Original Research Paper

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EVALUATION OF MARINE ALGAL SAP FOR INCREASING THE PRODUCTION OF SUMMER GREENGRAM

Agronomy

KEYWORDS: : Green gram, marine algal sap- K sap and G sap)

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ABSTRACT

A field investigation entitled "Effect of foliar application of marine algal sap on growth, yield and quality of summer Green gram" was carried out to explore the knowledge and to test its suitability as an alternative organic source of nutrients during the summer season of 2012-2013. Growth characters viz., plant height, number of branches, leaf area, leaf area index were maximum with treatments K sap at 15 % and G sap at 15 % concentration along with 100 % RDF while chlorophyll content index, dry matter, number of leaves, root length was maximum with application of K sap 20 % and G sap 20 % concentration along with 100 % RDF. Nutrients content of grains and straw was found significantly higher in treatment K sap at 15 % followed by G sap at 15 %. Gross monetary return, net monetary return and B:C ratio recorded maximum with application of 15 % K sap followed by application of 15 % G sap at concentration.

INTRODUCTION

Green gram is one of the major pulse crop. It is an excellent source of quality protein. It contains about 25 per cent protein. Green gram also used as a green manuring crop. Being a leguminous crop it has the capacity to fix the atmospheric Nitrogen. It also helps in preventing soil erosion. Being a short duration crop it fits well in many intensive crop rotations. Green gram can be used as feed for cattle. After harvesting the pods, green plants are uprooted or cut from ground level and chopped small pieces and fed to cattle. The husks of the seeds can be soaked in the water and used as cattle feed. (Singh *et al*., 2010).

It has been reported that the performance of seaweed manure is superior to the conventional organic manure viz., farm yard manure. Liquid extract derived from marine algae have been used over the past 40 years on various crops to promote growth and development. Interest in these seaweed concentrates in agricultural system is focused on their use as an inexpensive source of naturally occurring plant growth regulator. Much of the benefit from the application of seaweed extract has been attributed to the presence of the plant hormones, especially cytokinin. Various seaweed concentrates contain significant amount of cytokinin in addition to other phytohormones, (Reitz and Trumble*et al.*1996). Liquid extracts or cell saps obtained from seaweeds have recently gained importance as foliar sprays for many crops. Seaweed contains major and minor nutrients, amino acids, vitamins, cytokinins, auxin and abscisic acid like growth promoting substances and these helps to stimulate the growth and yield of plants, developed tolerance to environment stress , increase nutrient uptake from soil and enhance antioxidant properties (Challen and Hemingway, 1965). *Kappaphycus alvarezii* (Doty) extract applied as a foliar spray at 0.25,0.5 and 1.0 per cent on wheat compared to control the yield of grain increased by 80.44 per cent when, the plant were sprayed with 1.0 per cent *Kappaphycu salvarezii* extract. The nutritional quality of grain such as carbohydrates, proteins and minerals also improved under the influence of treatments (Zodape*et al.* 2009). Similarly, Sivasankari *et al.* (2006a) observed that in cluster bean 1.0 per cent concentration of *Caulerpascal pelliformis* and *Gracillari acorticata* enhanced the biochemical parameters such as chlorophyll-a, chlorophyll-b, xanthophylls, carotenes, total carbohydrate, total protein and lipid.

Upon these considerations, the present investigation was undertaken to study the effect of foliar spray of seaweed extract (Kappaphycus sap) and (Gracilaria sap) on growth and yield of green gram to find out optimum concentration of seaweed extract so as to enhance yield of green gram.

MATERIAL AND METHODS

A field experiment entitled "Effect of foliar application of marine algal saps on growth, yield and quality of *summer* green gram" was conducted during *summer* season of 2012-2013. An experiment was conducted in randomised block design with three replications and nine treatments which comprised as 100 per cent recommended dose of nutrient with 5, 10, 15, 20 per cent K sap and 100 per cent recommended dose of nutrient with 5, 10, 15, 20 per cent G sap which were compared with no spray of any fertilizer. The gross and net plot size were 4.5m x 3.6mand 3.6m x 2.7m, respectively. The Green gram variety Pusavaishkhi was sown on March 11th, 2013 and harvested on 28th May 2013.

