INTERNATIONAL JOURNAL OF SCIENCE AND NATURE

www.scienceandnature.org

POTENTIAL EFFECT SEAWEED SAP ON NUTRIENT UPTAKE OF GREENGRAM

R.V. Mahajan, V.M. Bhale & J.P. Deshmukh,
Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, 444104, Maharashtra
*Corresponding author email: ram9962@gmail.com

ABSTRACT
A field experiment on "Potential Effect Seaweed Sap on Nutrient Uptake of Greengram" was carried out at Research farm of Department of Agronomy, Dr. PDKV, Akola. (Maharashtra), India during *kharif* season 2012. Seven treatments concerning different concentration level (0, 5.0, 10.0 and 15.0% v/v) and with two sources of seaweed sap Kappap*hycus alvarezii* (K-sap) and *Gracilaria edulis* (G-sap) with recommended dose of fertilizer were tested in randomize block design replicated thrice. Foliar application of seaweed sap applied at Pre-flowering (20-25 DAS) and flowering stage (35-40 DAS). Foliar applications of seaweed saps were found significantly impact on seed quality and nutrient uptake. Among all the treatment 15% *Gracilaria sap* + recommended dose of fertilizer significantly higher the nitrogen (N), phosphorus (P) and potassium (K) uptake in grain and straw. Similarly highest micronutrients uptake i.e. (Cu, Fe, Mn and Zn) was noted with foliar application of seaweed sap G-sap@15% (T_7) and it may at par with foliar application of K-sap@15%+RDF (T_4), G-sap@10%+RDF (T_6) and K-sap@10%+RDF (T_3). Total uptake of micronutrient increased approximately i.e. 30.42% in Zinc, 35.01% in Copper, 29.40% in Iron and 33.03% in Manganese over control.

KEYWORDS: Greengram, *Kappaphycus* and *Gracilaria sap,* nutrients uptake.

INTRODUCTION
Mungbean (*Vigna radiata* L. wilczek) is an important pulse crop of India having an excellent source of high quality protein**.** Among the various pulses, greengram or mungbean (*Vigna radiata*) is an important grain legume with easily digestible protein. It belongs to the family fabaceace with 2n=22. India is the world's largest producer as well as consumer of greengram. It not only plays an important role in human diet but also in improving the soil fertility by fixing the atmospheric nitrogen. Its seed is more palatable, nutritive, digestible and non-flatulent than other pulses. It occupies as good position due to its high seed protein content and ability to store the soil fertility through symbiotic nitrogen fixation. Thus, it contributed significantly to enhancing the yield of subsequent crops (Jat *et al*., 2012). The productivity of this crop is very low because of their cultivation on marginal and sub marginal lands of low soil fertility where little attention is paid to adequate fertilization (Saravanan *et al*., 2013). Besides this, mungbean has special importance in intensive crop production due to its short growing period as it can be grown as a catch crop in rice wheat cropping system. It is not only ideal for catch cropping, inter cropping and multiple cropping system but also serve as excellent cover crop to protect the soil against erosion. It is mainly utilized in making dal, curries, soup, sweets and snacks. During sprouting, there is an increase in thiamine, niacin and ascorbic acid concentration. The food values of mungbean lie in its high and easily digestible protein. The mungbean seeds contain approximately 25-28% protein, 1.0-1.5% oil, 3.5-4.5% fiber, 4.5-5.5% ash and 62-65% carbohydrates on dry weight basis. Seaweed extract is a new generation of natural organic fertilizers containing highly effective nutritious and promotes faster germination of seeds and increase yield and resistant ability of many crops. Unlike, chemical fertilizers, extracts derived from seaweeds are biodegradable, non-toxic, nonpolluting and non-hazrdous to humans, animals and birds (Dhargalkar and Pereira, 2005). Seaweeds are the macroscopic marine algae found attached to the bottom in relatively shallow coastal waters. They grow in the intertidal, shallow and deep sea areas up to 180 meter depth and also in estuaries and backwaters on the solid substrate such as rocks, dead corals and pebbles (Thirumaran *et al*., 2009)

