The maximum number of nodules/plant with regards to organic manures was recorded by application of FYM (10 t ha-1). The increase in number of nodules/plant can be due to favourable effects of FYM in improving the soil fertility through positive effects on physical and chemical and biological soil properties. Inoculation has showed significantly superior results over no inoculation. The inoculation and chemical fertilization in combination has a significant effect on the total number of nodules/plant (Alam *et al.*, 2009) [2].

Table 1: Effect of Integrated Nutrient Management on number of nodules and 100-seed weight (gm) {Pooled Data of Two Years}

Chemical Fertilizers	Organic Manures	Bio - Inoculation				Mean		Factor means for Organic Manures	
		Uninoculated (I_0)		Inoculated (Rhizobium + PSB) (I_1)					
		No.of nodules	*100-seed weight*	*No.of nodules*	*100-seed weight*	*No.of nodules*	*100-seed weight*	*No.of nodules*	*100-seed weight*
50% RD (C_1)	No Manure	25.93	22.80	34.59	24.07	30.62	23.44	No manure = 32.09	No manure =23.65
	FYM @ 10 t ha^{-1}	27.27	23.57	34.84	25.01	31.05	24.29		
	Dalweed @ 10 t ha^{-1}	26.79	22.91	33.94	25.07	30.36	23.99		
Mean		24.66	23.09	34.46	24.72	30.56	23.91		
75% RD (C_2)	No Manure	28.16	23.53	35.22	24.87	31.69	24.20	FYM @10 t/ha = 33.02	FYM @10 t/ha = 24.08
	FYM @ 10 t ha^{-1}	28.77	23.89	35.86	24.76	32.32	24.33		
	Dalweed @ 10 t ha^{-1}	28.49	23.75	35.46	23.81	31.98	23.78		
Mean		28.48		35.51	24.48	31.99	24.10		

100% RD (C_3)	No Manure	32.06	23.71	36.57	22.90	34.31	23.30	Dalweed @10 t/ha = 32.41	Dalweed @10 t/ha = 23.76
	FYM @ 10 t ha^{-1}	33.75	23.91	37.65	23.34	35.70	23.62		
	Dalweed @ 10 t ha^{-1}	33.33	23.81	36.47	23.24	34.90	23.53		
Mean		33.05	23.72	36.90	23.16	34.97	23.49		
Factor means for Bio - Inoculation		29.40	23.54	35.62	24.12				

CD(P = 0.05)	**no. of nodules**	**100-seed wt**.		**no. of nodules**	**100-seed wt**.
Chemical	= 0.175	0.325	Chemical x Organic	= 0.304	NS
Organic	= 0.175	0.325	Chemical x Inoculation	= 0.248	0.460
Inoculation	= 0.143	0.265	Chemical x Organic x Inoculation	= 0.430	NS
Organic x Inoculation	= 0.248	NS			

100-seed weight with recommended inorganic fertilizers were found to be superior at 75 per cent but further increase in recommended inorganic fertilizer level the effect was statistically non-significant. Application of 10 t ha^{-1} FYM recorded superior (24.08 g) followed by Dalweed (23.76 g) which were superior over no manure. Inoculation of Rhizobium and PSB were found superior over no inoculation. Inoculation gave (24.12 g) 100-seed weight of soybean seeds over no inoculation (23.54 g). The seeds of soybean revealed that with increase in chemical fertilizer levels the 100-seed weight remained unaffected. However, application of FYM (10 t ha^{-1}) showed superior results over Dalweed (10 t ha^{-1}) and both were superior over no manure. This may be attributed to availability of sufficient amount of nutrients throughout growth period resulting in better uptake, plant vigour and superior yield attributes (Shivakumar and Ahlawat, 2008) [13].

The 100-seed weight was high due to inoculation with biofertilizers over no inoculation. This might be due to that biofertilizers play an important role in nutrient supply and their availability for plant nutrition. Besides, increasing the biologically fixed atmospheric nitrogen and enhancing native P availability to crop. Rhizobium and PSB have shown encouraging results in sustaining crop productivity and improving soil fertility (Govindan and Thirumorgan, 2005) [7]. Integrated nutrient management of inorganic chemical fertilizers and FYM application along with inoculation has shown superior results (Kumpawat, 2010) [10].