The soil of the experimental site was characterized as clayey in texture and slightly alkaline in reaction (pH-7.9). It was in nitrogen (184.88), medium phosphorous (19.57) and fairly rich in potash (379.42). There was 2.5 and 1.5 mm rainfall during 12th and 16th meteorological weeks respectively as against the normal of 0.6 and 0.5 mm. Monsoon rains during 10th to 22th MW i.e. 5 March to 3 Jun amounted to 4.0 mm in 1 rainy day as against the normal of 27.8 mm. The rainfall received during the season was less than (23.8 mm) normal. During the crop growing season the maximum temperature ranged between 35.3 during 23rd MW (4.9 ^{o}C lower than normal) to 43.6 ^{o}C during 21st MW (1.5 ^{o}C higher than normal). The minimum temperature varied from 29.9 ^{o}C during 20th MW (2.2 ^{o}C higher than normal) to 15.2 ^{o}C during 10th MW (2.1 ^{o}C lower than normal).

Observations were recorded on growth parameters such as Root length, Plant height, Number of leaves plant^{-1}, Number of branches plant^{-1}, leaf area plant^{-1}, Leaf area index, Chlorophyll content, Number of branches plant^{-1}, Dry matter (g) plant^{-1}, Dry matter partitioning, Days to 50% flowering, and yield parameters as No. of podsplant^{-1}, Pod weight plant^{-1}, Grain weight plant^{-1}, Test weight, Grain yield (q ha^{-1}.), Straw yield (q ha^{-1}.), Harvest index, Grain to straw ratio and economics as Gross monetary returns(Rs.ha^{-1}.), Net monetary return (Rs. ha^{-1}.), B:C ratio.

RESULTS AND DISCUSSION

Effects of foliar application of marine algal sap on growth parameters

Improvement in root length was found significantly maximum with

foliar spray of 20 % K sap concentration (25.92 cm) over control (20.25). However, it was at par with the foliar spray of 20 % G-sap (25.17), 15% K-sap (25.07), 15 % G-sap (24.42). This might be due to plant hormones specially auxins and cytokinins which stimulates cell division and elongation of roots. Similar results were reported by Pramanick*et al.* (2013).However, maximumPlant height(54.10cm) and leaf area(386.80 cm^2)was recorded at foliar spray of 15 % K sap concentration but it was on par with 15 % G sap and 20 % concentration of both saps and found significantly superior to lower concentration of both saps with regards to plant height and the leaf area. Significant increase in plant height and leaf area might be due to the presence of macro and micro nutrients, natural enzymes and plant growth hormones in seaweed extract, which helps in enhancing the metabolic rate, cell division and cell elongation which allow the plant, to grow faster. Similar results in relation to occurrence of macro, micronutrients, natural enzymes and growth hormones in sea weed extract were recorded by Shaaban *et al.* (2001) and in relation to increase growth parameters by Lingakumar *et al.* (2004)

Chlorophyll content index of leaves (18.35) and dry matter accumulation per plant (23.56g) also recorded significantly maximum with foliar spray of Ksap 20 % concentration it was at par with G sap 20 % (18.26) and 15 %concentration of both the saps with regards to chlorophyll content index of the leaves and dry matter accumulation. This might be due to plant bio-physiological activitiesregulated by liquid seaweed extracts, collectively resulted in maintaining higher photosynthetic activities. Also increase in the photosynthetic pigments may be due to the presence of magnesium which is the chief constituent for chlorophyll synthesis. Similar results were supported byJothinayagi and Anbazhagan (2009) and Sivasangari *et al.* (2010)The presence of Nitrogen and magnesium impart dark green colour (chlorophyll) in leaf, due to that leaf synthesize more photosynthetes in plant, phosphorus and potash also involve in production of carbohydrate and translocation to different parts of the plant to produce maximum dry matter accumulation in plant. Similar results in respect of dry matter production were found by Rathore *et al.* (2008).

