International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(6): 2304-2306

Received: 16-09-2019
Accepted: 18-10-2019

SD Patil
Department of Agronomy, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

GA Bhalerao
Department of Agronomy, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

VR More
Department of Agronomy, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

PK Waghmare
Department of Agronomy, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Corresponding Author:
SD Patil
Department of Agronomy, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Effect of combination of inorganic fertilizer and seaweed extract on growth and yield of soybean crop

SD Patil, GA Bhalerao, VR More and PK Waghmare

Abstract
A field experiment was conducted during the rainy (kharif) season in Indian in 2017 to study the effects of seaweed extract (prepared from *Ascophyllum nodosum*) on the growth and yield of soybean [*Glycine max* (L.) Merr.] [1] Grown under rainfed conditions with combination of chemical fertilizers and seaweed extract. The granular application was applied at the time of sowing with two different concentrations (20 and 40 kg/ha) and foliar spray was applied at the time of flowering (2 Ml SL lit^{-1}).Granular and Foliar applications of seaweed extract significantly enhanced yield parameters. The highest growth parameters, yield attributes, seed yield was recorded with applications of 100% RDF + 40 Kg SG ha^{-1} + 2 Ml SL ha^{-1} (T_7) seaweed extract, followed by 100% RDF + 20 Kg SG ha^{-1} + 2 Ml SL ha^{-1} (T_6) seaweed extract. The maximum straw yield was also achieved with T_7. Thus, under rainfed soybean production, applications of inorganic fertilizers with seaweed extracts could be a promising option for yield enhancement.

Keywords: Inorganic fertilizer, seaweed extract, growth, yield, soybean crop

Introduction
Soybean (*Glycine max* (L.) Merrill) [1] is a leguminous crop and belongs to family Leguminosae. Its origin is in Eastern Asia region. Soybean was cultivated in China from 3000 B.C. Soybean is the world's as well as India's first ranking crop as a source of vegetable oil. It will continue to play a key role in fighting edible oil deficit in the country. Soybean is well known for its nutritional and health benefits. It contains about 40% good quality protein, 20% oil having about 85% unsaturated fatty acids, 25-30% carbohydrates and almost no starch (useful to diabetic patients), 4-5% minerals, anti-oxidants *viz*. ascorbic acid and beta carotene, and about 0.3% is of lavones. That's why, it is also known as a 'Wonder Crop', 'Miracle Crop' and also 'Golden Bean. Seaweeds are one of the most important marine resources of the world. Seaweed extracts have been marketed for several years as fertilizer additives. The possibilities of using seaweed in modern agriculture have been investigated by many. Different forms of seaweed preparation such as LSF (Liquid Seaweed Fertilizers), SLF (Seaweed Liquid Fertilizers), LF (Liquid Fertilizers), and either whole or finally chopped powdered algal manure have been used and all of them have been reported to produce beneficial effects on cereals, pulses and flowering plants. Seaweed manures have the advantage of being free from weeds and pathogenic fungi. Liquid extracts of brown algae are being sold as bio-stimulants or bio-fertilizers in various brand names. Seaweed extracts exhibit growth motivating property on crop plants. Hence its formulation can be used as a bio-stimulant in agriculture. Bio-stimulant is defined as a 'material' other than fertilizer that promotes the growth and yield attribute property of the plants when applied in a small quantity during a crop cycle. The bio-stimulant present in seaweed extract increase the vegetative growth (10%), the leaf chlorophyll content (11%), the stomata density (6.5%), photosynthetic rate and the fruit production (27%) of the plant (Spinelli *et al*. 2010). Seaweed liquid fertilizer has been shown in the recent past to possess great potential as an organic bio stimulant and this potential still remains to be exploited in Indian agriculture (Sujatha, K. and V. Vijayalakshmi, 2013) [4]. Seaweeds are rich source of growth promoting substances such as IAA, kinetin, zeatin and gibberellins, auxins and cytokines, macro and micro elements, amino acids, vitamins and beneficial results from their use in crop plants like early seed germination and establishment, improved crop performance and yield, elevated resistance to biotic and abiotic stress has been reported performance and yield, elevated resistance to biotic and abiotic stress has been reported.