Seaweed liquid extract (SLE) which contains macro nutrients, trace elements, organic substances like amino acids and plant growth regulators such as auxin, cytokinin and gibberellins are applied to improve nutritional status, vegetative growth, yield and fruit quality in some plants (Eman et al., 2008; Spinelli et al., 2009). Seaweed liquid fertilizer can improve the physiological efficiency including photosynthetic ability and can enhance the effective partitioning of accumulates from source and sink in the field crops. Seaweed extract also pusses the ability to influence plant physiological aspects by way of moderating the chlorophyll content index apart from modifying the nutrient uptake of the plant.

METHODOLOGY
Field experiment was carried out during Kharif season of 2013 at Research Farm of Department of Agronomy, Dr. PDKV, Akola (Maharashtra) Weekly average meteorological data during the span of experimentation, recorded at meteorological observatory, Dr. PDKV, Akola. The total rainfall of 638.09 mm was received during *Kharif* season 2012. The experiment comprised of

seven treatments, the details of treatments are T_1:Control, T_2:K-Sap@5%+RDF, T_3: K-Sap@10%+RDF, T_4:K-Sap15%+RDF, T_5:G-Sap@5%+RDF, T_6:G-Sap@10%+RDF, T_7: G-Sap@15+RDF, Two sprays of *Kappaphycus* and *Gracilaria* extract were applied at different growth stages (20 and 35 days after sowing) through knapsack sprayer. Spraying of sea weed saps was done in the field as per the treatment. The quantity of water used was 500- 600 liter ha-1 with adjuvant. The sap of *Kappaphycus* and *Gracilaria* spp. having 100% concentration was procured from Central Salt and Marine Chemical Research Institute, Bhavnagar, Gujarat. Then it was converted in foliar application liquid by adopting serial dilution technique and finally the foliar spray of 5, 10 and 15% concentration was applied to soybean at 20 and 35 days after sowing.

RESULTS & DISCUSSION

TABLE 1: Effect of seaweed sap on nutrients uptake (Nitrogen, Phosphorous and Potassium) of greengram

Treatments	N Content (%)		P Content (%)		K Content (%)	
	Grain	Straw	Grain	Straw	Grain	Straw
T_1:Control	3.13	1.14	0.58	0.18	1.11	0.66
T_2:K-Sap@5%+RDF	3.22	1.17	0.61	0.20	1.14	0.70
T_3:K-Sap@10%+RDF	3.30	1.19	0.63	0.23	1.18	0.73
T_4:K-Sap@15%+RDF	3.37	1.24	0.66	0.25	1.21	0.75
T_5:G-Sap@5%+RDF	3.24	1.18	0.61	0.21	1.15	0.71
T_6:G-Sap@5%+RDF	3.32	1.21	0.65	0.25	1.20	0.74
T_7:G-Sap@5%+RDF	3.38	1.27	0.67	0.26	1.22	0.77
SE(m)	0.11	0.034	0.011	0.018	0.042	0.022
CD at 5%	NS	NS	NS	NS	NS	NS
GM	3.28	1.20	0.63	0.22	1.17	0.72

Nutrients Content

Data on nitrogen, phosphorous and potassium content in greengram as influenced by different seaweed liquid fertilizer are presented in Table 1. Nitrogen, phosphorous and potassium content in grain and straw did not differ significantly due to various seaweed liquid fertilizer treatments.

