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Effect of Integrated Nutrient Management on Lysine and Linoleic Acid Content of Soybean (*Glycine max* (L.) Merill) under Temperate conditions

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Abstract:

A field experiment was conducted at KVK, Srinagar during two consecutive kharif seasons of 2008-09 and 2009-10 to study the "Effect of Integrated Nutrient Management for Soybean (*Glycine max* L.) Under Temperate Conditions". The experiment was laid out under 18 treatment combinations viz., three levels of recommended inorganic fertilizers (50, 75 and 100% RD), three levels of 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. Lysine content was found superior with application of 75% recommended inorganic fertilizers over other levels, Linoleic acid 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}). Dual inoculation with Rhizobium + PSB showed significantly superior seed quality over control.

Keywords: INM, Linoleic acid, Lysine, Bio fertilizers, FYM, Soybean

1.0 Introduction:

Cultivation of soybean has been increasing rapidly and now it is the first in area and second in production among oilseed crops grown in the country. Being oilseed and pulse crop, proper nutrient management is one of the crucial factors in giving optimum yield. The crop responds well to integrated nutrient sources. 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 and20-22% oil has already emerged as one of the major oilseed crop in India. In spite of its high yielding potential(4.5 tonne/ha), soybean productivity is much less in India (0.95 tonne/ha) than world average of 2.3 tonne/ha. 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). Soybean is an energy rich crop and hence the requirement of major nutrients including secondary and micronutrients is high for soybean (Singh *et al*., 2006). 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). Integration of organic and inorganic sources of nutrients alongwith biofertilizers is found to give higher productivity and monetary returns in soybean (Singh and Rai, 2004; Bhattacharyya *et al*., 2008). Further the organic sources unlike inorganic ones have substantial residual effect on succeeding crops (Duraisami and Mani, 2001; Shivakumar and Ahlawat, 2008). 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.

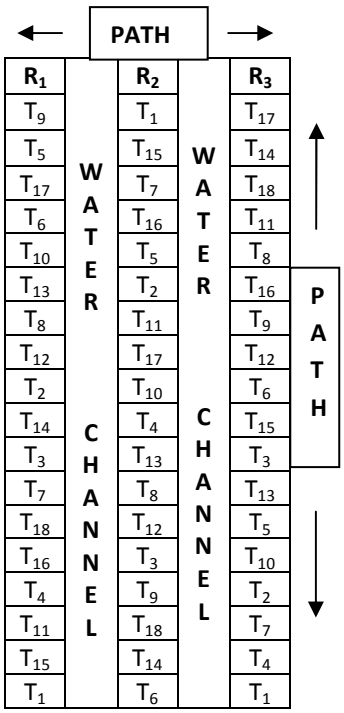
2.0 Material and Methods:

The present study 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 site is situated 26 km away from city centre

and lies between 340°.8' N latitude and 74° 83' E longitude at an altitude of 1587 meters above the mean sea level. The soil of the experimental field was silty clay loam having pH 7.8 was medium in organic carbon (0.70%), available P_2O_5 (15.36kg ha^{-1}), available K_2O (120.62 kg ha^{-1}) and was low in available N (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 ($N:P_2O_5:K_2O:Zn$)

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.



Lysine was estimated by the method as described by Tsai *et al*. (1972).the protein content in the seed sample is hydrolysed with a proteolytic enzyme, papain. then the α – amino groups of the derived aminoacids are made to form a complex with copper. the € - amino group of lysine which does not couple with copper is made to form € - dinitropyridyl derivative of lysine with 2-chloro-3, 5-dinitropyridine.the excess pyridine is removed with ethyl acetate and the colour of €-dinitropyridyl derivative is read at 390nm. Linoleic acid in soybean seeds is estimated by extraction with alcohol, ethyl ether and petroleum ether and identified by Gas chromatography method by AOAC (2000).