Significantly maximum number of branches were observed with foliar spray of 15 % K sap concentration (4.20), which was at par with G sap 15 % (4.10), and 20 % concentration of both saps (3.95 and 3.92, respectively). This might be due to presence of macro, micro nutrients, natural enzymes and plant growth hormones like cytokinins in sea weed extract which involved in boosting of number of branches through participating in cell enlargement during development of auxiliary buds of plant. Similar results were supporting the findings of Pramanick *et al.* (2013).

Foliar application of treatment K sap and G sap recorded non-significant effects in days required for 50 % flowering. It might be due to flowering character of any crop is a genetically controlled and as a result it had no significant effect on any variation of concentration

Effects of foliar application of marine algal sap on yield parameters

Number of pods per plant was maximum at 15 % concentrations of K sap (17.3) and which was at par with 15 % concentration of G Sap (16.3) and 20% concentration of K sap (14.5) and found significantly higher than other treatments. Number of pods at higher concentration may be due to better translocation of photosynthetes towards developing pods as sap content growth hormones which facilitated better translocation.The present results are in accordance with the findings of Rathore *et al.* (2008), and Zodpe *et al.* (2010).

Foliar spray with K sap 15 % recorded significantly highest pod weight per plant (8.93g) and remains at par with treatment G sap 15 % (8.77g) and G sap 20 % (7.54g). However lowest pod weight per plant was observed in K sap 5 % (5.96g) followed by control (5.71g). The results obtained were in conformity with findings of Sethi and Adhikary (2008) and Zodape *et al.* (2010)

Foliar application of marine algal saps were significantly influenced the grain weight per plant. K sap sprayed with 15 % concentration recorded significantly highest grain weight per plant (7.91g) and remains at par with G sap 15 % (7.77g) and K sap 20 % (6.53g) and found significantly higher than rest of the treatments. Lowest grain weight per plant was observed in G sap 5 % (4.88g) followed by control (4.61g). Similar results were also obtained by Zodape*et al.* (2010).

Foliar application of marine algal saps was significantly influenced the grain weight per cent. K sap at 15 % recorded significantly highest test weight per

Table 1. Effects of foliar application of marine algal sap on growth of sunflower.

Treatments	Root length of plant (cm)	Plant height (cm)	Number of leaves plant-1	leaf areapl ant-1 (cm2)	Chlo roph yll cont ent	Numbe r of branch es plant-1,	Dry matt er (g) plant -1	Days to 50% flowe ring
T1-100% RDF + K sap 5 %	21.85	46.41	9.25	300.80	11.73	3.59	15.89	34
T2-100% RDF + K sap 10 %	23.05	48.33	10.10	348.70	12.14	3.77	18.26	33
T3-100% RDF + K sap 15 %	25.07	54.10	11.08	386.80	16.85	4.20	22.69	34
T4-100% RDF + K sap 20 %	25.92	50.53	12.30	384.00	18.35	3.95	23.56	34
T5-100% RDF + G sap 5 %	21.45	44.97	8.15	298.48	15.73	3.40	16.57	34
T6-100% RDF + G sap 10 %	23.73	47.49	9.60	341.75	11.76	3.62	17.91	34
T7-100% RDF + G sap 15 %	24.42	51.94	10.64	383.75	17.61	4.10	21.14	33
T8-100% RDF + G sap 20 %	25.17	49.15	11.93	362.70	18.26	3.92	23.13	34
T9-Control	20.25	42.86	7.89	293.40	11.03	2.84	14.44	33
SE (m) ±	0.67	1.48	0.67	11.61	0.72	0.13	1.32	1.08
CD at 5 %	2.01	4.46	2.01	34.95	2.17	0.39	3.97	NS