TABLE 2: Effect of seaweed sap on nutrients uptake (Nitrogen, Phosphorous and Potassium) of greengram

Treatments	N uptake (kg ha^{-1})		P uptake (kg ha^{-1})		K uptake (kg ha^{-1})	
	Grain	Straw	Grain	Straw	Grain	Straw
T_1:Control	31.64	21.18	5.88	3.46	11.09	12.26
T_2:K-Sap@5%+RDF	35.33	23.86	6.72	4.08	12.47	14.20
T_3:K-Sap@10%+RDF	40.01	26.38	7.68	5.04	14.35	16.26
T_4:K-Sap@15%+RDF	43.64	29.08	8.54	5.76	15.68	17.56
T_5:G-Sap@5%+RDF	36.88	24.80	6.90	4.38	13.06	14.91
T_6:G-Sap@10%+RDF	41.55	27.44	8.09	5.60	15.01	16.79
T_7:G-Sap@15%+RDF	45.26	30.55	8.95	6.27	16.44	18.47
SE(m)	2.11	1.34	0.47	0.46	0.80	0.78
CD at 5%	6.50	4.15	1.47	1.45	2.47	2.41
GM	39.19	26.18	7.54	4.94	14.01	15.78

Macronutrients uptake (N, P and K, Kg ha^{-1})

The uptake of N, P_2O_5 and K_2O by grain and straw of greengram at harvest were influenced significantly due to foliar application of seaweed sap (K-sap and G-sap). Increased concentrations of seaweed sap increased the uptake (10% and above) and reached maximum at 15% of both the saps as compared with control (Table 2).

Foliar application of seaweed sap i.e. G-sap@15%+RDF (T_7) registered highest uptake of nitrogen (45.26 and 30.55 kg ha^{-1}), phosphorous (8.95 and 6.27 kg ha^{-1}) and potassium (16.44 and 18.47 kg ha^{-1}) in grain and straw, it may at par with foliar application of K-sap@15%+RDF (T_4), G-sap@10%+RDF (T_6) and K-sap@10%+RDF (T_3). Lowest nitrogen uptake in both grain and straw were noticed in control. The approximate percent rise of soybean uptake in grain and straw were 30.09% and 30.67%, 34.30 and 44.81% and 32.54 and 33.62% in nitrogen, phosphorous and potassium as compared to control. However the lowest nitrogen, phosphorous and potassium noticed under control.

Seaweed liquid fertilizer is richest source of macronutrient and micronutrient applied foliar at critical stages of the crop were effectively absorbed through the leaves and absorption would be rapid and translocated to the vegetative and reproductive part. Nitrogen uptake was found to be higher in grain than straw indicating higher demand of nutrients by seeds and translocation of nutrients into from vegetative parts to reproductive system. Increase in phosphorus uptake might be due to vigorous growth of plant because of efficient utilization of native and applied phosphorus through foliar application of seaweed sap which has resulted in increase in phosphorus content in grain and straw, which ultimately resulted in increase in phosphorus uptake. Zinc is effective in plant nutrition for the synthesis of plant hormones and balancing intake of P and K inside the plant cells. These results are in confirmation with results obtained by Zodape *et al.* (2010), Sharma *et al.* (2011) and Abou El-Yazied *et al.* (2012).

TABLE 3: Effect of seaweed sap on micronutrients uptake (Zn, Cu, Fe and Mn) of greengram

Treatment	Zn (g/ha)			Cu (g/ha)			Fe (g/ha)			Mn (g/ha)		
	Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total
FS_0	58.13	41.65	99.79	10.30	6.99	17.30	199.44	186.94	386.38	61.84	47.00	108.84
FS_1	65.33	47.17	112.49	11.65	8.22	19.87	224.38	211.81	436.19	70.60	57.16	127.75
FS_2	73.54	53.34	126.87	13.53	9.58	23.11	250.99	235.96	486.95	79.61	63.31	142.91
FS_3	79.50	57.81	137.31	14.85	10.59	25.43	272.35	255.13	527.48	86.02	69.40	155.42
FS_4	67.94	48.59	116.53	12.34	8.66	20.99	233.91	219.19	453.10	73.72	58.90	132.62
FS_5	76.33	54.62	130.95	14.15	10.17	24.32	260.43	244.37	504.81	82.61	66.36	148.97
FS_6	83.62	59.80	143.42	15.52	11.10	26.62	283.24	263.55	547.78	90.46	72.08	162.54
SE(m)	3.63	2.60	6.20	0.77	0.59	1.28	12.19	10.64	22.53	3.86	3.33	7.16
CD at 5%	11.20	8.03	19.13	2.40	1.83	3.95	37.57	32.80	69.42	11.90	10.27	22.09
GM	72.06	51.85	123.91	13.19	9.33	22.52	246.39	230.99	477.38	77.84	62.03	139.86