3.0 Results and Discussion:

Lysine (2,6-diaminohexanoic acid, $C_6H_{14}N_2O_2$) and Linoleic acid (*cis, cis*-9,12-Octadecadienoic acid, $C_{18}H_{32}O_2$) has been found to be the important constituent of soybeans Grains. The results of the Present study revealed that the integrated nutrient management had a positive correlation with respect to Lysine and Linoleic acid content of soybean. Lysine content of soybean as effected by different treatments is presented in Table 1.It revealed that there was a corresponding increase in lysine content upto 75 per cent (59.58 mg/100 g of protein) was recorded with 75 per cent of recommended inorganic fertilizers. Application of FYM @ 10 t ha-1 recorded highest (60.72 mg/100 g

of protein) of lysine content which was significantly superior over application with Dalweed (10 t ha^{-1}) and no manure. Inoculation with *Rhizobium* and PSB showed significantly superior results over no inoculation. Highest lysine content (61.27 mg/100 g of protein) was recorded with inoculation over no inoculation (57.13 mg/100 g of protein). Application of recommended inorganic fertilizers at all levels along with FYM @ 10 t ha^{-1} and inoculation with Rhizobium and PSB were found superior over other treatment combinations. Lysine is one of the important amino acid, the constituent of soy protein. As protein increases with increasing levels of inorganic fertilizers, organics and bio-fertilizers, lysine being a constituent of protein also increased (Liu *et al.*, 2003).

Table 1: Effect of Integrated Nutrient Management on Lysine content in Soybean Stover (mg/100 g of protein) {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)		
50 % RD (C_1)	No manure (F_0)	55.00	60.00	**57.50**	F_0 = 58.58
	FYM @ 10 t ha^{-1} (F_1)	58.50	61.00	**59.75**	
	Dalweed @ 10 t ha^{-1} (F_2)	56.66	60.16	**58.41**	
	Mean	**56.72**	**60.38**	**58.55**	
75 % RD (C_2)	No manure (F_0)	56.66	61.16	**58.91**	F_1 = 60.72
	FYM @ 10 t ha^{-1} (F_1)	59.33	61.83	**60.58**	
	Dalweed @ 10 t ha^{-1} (F_2)	57.00	61.50	**59.25**	
	Mean	**57.66**	**61.50**	**59.58**	
100 % RD (C_3)	No manure (F_0)	57.00	61.66	**59.33**	F_2 = 58.30
	FYM @ 10 t ha^{-1} (F_1)	60.50	63.16	**61.83**	
	Dalweed @ 10 t ha^{-1} (F_2)	53.50	61.00	**57.25**	
	Mean	**57.00**	**61.94**	**59.47**	
Factor means for bio-inoculation		**57.13**	**61.27**		

CD $_{(P=0.05)}$

Chemical=NS **Chemical x Organic=NS** **Organic=1.642**
Inoculation=1.341 **Chemical x Organic x Inoculation=NS** **Organic x Inoculation = NS**
Chemical x Inoculation=NS

It is reported that protein content attributed to energy storage and transfer in forms of ADD and ATP which are essential for protein syntheses. Jain *et al.* (1995) also reported same results. Linoleic acid with regards to effect of different treatments is presented in Table 2 also revealed that with increase in recommended inorganic fertilizers there was a corresponding increase in linoleic acid. Highest amount of linoleic acid was recorded at 100 per cent (51.30 %) followed by 75 per cent (50.72%) and at 50 per cent (49.25%) recommended inorganic fertilizers. Application of FYM @ 10 t ha^{-1} recorded a highest linoleic acid (51.27%) followed by Dalweed @ 10 t ha^{-1} (50.41%) which were superior over no manorial application. Linoleic acid is component of fatty acid of soybean oil with increase in oil content of soybean there will be increase in linoleic acid content. Enhance oil content due to synthesis of fatty acids as their etherification by accelerating biochemical reaction in glycoxalate cycle.