Yield

Integrated nutrient management enhanced the yield ability of soybean (Table 2) the results also revealed that there was increase in grain yield upto 75 per cent of recommended inorganic fertilizers and at 100 per cent recommended inorganic fertilizers. Increase in grain yield was statistically non-significant but both were found superior over 50 per cent of recommended inorganic fertilizer level. Highest grain yield (17.57 q ha^{-1}) was recorded at 75 per cent of recommended inorganic fertiliser. Application of FYM @ 10 t ha^{-1} recorded a highest (15.78 q ha^{-1}) grain yield. Inoculation with Rhizobium and PSB showed significantly superior results over no inoculation. Inoculation recorded a grain yield of 16.79 q ha^{-1} which was significantly superior over no inoculation with a grain yield of 11.79 q ha^{-1}. The grain yield of soybean was significant at 100 per cent recommended inorganic fertilizers as compared to 75 per cent and 50 per cent fertility levels. Increase in grain yield of soybean may be because of yield attributes viz. pod length, pods/plant, grain/pod and grain weight increased significantly which may be due to the direct effect of fertilizers on seed growth. Grain yield kept on increasing significantly upto 100 per cent NPK as it facilitates a greater economic sink capacity as yield has a highly significant correlation with pods/plant, grains/pod and seed weight. Similar results were also reported by Kumar *et al.* (2009) [9].

Table 2: Effect of Integrated Nutrient Management on Grain and Stover yield (q ha^{-1}) {Pooled Data of Two Years}

Chemical Fertilizers	**Organic Manures**	**Bio - Inoculation**				**Mean**		**Factor means for Organic Manures**	
		Uninoculated (I_0)		**Inoculated (Rhizobium + PSB) (I_1)**					
		Grain yield	***Stover yield***	***Grain yield***	***Stover yield***	***Grain yield***	***Stover yield***	***Grain yield***	***Stover yield***
50% RD (C_1)	No Manure	9.13	35.07	12.96	46.79	11.05	40.93	No manure = 12.50	No manure = 43.35
	FYM @ 10 t ha^{-1}	11.71	41.32	14.13	52.03	12.92	46.67		
	Dalweed @ 10 t ha^{-1}	10.62	37.97	13.98	49.69	12.30	43.82		
Mean		10.49	38.11	13.69	49.50	12.10	43.82		
75% RD (C_2)	No Manure	12.73	38.43	15.54	53.59	14.13	46.01	FYM @10 t/ha = 15.78	FYM @10 t/ha = 48.59
	FYM @ 10 t ha^{-1}	13.27	44.21	27.65	57.65	20.46	50.93		
	Dalweed @ 10 t ha^{-1}	12.73	40.30	23.66	54.52	18.19	47.41		
Mean		12.90	40.98	22.28	55.25	17.57	48.12		
100% RD (C_3)	No Manure	11.32	36.55	13.74	49.84	12.53	43.19	Dalweed @10 t/ha = 0.93	Dalweed @10 t/ha = 45.38
	FYM @ 10 t ha^{-1}	12.89	41.56	15.07	56.25	13.97	48.90		
	Dalweed @ 10 t ha^{-1}	12.02	39.06	14.45	51.09	13.23	45.38		
Mean		12.07	39.05	14.42	52.39	13.19	45.62		
Factor means for Bio - Inoculation		11.79	39.37	16.79	52.41				

CD(P = 0.05)	**grain yield**	**stover yield**		**grain yield**	**stover yield**
Chemical	= 0.021	0.069	Chemical x Organic	= 0.037	NS
Organic	= 0.021	0.069	Chemical x Inoculation	= 0.030	0.098
Inoculation	= 0.017	0.056	Chemical x Organic x Inoculation	= 0.052	NS
Organic x Inoculation	= 0.030	NS			

The results also revealed that application of 10 t ha^{-1} FYM and 10 t ha^{-1} Dalweed recorded higher yield over no manure. Increase in grain yield due to FYM may be due to its beneficial effects both on soil and plant by making sufficient amounts available to plant nutrients throughout the growth period resulting in better uptake, plant vigour and superior

yield attributes (Shivakumar and Ahlawat, 2008) [13]. Organic manures alongwith inorganic fertilizers attribute to higher availability and adsorption of nutrients (Kumar *et al.*, 2009) [9].

Inoculation with Rhizobium and PSB has a significant effect on grain yield of soybean. Seed inoculation resulted in higher yield. This may be attributed to increased nodulation and nitrogen fixation, more solubilization of native P and production of secondary metabolites by bacteria. These results are in conformity with findings of Kumar *et al.* (2009) [9].

Integrated usage of inorganic chemical fertilizers along with inoculation of biofertilizers grain yield was found significant. Similar results were also reported by Alam *et al.* (2009) [2]. The favourable effect of integration of chemical fertilizers, Rhizobium and PSB on growth and yield were also reported by Afzal and Bano (2008) [1].