Material and METHOD

The field experiment conducted during 2017 was conducted at balsa block Central Farm, VNMKV, Parbhani. The experimental field was leveled and well drained. The soil was clay in texture, low in nitrogen, medium in phosphorus and high in potassium and alkaline in reaction. Total rainfall received during crop growing season was 995.01 mm and distributed over 42 rainy days during the process of experimentation. The environmental conditions prevailed during experimental period was favorable for normal growth and maturity of soybean. The experiment was laid out in Randomized block design with seven treatments viz, T_1- Control, T_2- 75% RDF (22.5:45:22.5 NPK kg ha^{-1}), T_3- 100% RDF (30:60:30 NPK kg ha^{-1}), T_4- 75% RDF + 20 kg SG ha^{-1} (Seaweed extract in granular form) + 2 ml SL lit^{-1} (Seaweed extract in liquid form), T_5- 75% RDF + 40 kg SG ha^{-1} + 2 ml SL lit^{-1}, T_6- 100% RDF + 20 kg SG ha^{-1} + 2 ml SL lit^{-1}, T_7- 100% RDF + 40 kg SG ha^{-1} + 2 ml SL lit^{-1} and 3 replications. Sowing of soybean variety MAUS-71 was done on 14th July, 2017 by dibbling the seeds at spacing 45 cm × 05 cm. The recommended cultural practices and plant protection measures were taken. Fertilizer *viz*, nitrogen, phosphorus and potassium were applied to respective plots by using urea, SSP and muriatic of potash uniformly in the lines opened for sowing as per the treatments.

Result and Discussions

The plant growth in respect of number of root nodules, dry weight of root nodules, plant height, leaf area plant^{-1}, number of functional leaves plant^{-1}, number of branches plant^{-1} and total dry matter plant^{-1} were significant in influenced by treatment under study. It was observed that Table no 1. Maximum number of root nodules (61.04) , dry weight of root nodules (39.27mg), maximum height of the plant^{-1} (46.94 cm) leaf area plant^{-1}(9.08 dm^2), number of functional leaves plant^{-1}(22.51), number of branches plant^{-1} (6.09), total dry matter plant^{-1} (15.47 g) was attained with application of 100% RDF + 40 Kg SG ha^{-1} + 2 Ml SL lit^{-1} (T_7) twice during flowering (45 DAS) and pod filling stage (60 DAS) recorded significantly highest growth attributing character but it was at par with the 100% RDF + 20 Kg SG ha^{-1} + 2 Ml SL lit^{-1} (T_6) and 75% RDF + 40 Kg SG ha^{-1} + 2 Ml SL lit^{-1} (T_5). Significantly minimum growth parameters recorded in treatment (T_1) Control.

Table 1: Mean number of Maximum number of root nodules, dry weight of root nodules,

Treatment	Root Nodules	Dry weight of root nodules	Plant height	Number of functional leaves	Leaf area	No. of branches	total dry matter
T_1- Control	42.83	27.02	30.48	12.33	4.58	3.19	8.31
T_2- 75% RDF	47.04	29.43	36.60	13.60	5.43	3.23	11.87
T_3- 100% RDF	53.94	33.75	39.79	17.89	7.23	5.06	12.61
T_4- 75% RDF + 20 kg SG + 2 ml SL	49.00	30.98	38.19	15.81	6.72	4.41	12.22
T_5- 75% RDF + 40 kg SG + 2 ml SL	55.97	35.76	42.03	20.78	7.99	5.64	13.91
T_6- 100% RDF + 20 kg SG + 2 ml SL	59.55	38.32	42.06	21.96	8.38	5.76	14.52
T_7- 100% RDF + 40 kg SG + 2 ml SL	61.04	39.27	45.70	22.51	9.08	6.09	15.47
S.E.(m) ±	2.23	1.44	1.74	1.01	0.32	0.26	0.52
CD at 5%	6.88	4.43	5.37	3.10	0.99	0.79	1.61
General Mean	52.77	33.51	39.26	17.84	7.06	4.77	12.70

Maximum height of the plant^{-1}, branches plant^{-1}, number of functional leaves plant^{-1},) leaf area plant^{-1}, total dry matter plant^{-1} of soybean as influenced by different treatments**.**

The application of recommended dose of fertilizer with seaweed extract resulted in increase in growth attributes may be due to better uptake trance location of better and translocation of plant nutrients to growing plants and more photosynthesis which in turn promoted More numbers of root nodules, plant height, leaf area plant^{-1}, and number of functional leaves plant^{-1}, number of branches plant^{-1} and total dry matter plant^{-1}. This result was conformity with Rathod *et al.* (2009) [1], Zodape *et al.* (2009) [1], Thirumaran *et al.* (2009) [1], Sridhar Rengasamy (2010) [a].