Inoculation with Rhizobium and PSB showed significantly superior over no inoculation. Inoculation recorded highest (52.22%) linoleic acid on soybean over no inoculation (48.63%). Treatment combination of recommended inorganic fertilizers alongwith FYM (10 t ha^{-1}) and inoculation showed better results over other treatments. Integrated plant nutrient supply are involved in an increased conversion of primary fatty acid metabolites to end products of fatty acid by increased activity of acetyl Co-A resulting in higher oil content. (Hemantarajan *et al*., 2000). Similar results were observed by Chaturvedi *et al*., 2010.

Integrated plant nutrient supply showed significantly positive effect for unsaturated fatty acids i.e. oleic and linoleic and linolenic contents. All the fertilizer treatments increased significantly unsaturated fatty acid with increasing levels. Application of FYM (10 t ha^{-1}) showed significantly superior results. Higher percentage of unsaturated

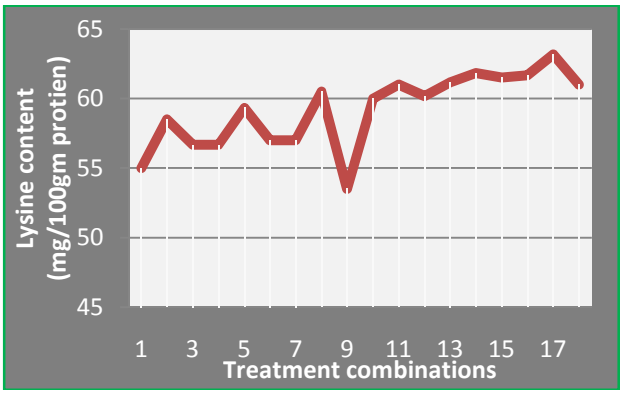
fatty acid with integrated nutrient supply may be attributed to the balanced nutrition of the crop (Chaturvedi *et al*., 2010). Similar results were also reported by Rani *et al*. (2006). Also Singh *et al*. (2007) reported the quality of soybean is enhanced by integrated usage of different nutrient sources.

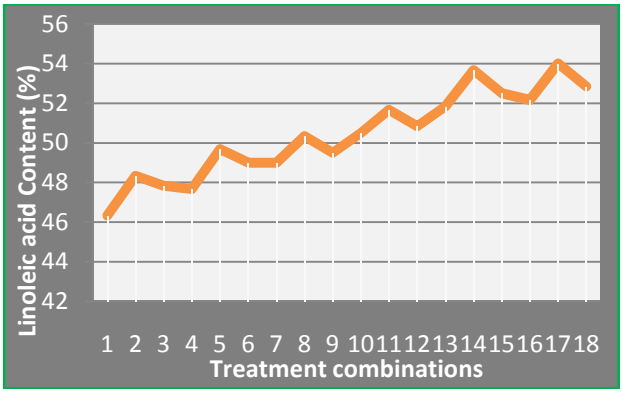
Table 2: Effect of Integrated Nutrient Management on Linoleic Acid in Soybean Oil (%) {Pooled Data of Two Years}

Chemical fertilizers	Organic manures	Bio-inoculation		Mean	Factor means for organic manures
		Uninoculated (I_0)	Inoculated (Rhizobium + PSB) (I_1)		
50 % RD (C_1)	No manure (F_0)	46.33	50.50	**48.41**	F_0 = 49.58
	FYM @ 10 t ha^{-1} (F_1)	48.33	51.66	**50.00**	
	Dalweed @ 10 t ha^{-1} (F_2)	47.83	50.83	**49.33**	
	Mean	**47.50**	**51.00**	**49.25**	
75 % RD (C_2)	No manure (F_0)	47.66	51.83	**49.75**	F_1 = 51.27
	FYM @ 10 t ha^{-1} (F_1)	49.66	53.66	**51.66**	
	Dalweed @ 10 t ha^{-1} (F_2)	49.00	52.50	**50.75**	
	Mean	**48.77**	**52.66**	**50.72**	
100 % RD (C_3)	No manure (F_0)	49.00	52.50	**50.58**	F_2 = 50.41
	FYM @ 10 t ha^{-1} (F_1)	50.33	54.00	**52.16**	
	Dalweed @ 10 t ha^{-1} (F_2)	49.50	52.83	**51.16**	
	Mean	**49.16**	**52.83**	**51.30**	
Factor means for bio-inoculation		**48.63**	**52.22**		