K Sap - Kappaphycus sap, G Sap - and Gracilaria sap

Table 2. Effects of foliar application of marine algal sap on yield parameters, yield and economics

Treatments	No. of pods plant-1	Pod weight plant-1 (g)	Grain weight plant-1 (g)	Test weigh t (g)	Harves t index	Grain yield (q ha-1)	Straw yield (q ha-1)
T1-100% RDF + K sap 5 %	11.9	5.96	4.88	38.51	34.53	8.82	16.72
T2-100% RDF + K sap 10 %	13.3	6.77	5.65	39.44	35.94	10.44	18.61

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T3-100% RDF + K sap 15 %	17.3	8.93	7.91	40.54	36.57	12.42	21.54
T4-100% RDF + K sap 20 %	14.5	7.43	6.53	39.88	32.27	11.61	24.37
T5-100% RDF + G sap 5 %	12.1	7.11	5.90	38.61	35.53	10.01	18.16
T6-100% RDF + G sap 10 %	12.8	6.64	5.50	38.96	35.87	10.89	19.47
T7-100% RDF + G sap 15 %	16.3	8.77	7.77	40.01	34.68	11.82	22.26
T8-100% RDF + G sap 20 %	14.0	7.54	6.31	39.79	31.70	11.04	23.79
T9-Control	10.6	5.71	4.61	37.07	35.27	8.19	15.03
SE (m) ±	0.96	0.46	0.47	0.35	0.42	0.49	1.02
CD at 5 %	2.90	1.39	1.42	1.05	1.27	1.48	3.07

plant (40.54g) which was at par with treatment K sap 20 % (39.88g) also it was at par with treatment G sap 15 % (40.01g), G sap 20 % (39.79g) whereas lowest test weight (grain weight) was observed in K sap 5 % (38.51g) followed by control (37.07g). Similar results were also obtained by Rathore *et al.* (2008).

Effects of foliar application of marine algal sap on economics

Perusal of data presented in Table 2 indicated that the maximum GMR was observed in K sap 15 % (53484 Rs ha^{-1}) which was at par with G sap 15 % (51295 Rs ha^{-1}) and 20 % concentration of both saps (50446 Rs. ha^{-1} and 48356 Rs. ha^{-1} respectively) and significantly more than other treatments. Similar trend was observed with NMR. Spraying of either K and G sap along with RDF, even at low concentration 5 and 10 % produced more GMR, NMR than control indicating beneficial effect of saps. B:C ratio was higher with K sap 15 % compare to other concentration.

Table 3. Effects of marine algal sap on yield and economics of sunflower

Treatments	GMR (Rs.ha^{-1})	NMR (Rs. ha^{-1})	B:C ratio.
T_1-100% RDF + K sap 5 %	43765	23954	2.21
T_2-100% RDF + K sap 10 %	44904	25990	2.27
T_3-100% RDF + K sap 15 %	53848	34037	2.72
T_4-100% RDF + K sap 20 %	50446	30635	2.55
T_5-100% RDF + G sap 5 %	43163	23963	2.25
T_6-100% RDF + G sap 10 %	43913	24102	2.22
T_7-100% RDF + G sap 15 %	51295	31484	2.59
T_8-100% RDF + G sap 20 %	48356	28545	2.44
T_9-Control	36475	19655	2.17
SE (m) ±	1846	1826	0.09
CD at 5 %	5558	5496	0.28

CONCLUSIONS

Both K and G sap at 15 % concentrations were beneficial to improve growth and yield. Protein content of grains of summer green gram was also found higher in K sap at 15 % concentration. Gross monetary returns, net monetary returns and B:C ratio were maximum with 15 % K sap which indicated that spraying of 15% K sap was economical.

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