Micronutrient uptake (Zn, Cu, Fe and Mn, h ha^{-1})

Micronutrient (Zn, Cu, Fe and Mn) uptake was significantly influenced by various seaweed fertilizer levels. Increase in the seaweed fertilizer levels of soybean from 0 to 15% of both sap (K-sap and G-sap) increased the uptake in both grain and straw which are presented in Table 3.

Foliar application of seaweed sap G-sap@15%+RDF (T_7), recorded highest uptake of trace element i.e. Zn, Cu, Fe and Mn by greengram with respective value (83.62 and 59.80 g ha^{-1}), (15.52 and 11.10 g ha^{-1}), (283.24 and 263.55 g ha^{-1}) and (90.46 and 72.08 g ha^{-1}) in grain and straw. However this treatment was found statistically at par with foliar application of K-sap@15%+RDF (T_4), G-sap@10%+RDF (T_6) and K-sap@10%+RDF (T_3). Lowest micronutrient uptake (Zn, Cu, Fe and Mn) recorded in control. Total uptake of micronutrient increased approximately i.e. 30.42% in Zinc, 35.01% in Copper, 29.40% in Iron and 33.03% in Manganese over control.

Supplementation of trace elements through seaweed liquid fertilizer could be a result of better utilization of micronutrient especially due to favourable bio-stimulant action of seaweed extract for enhancement in assimilation of the trace element. Increasing the membrane permeability of roots, leaves and stomata cell and harmone like activities of seaweed extract through their involvement in cell respiration, photosynthesis and enzymatic reaction. Increased root proliferation and establishment; thereby plants were able to mine more nutrients even from distant places and deeper soil horizons, in balanced proportion. Similar results were also reported by Patel *et al.* (2008,) and Zodape *et al.* (2010).

REFERENCES

Abou El-Yazied, A., El-Gizawy, A.M., Ragab, M.I. and Hamed, E.S. (2012) Effect of Seaweed Extract and Compost Treatments on Growth, Yield and Quality of Snap Bean. *Journal of American Science.* 8(6):1-20.

Pramanick, B., Brahmachari, K. and Ghosh, A. (2001) Effect of seaweed saps on growth and yield improvement of green gram. *African Journal of Agricultural Research.* Vol. 8(13), pp. 1180-1186.

Blunden, G., Jenkins, T. and Liu, Y. (1999) Enhanced leaf chlorophyll levels in plants treated with seaweed extract. *Journal of Applied Phycology*. 8:535–543.

Dhargalkar, V.K., Pereira, N. (2005) Seaweed: promising plant of the millennium. Science and Culture, 71:60-66.

Dwivedi, S.K., Meshram, M.R., Pal, A., Pandey, N. and Ghosh, A. (2014) Impact of natural organic fertilizer (seaweed saps) onproductivity and nutrient status of blackgram (PhaseolusmungoL.). The Bioscan. 9(4): 1535-1539.

Eman, A., Abd El-Moniem and Abd-Allah, A. S.E. (2008) Effect of green algae cells extract as foliar spray on vegetative growth, yield and berries quality of superior grapevines. Am. Euras. J. Agric. and Environ. Sci. 4(4): 427-433.

Jat, S.K., Shivay, Y.S., Parhar, C.M. and Meena, H.N. (2012) Evaluation of summer legumes for their economic feasibility, nutrient accumulation and soil fertility. J. Food Leg. 25: 239-242.

Rathore, S.S., Chaudhary, D.R. Boricha, G.N. Ghosh, A. Bhatt, B.P. Zodape, S.T. and Patolia, J.S. (2009) Effect of seaweed extract on the growth, yield and nutrient uptake of soybean (*Glycine max*) under rainfed conditions. *South African Journal of Botany* 75: 351–355.