$CD_{(P=0.05)}$

Chemical=0.601 **Chemical x Organic=NS** **Organic =0.601**
Chemical x Inoculation=NS **Inoculation=0.491** **Chemical x Organic x Inoculation=NS**
Organic x Inoculation=NS





4.0 Conclusion:

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 quality of the soybean and also maintaining the soil health under the irrigated conditions. However such study needs further testing under different agro climatic locations.

References:

1) A.O.A.C. (2000). Official Method 999.25. Gas chromatographic method. Chapter 50. p. 19.
2) Bhattacharyya, R., Kundu, S., Prakash, R. and Gupta, H.S. (2008). Sustainability under combined application of mineral and organic fertilizers in a rainfed soybean-wheat system of the Indian Himalayas. *European Journal of Agronomy* 28(1): 33-46.
3) Chaturvedi, S., Chandel, A.S., Dhyani, A.S. and Singh, A.P. (2010). Productivity, profitability and quality of soybean (*Glycine max*) and residual soil fertility as influenced by

integrated nutrient management. *Indian Journal of Agronomy* 55(2) : 133-137.

4) Duraisami, V.P. and Mani, A.K. (2001). Residual effect of inorganic nitrogen, composted coir pith and biofertilizer on yield and uptake of soybean in on inceptisol. *Madras Agricultural Journal* 88(4/6) : 277-280.
5) Gaikwad, S.S., Puranik, R.B. and Deshmukh, D. (1996). Dynamics of soil microbial population and nutrient availability as influenced by application of pressmud cake in an Entisol. *Journal of Soils and Crops,* 6 (1) : 82-85.
6) Hemantarajan, A.,Trivedi, A.K. and Mini Ram.(2000).Effect of foliar application of boron and soil applied iron and sulphur on growth and yield of soybean *glycine max*(L) Merr.*Indian Journal of Plant Physiology* 5(2):142-144
7) Jain, R.C., Tiwari, R.J., Kalyan, S. and Singh, K. (1995). Effect of farmyard manure and sugar press mud on productivity and quality of soybean. *Crop Research* 9(2) : 229-232.
8) Liu, P. and Yang, Y.A. (2003). Effect of molybdenum and boron on quality of soybean. *Scinetia Agricultura Sinica* 36(2) : 184-189.
9) Rani, A., Kumar, V. and Chauhan, G.S. (2006). Fatty acid composition in germinating soybean. *Journal of Oilseed Research* 23(1) : 139-141.
10) Shivakumar, B.G. and Ahlawat, I.P.S. (2008). Integrated nutrient management in soybean (*Glycine max*) – wheat (*Triticum aestivum*) cropping system. *Indian Journal of Agronomy* 53(4) : 273-278.
11) Singh, R. and Rai, R.K. (2004). Yield attributes, yield and quality of soybean (*Glycine max*) as influenced by integrated nutrient management. *Indian Journal of Agronomy* 49(4) : 271-274.
12) Singh, R.K., Ghosh, P.K., Bandyopadhyay, K.K., Misra, A.K., Mandal, K.G. and Hati, K.M. (2006). Integrated plant nutrient supply for sustainable production in soybean – based cropping system. *Indian Journal of Fertilizers* 1(11) : 25-32.
13) Singh, S.R., Najar, G.R. and Singh Ummed. (2007). Productivity and nutrient uptake of soybean (*Glycine max*) as influenced by bioinoculants and farmyard manure under rainfed conditions.*Indian Journal of Agronomy* 52(4):325-329.
14) Tsai, O.Y., Hansel, L.W. and Nelson, O.E. (1972). Cereal chemistry 49(5): 572-579.