Table 2: Mean number of pods plant^{-1}, weight of pods plant^{-1}, weight of seeds plant^{-1}, number of seeds pod^{-1}, test weight, seed yield (kg ha^{-1}), straw yield (kg ha^{-1}), biological yield (kg ha^{-1}) and 010) [a].

Treatment	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)
T_1- Control	1183	1576	2759	42.89
T_2- 75% RDF	1453	1957	3410	42.62
T_3- 100% RDF	1783	2354	4137	43.10
T_4- 75% RDF + 20 kg SG + 2 ml SL	1770	2355	4125	42.93
T_5- 75% RDF + 40 kg SG + 2 ml SL	2015	2635	4650	43.32
T_6- 100% RDF + 20 kg SG + 2 ml SL	2120	2782	4902	43.30
T_7- 100% RDF + 40 kg SG + 2 ml SL	2232	2879	5111	43.67
S.E.(m) ±	75.29	117.26	190.29	0.43
CD at 5%	231.95	361.25	586.27	NS
General Mean	1794	2363	4156	43.12

(%) of soybean as influenced by different treatments

The seed yield (kg ha^{-1}), straw yield (kg ha^{-1}), biological yield (kg ha^{-1}) and harvest index (%) were reported by application of 100% RDF + 40 Kg SG ha^{-1} + 2 Ml SL lit^{-1} (T_7) twice pod filling stage (60 DAS) and harvesting stage recorded significantly highest pods but it was at par with the 100% RDF + 20 Kg SG ha^{-1} + 2 Ml SL lit^{-1} (T_6) and 75% RDF + 40 Kg SG ha^{-1} + 2 Ml SL lit^{-1} (T_5).This might be due to enhancement of photosynthetic and enzymatic activity .This may be because of

production of more number of fruiting points and flower production, which lead to marked influence in partitioning of vegetative and reproductive growth. Being a part of the enzyme system or as a catalyst in enzymatic reactions, they are required for plant metabolic activities such as respiration, meristomatic development chlorophyll formation, photosynthesis, energy system, protein synthesis and oil content and also these nutrients play a major role in production of more number of flowering, production of more number of pods. This results are conformity with Rathod *et al.* (2009) [1], Zodape *et al.* (2009) [1], Sridhar Rengasamy (2010) a [2] .Sridhar Rengasamy (2010) b [3].

Conclusion

On the basis of one year data it can be concluded that application of 100% RDF + 40 Kg SG ha^{-1} + 2 Ml SL lit^{-1} (T_7) during *kharif* season of 2017 recorded highest growth parameter, yield attributes, seed yield and fallowed by treatment 100% RDF + 20 Kg SG ha^{-1} + 2 Ml SL lit^{-1} (T_6) and 75% RDF + 40 Kg SG ha^{-1} + 2 Ml SL lit^{-1} (T_5)

References

1. Rathore SS, Chaudhary DR, Boricha GN, Ghosh A, Bhatt BP, Zodape ST *et al*. Effect of seaweed extract on the growth, yield and nutrient uptake of soybean (*Glycine max*) under rainfed conditions. South African Journal of Botany. 2009; 75(2):351-355.
2. Sridhar S, Rengasamy R. Effect of seaweed liquid fertilizer on the growth, biochemical constituents and yield of *Tagetes erecta*, under field trial. Journal of Phytology. 2010; (6):61-68.
3. Sridhar S, Rengasamy R. Studies on the Effect of Seaweed Liquid Fertilizer on the Flowering Plant *Tagetes erecta* in Field Trial. Advances in Bioresearch. *2010;* 1(2):29-34.
4. Sujatha K, Vijayalakshmi V. Foliar application of *Caulerpa racemosa* seaweed extract as bio-stimulant for enhancement of growth and yield of black gram (*Vigna mungo* L.). International Journal of Advancements in Research & Technology, 2013; 2(10):216-230.
5. Zodape S, Mukhopadhayay TK, Eshwaran MP, Reddy J, Chakra. Enhancement of yield and nutritional quality in green gram treated with seaweed Kappaphycus alvarezii. Journal of Scientific and industrial research. 2010; 69(1):468-471.
6. Zodape ST, Mukherjee S, Reddy MP, Chaudhary DR. Effect of Kappaphycus alvarezii (Doty) extract on grain quality, yield and some yield components of wheat (*Tritium aestivum* L.). International Journal of Plant Production. 2009; 3(2):97-101.
7. Zodape S, J Kawarkhe TV, Patolia JS, Warade AD. Effect of seaweed liquid fertilizer on growth and yield of okra. Journal of scientific and industrial research. 2008; 67:1115-1117