Integrated nutrient management of inorganic chemical fertilizers alongwith application of FYM and inoculation with biofertilizers (Rhizobium and PSB) produced significantly higher yield (Kumpawat, 2010) [10].

Highest stover yield was recorded with 75 per cent recommended inorganic fertilizers but there was statistically not much difference in stover yield with regards to other levels of recommended inorganic fertilizers. Application of 10 t ha^{-1} FYM was found significantly superior over Dalweed and no manure recorded a highest stover yield of 48.59q ha^{-1}.Inoculation with rhizobium and PSB showed superior results (54.41 q ha^{-1}) over no inoculation.

The significant increase in stover yield of soybean was observed upto 100 per cent recommended inorganic fertilizers as compared to other fertility level. Increase in stover yield of soybean might be due to supply of essential mineral nutrients in balanced amount which resulted in better growth and development of plants (Thirumelai *et al.*, 1993) [16]. Similar results were reported by Kumar *et al.* (2009) [9].

The data presented in Table 2 also revealed that application of 10 t ha^{-1} FYM and 10 t ha^{-1} Dalweed recorded a higher yield over no manure. Such increase in yield to be associated with release of nutrients during microbial decomposition. Organic matter is a source of energy for soil microflora which brings transformation of inorganic nutrients held in soil in a form that is readily utilised by growing plants. The additional beneficial effects of FYM for improvement in soil physical properties. The beneficial response of FYM to yield might also be attributed to the availability of sufficient amounts of plant nutrients throughout the growth period resulting in better uptake, plant vigour and superior yield attributes (Shivakumar and Ahlawat, 2008) [13]. Significant variations by addition of organic manure with mineral fertilizers are attributed to higher availability and absorption of nutrients. Similar results were also reported by Kumar *et al.* (2009) [9].

Quality

Nutrient management had a significant effect on quality parameters of soybean (Table 3). The results revealed that there was corresponding increase of protein content in soybean seeds with corresponding increase in recommended inorganic fertilizers. The highest (36.59 %) protein content was recorded with 100 per cent of recommended inorganic fertilizer followed by (36.14 %) for 75 per cent and for 50 per cent (36.02 %). Application of FYM @ 10 t ha-1 and Dalweed @ 10 t ha-1 also increased protein content of soybean seed over no manure. Inoculation with Rhizobium and PSB showed superior results over uninoculated treatments. Inoculation recorded (37.60 %) protein content which was superior over no inoculation (34.09 %). Protein content in grains of soybean increased correspondingly with corresponding increase in levels of recommended inorganic fertilizers. Highest amount of protein content was observed at 100 per cent recommended inorganic level of fertilizer dose, 75 and 50 per cent of recommended inorganic fertilizer levels were found at par with each other. The results support the findings of Alam *et al.* (2009) [2] besides these results are in conformity with findings reported by Singh and Rai (2004) [14]. Protein content in grains was also significantly influenced by application of organic manure. Protein content was maximum under FYM (10 t ha^{-1}) followed by Dalweed (10 t ha^{-1}) and minimum under no manure. Increased protein content with FYM could be due to supplementation of soil reservoir on mineralization of organic N and P of FYM and enhanced microbial activity of ammonifiers, nitrifiers and phosphate solublizing bacteria in particular, due to available organic carbon which might have increased root growth and nodulation resulting in increasing nitrogen and phosphorus content and hence protein content. It has also reported such increase in protein content attributed to increase in nitrogen content a role of phophorus in energy storage and transfer in forms of ADD and ATP which are essential for protein synthesis. Jain *et al.* (1995) [8] and Tiwari *et al.* (1995) [17] also reported a significant positive impact of FYM on protein content of other legumes. Inoculation significantly increased protein content in grain compared to no inoculation. Increase in protein content due to inoculation might be due to enhanced nitrogen fixation along with adequate supply of phosphorus, thereby, enhancing the protein synthesis in the plant and its higher concentration in grain Nagar and Meena (2004) [12] have also reported that PSB inoculation increased the protein content in cluster bean. Application of FYM along with inorganic fertilizer increased protein content in grain of soybean. Similar results were also reported by Alam *et al.* (2009) [2].