Raverkar, K.P., Pareek, N. Chandra, R. Chauhan, S. Yaseen, Md. Zodape, S.T. and Ghosh, A. (2012) Effect of foliar application of seaweed saps on yield and nutritional quality of blackgram. *International Symposium on New-Dimensions in Agrometeorology for Sustainable. Pantnagar, (Uttarakhand). October, 2014.*

Renuka Bai, N. Thisya, K. Mary Christi, R. and Christy Kala, T. (2011) Integrated application of organic manures on the growth, yield and nutritional status of *vigna mungo*. *Plant Archives* 11(2): 973-978.

Renuka Bai, N. Mary Christi, R. and Christy Kala, T. (2011) Seaweed liquid fertilizer as an alternate source of chemical fertilizer in improving the yield of *vigna radiate. Plant Archives* 11(2): 895-898.

Satya Sundaram, 2010. India Needs: A Pulses Revolution

Saravanan, P.S., Singh, K. and Ignesh, A. (2013) Effect of organic manures and chemical fertilizers on the yield and macronutrient concentrations of green gram. Int. J. Pharmaceutical Sci. Invention 2(1): 18-20.

Shankar, T. Malik, G.C. Banerjee, M. Ghosh, A. (2014) Evaluation of foliar spray of seaweed liquid fertilizer on the growth and yield of sesame (*Sesamum indicum.L*) in the red and lateritic belt of West Bengal. *National Seminar on Agricultural Diversification for Sustainable livelihood and Environmental Security November 18-20, 2014, Ludhiana, Punjab.*

Sharma, J.D., Sapre, N., Dwivedi, B.S., Agrawal, S.B., and Sharma, A. (2011) Effect of sea weed extract on yield and uptake of soybean under rainfed conditions. *International Symposium on New-Dimensions in Agrometeorology for Sustainable. Pantnagar, (Uttara khand). October, 2014.*

Singh, S., Singh, M.K., Pal, S.K., Thakur, R. Zodape, S. T. and Ghosh, A. (2015) Use of seaweed sap for sustainable productivity of maize. *The Bioscan* 10 (3) 1349-1355.

Spinelli, F., Giovanni, F., Massimo, N., Mattia S. and Guglielmo, C. (2009) Perspectives on the use of a seaweed extract to moderate the negative effects of alternate bearing in apple trees. J. Hort. Sci. Biotech. 17(1): 131-137.

Sujatha, K. and Vijayalakshmi, V. (2013) Foliar application of *Caulerpa racemosa* seaweed extract as bio-stimulant for enhancement of growth and yield of blackgram (*Vigna mungo* L.). *International Journal of Advancements in Research & Technology*, 2, (10), 216-230.

Thirumaran, G., Arumugam, M., Arumugam, R. and Anantharaman., P. (2009a) Effect of seaweed liquid fertilizer on growth and pigment concentration of *Cyamopsis tetrogonolaba* (L.) Taub. Am. Euras. J. Agron. 2(2): 50-56.

Thirumaran, G., Arumugam, M., Arumugam, R. and Anantharaman, P. (2009b) Effect of seaweed liquid fertilizer on growth and pigment concentration of *Abelmoschus ensculetus* (L.) medikus. Am. Euras. J. Agron. 2(2): 57-66.

Turan, M. and Köse, C. (2004) Seaweed extracts improve copper uptake of grapevine. *Acta. Agric. Scand.* 54:213-220.

Venkataraman, K. and Mohan, V. R. (1997) The effect of liquid seaweed fertilizer on black gram. *Phykos* 36:43-47.

Verkleij F.N. (1992) Seaweed extracts in agriculture and horticulture: a review. Biol. *Agricul. Horticul.* 8:309-324.

Zodape, S., Mukhopadhayay, T.K., Eshwaran, K., Reddy, M.P. and Chakara, J. (2010) Enhancement of yield and nutritional quality in greengram treated with seaweed *Kappaphycus alvarezii*. *Journal of Scintific and industrial research* 69 (1): 468-471.