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Full Research Article

Effect of Different Concentration of Seaweed Saps on Quality, Green Fodder and Seed Yields of Berseem (*Trifolium alexandrium*)

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Abstract

A field experiment was conducted during *rabi* seasons 2012 and 2013 at research farm of Department of Agronomy Jawaharlal Nehru Krishi Vishwa-Vidyalaya, Jabalpur, Madhya Pradesh, India. The experiment was laid out in Randomized Block Design in three replications with ten treatments are as follows: RDF+2.5% K-sap, RDF+5% K sap, RDF+7.5% K sap, RDF+10% K sap, RDF+2.5% G sap, RDF+5% G sap, RDF+7.5% G sap, RDF+10% G sap, RDF+water spray, 50% RDF+6.25% K sap. The sowing date of Berseem variety- JB-5 were sown on 17th November, 2012 and 19th November of 2013. The highest GFY and DMY were recorded with the application of RDF with 10% G sap (613.45 and 83.24 q ha^{-1}) followed by application of RDF+10% K sap (607.35 and 82.01 q ha^{-1}), similarly the maximum seed yield and stover yield were recorded with the application of RDF with 10% G sap (4.72 and 62.36 q ha^{-1}) followed by application of RDF+10% K sap (4.07 and 60.59 q ha^{-1}), respectively due to presence of growth promoting hormones (Auxins, Cytokinins, Gibberellins), trace elements, vitamins, amino acids, antibiotics and micronutrients in these saps. The higher crude protein yield and crude fiber yield were observed under application of 10% G sap+RDF (11.67 and 15.10 q ha^{-1}) followed by10% K sap+RDF (11.83 and 15.34 q ha^{-1}).

1. Introduction

The seaweeds resources are intensively used to improve harvest quantity and quality in agriculture and horticulture. The beneficial effects of seaweed products on the cultured plants are well documented. The using of seaweed products improve seeds germination, seedlings development, increase plant tolerance to environmental stresses (Zhang and Ervin, 2008), and enhance plant growth and yield (Kumari et al., 2011; Craigie, 2011). More over seaweeds are used as soil amendment (Gandhiyappan and Perumal, 2001), in pests control (Hong et al., 2007) and plant diseases management (Jayaraj et al., 2008). Liquid extracts obtained from seaweeds have gained importance as foliar sprays and soil drench for many crops including various grasses, cereals, flowers and vegetable species. Also they apply to stimulate seedling germination and rooting. Seaweeds have been used as manure, cattle feed, food for human consumption and as a source of phycocolloids such as agar, alginic acid and carrageenan. Besides their application as Farmyard Manure (FYM), liquid extracts obtained from seaweeds (LSF/SLF) have recently gained importance as foliar sprays for several crops because the extract contains growth promoting hormones (IAA and IBA), cytokinins, trace elements (Fe, Cu, Zn, Co, Mo, Mn, Ni), vitamins (Sivasankari, 2006). Seaweed extracts have been reported to stimulate the growth and yield of plants, develop tolerance to environment stress, increase nutrient uptake from soil and enhance antioxidant properties (Rathore, 2009). Recently researchers proved that seaweed fertilizers are better than other fertilizers and are very economical (Sivasangari et al., 2011).

2. Materials and Methods

2.1. Preparation and chemical composition of liquid seaweed extracts

The algae *Kappaphycus* sp. and *Gracilaria* sp. were handpicked from the coastal area of Rameswaram, Tamilnadu (India) in September, 2011. The seaweed were washed with water to remove unwanted impurities and transported to the laboratory at Mandapum, Rameswaram. The seaweed samples were thoroughly washed using tap water and homogenized in a grinder with stainless steel blades at ambient temperature, filtered and stored. The liquid filtrate was taken as 100%

concentration of seaweed extract and diluted as the treatments^{-1}. The nitrogen (N) content of seaweed extract was determined by taking 20 ml filtrate and oxidized by concentrate sulphuric acid (10 ml) with digestion mixture (K_2SO_4:$CuSO_4$=5:1) heated at 400 °C for 2½ h as semi-micro Kjeldahl's method. The other nutrient elements were analyzed by inductively coupled plasma-optical emission spectroscopy (ICP-OES) after wet digestion of filtrate (20 ml) with HNO_3-$HClO_4$ (10:4) diacid mixture (20 ml) and heated at 100 °C for 1 h and then temperature raised to 150 °C.

2.2. Details of the experiment

A field experiment was conducted during *rabi* seasons 2012 and 2013 at research farm of department of agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India. The experiment was laid out in Randomized Block Design in three replications with ten treatments are as follows: RDF+2.5% K sap+, RDF+5% K sap, RDF+7.5% K sap, RDF+10% K sap, RDF+2.5% G sap, RDF+5% G sap, RDF+7.5% G sap, RDF+10% G sap, RDF+water spray, 50% RDF+6.25% K sap. Spraying of seaweed saps *Kappaphycus* sap (K sap) and *Gyaciradia* Sap (G sap) were done at 30 days, first cutting (at 55 days) and second cutting (at 75 days) of berseem after sowing. Berseem var. JB 5 was sown by broadcast method by using seed rate of 35 kg ha^{-1}.