Table 3: Effect of Integrated Nutrient Management on Protien and Oil content (%) of soybean seeds {Pooled Data of Two Years}

Chemical Fertilizers	Organic Manures	Bio - Inoculation				Mean		Factor means for Organic Manures	
		Uninoculated (I_0)		Inoculated (Rhizobium + PSB) (I_1)					
		Protien content	*Oil content*	*Protien content*	*Oil content*	*Protien content*	*Oil content*	*Protien content*	*Oil content*
50% RD (C_1)	No Manure	34.22	15.22	37.07	17.25	35.64	16.23	No manure = 35.91	No manure = 16.27
	FYM @ 10 t ha^{-1}	34.90	16.66	38.07	19.21	36.48	17.94		
	Dalweed @ 10 t ha^{-1}	34.64	15.73	37.24	18.58	35.94	17.15		
Mean		34.59	15.87	37.46	18.35	36.02	17.11		
75% RD (C_2)	No Manure	34.41	15.26	37.26	17.22	35.84	16.24	FYM @10 t/ha = 36.74	FYM @10 t/ha = 17.97
	FYM @ 10 t ha^{-1}	34.95	16.70	38.30	19.25	36.62	17.97		
	Dalweed @ 10 t ha^{-1}	34.67	15.69	37.26	18.79	35.96	17.24		

Mean		34.68	15.88	37.61	18.42	36.14	17.15		
100% RD (C_3)	No Manure	35.22	15.30	37.28	17.37	36.25	16.33	Dalweed @10 t/ha = 36.10	Dalweed @10 t/ha = 16.98
	FYM @ 10 t ha^{-1}	35.63	16.71	38.61	19.30	37.12	18.00		
	Dalweed @ 10 t ha^{-1}	35.49	15.72	37.30	17.36	36.39	16.54		
Mean		35.44	15.91	37.73	18.26	36.59	16.96		
Factor means for Bio - Inoculation		34.90	15.89	37.60	18.26				

CD(P = 0.05)	**protein content**	**oil content**		**protein content**	**oil content**
Chemical	= 0.021	NS	Chemical x Organic	= 0.038	NS
Organic	= 0.021	0.422	Chemical x Inoculation	= 0.031	NS
Inoculation	= 0.017	0.344	Chemical x Organic x Inoculation	= 0.053	NS
Organic x Inoculation	= 0.031	NS			

The data also revealed that there was increase in oil content of soybean upto 75 per cent of recommended inorganic fertilizers and after which a decreasing trend was recorded in the oil content. The highest (17.15%) oil content in soybean was recorded by application of recommended inorganic fertilizers. Application of organics higher amount of oil content in soybean was recorded with application of FYM @ 10 t ha^{-1} (17.97 %) followed by application of Dalweed @ 10 t ha-q (16.98 %0 and both were found superior over no manure application (16.27%).Inoculation with Rhizobium and PSB showed significantly superior results for oil content (18.26%) over no inoculation (15.89%). At all levels of recommended inorganic fertilizers along with FYM and inoculation with Rhizobium and PSB recommended superior over other treatments. Oil content in grain of soybean revealed that oil content was at par with application of 50 and 75 per cent of recommended inorganic fertilizer levels and beyond that (100 %) increase in oil content was statistically non-significant. The results are in conformity with results of Alam *et al.* (2009) [2] & Singh and Rai (2004) [14] in soybean. FYM (10t ha^{-1}) recorded highest oil content in grain of soybean followed by Dalweed (10 t ha^{-1}) and no manurial treatment. This increase may be due to mineralization of organic nutrients of FYM as well as microbial activity due to available organic carbon. The mineralization of organics enhanced oil content due to synthesis of fatty acids and their etherification by accelerating biochemical reaction in glycoxalate cycle. Similar results were also reported by Alam *et al.* (2009) [2].

Inoculation showed significantly superior results over no inoculation (Umale *et al.*, 2002) [18]. The oil content in grain of soybean increased significantly due to inoculation over no inoculation these results are in conformity with findings of Wahane *et al.* (1992) [19].

Conclusion

The result of the study for two years showed that amongst different levels of the inorganic fertilizers, 75 per cent of the recommended dose (40:60:20 kg N:P_2O_5:K_2O ha^{-1}) of recommended inorganic fertilizers alongwith FYM (10 t ha^{-1}) produced highest grain yield of soybean. There was also significant effect of bioinoculation on grain yield of soybean.

Under low to medium fertile soils, inorganic fertilizer combination of N:P_2O_5:K_2O at the rate 30:45:15 kg ha^{-1}, respectively i.e, 75 percent of recommended inorganic fertilizers along with application of 10 t FYM ha^{-1} with dual inoculation of rhizobium and PSB is recommended for more profitable and sustained crop yield and maintaining the soil health under the irrigated conditions of the valley. However such study needs further testing under different agro climatic locations.

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