The crop was fertilized as the recommended^{-1} dose of 20:60:20 kg NPK ha^{-1}. The 100% dose of N, P_2O_5 and K_2O were applied as basal in the form of urea, SSP and MOP, respectively. As per the proposed set up of treatments by company the dose of K sap and G sap were applied at the time of cutting in three foliar sprays. After physical maturity berseem were harvested in the month of May. Total seed yield was noted at harvest in kg plot^{-1}.

3. Results and Discussion

3.1. Effect on green fodder yield

The shoot height was recorded at first, second and third cutting of the besrseem and average shoot height was calculated (Table 1). It observed that the increasing the dose of K sap as well as G sap increases the average shoot height significantly. The maximum average shoot height was observed under application of RDF with 10% G sap (49.49 cm) followed by application of RDF+10% K sap (49.72 cm), while minimum average shoot height was recorded under RDF+water spray (42.81 cm). L:S ratio of different treatments was presented in (Table 1). Data revealed that all the combination of K sap as well as G sap with recommended dose of fertilizer recorded significantly higher L:S ratio. The maximum L:S ratio was observed with the application of RDF with 10% G sap (0.98) followed by application of RDF+10% K sap (0.95), while minimum L:S ratio was recorded under RDF+water spray (0.76). Data revealed that all the combination of K sap as well as G sap with recommended dose of fertilizer recorded significantly higher GFY and DMY. The highest GFY and DMY were recorded with the application of RDF with 10% G sap (613.45 and 83.24 q ha^{-1}) followed by application of RDF+10% K sap (607.35 and 82.01 q ha^{-1}), while the lowest GFY and DMY recorded under RDF+water spray (559.2 5 and 72.49 q ha^{-1}). There was an increase in vegetative growth parameters by the application of seaweed extract. This is coincided with those of earlier studies made in *Phaseolus vulgaris* L. (Kocira et al., 2013).

3.2. Effect on fodder quality

The data presented in Table 1 showed that the average crude

Table 1: Effect of different treatments on shoot length, L:S ratio, green fodder yield, dry matte yield, crude protein %, crude protein yield and crude fiber % of berseem (Mean of two year 2012 and 2013)

Treatments	Shoot length	L:S ratio	Green fodder yield (q ha^{-1})	Dry matter yield (q ha^{-1})	Crude protein %	Crudeprotein yield (q ha^{-1})	Crude fiber %	Crude fiber yield (q ha^{-1})
RDF+2.5% K sap	48.34	0.82	575.85	76.10	15.06	10.80	18.17	13.65
RDF+5% K sap	48.65	0.83	581.75	77.71	15.31	11.18	18.37	14.01
RDF+7.5% K sap	49.56	0.87	589.55	78.62	15.36	11.42	18.50	14.37
RDF+10% K sap	49.72	0.95	607.35	82.01	15.46	12.03	18.67	15.15
RDF+2.5% G sap	48.16	0.88	580.85	77.36	15.37	11.24	18.22	13.91
RDF+5% G sap	48.70	0.91	584.65	78.37	15.42	11.43	18.48	14.30
RDF+7.5% G sap	49.59	0.94	602.55	80.94	15.45	11.83	18.57	14.84
RDF+10% G sap	49.97	0.98	613.45	83.24	15.51	12.22	18.77	15.42
RDF+water spray	42.81	0.76	559.25	72.49	14.89	10.14	18.04	12.92
50% RD+6.25% K sap	49.61	0.88	593.45	79.27	15.43	11.58	18.32	14.37
SEm±	0.10	0.02	0.95	0.52	0.04	0.11	0.08	0.04
CD (*p*=0.05)	0.32	0.05	2.65	1.45	0.14	0.35	0.26	0.12

Protein (CP) and Crude Fiber (CF) % were also found maximum under the 10% G sap+RDF (15.51 and 18.77%) followed by 10% K sap+RDF (15.46 and 18.67%). The minimum CP and CF% were observed in the application of water alone (14.89 and 18.04%). Data revealed that (Table 1) all the combination of K sap and G sap with recommended dose of fertilizer recorded significantly recorded higher CPY and CFY. Further, 10% K sap with RDF and 10% G sap with RDF was found superior over 5% and 7.5% K sap And G sap with recommended dose of fertilizer. The higher CPY and CFY were observed under application of 10% K sap+RDF (12.03 and 15.15 q ha^{-1}) followed by 10% G sap+RDF (12.22 and 15.42 q ha^{-1}). The presence of marine bioactive substances in seaweed extract improves stomata uptake efficiency in treated plants compared to non-treated plants (Mancuso et al., 2006).

3.3. Effect on yield attributes and yields

Number of branches shoot^{-1} were recorded at maturity and presented in Table 2. It also increases with the increasing dose of K sap as well as G sap. The maximum number of shoots plant^{-1} were observed under application of RDF with 10% G sap (11.22) followed by application of RDF+10% K sap (11.06), while minimum number of shoots plant^{-1} was recorded under RDF+water spray (8.65). Yield attributing characters like Number of capsules plant^{-1} and test weight were presented in Table 2. Data revealed that all the combination of K sap and G sap with recommended dose of fertilizer recorded significantly higher number of capsules plant^{-1} as well as test weight. Further, 10% K sap with RDF and 10% G sap with RDF was found superior over 5% and 7.5% K sap And G sap with recommended dose of fertilizer. The maximum number of capsules plant^{-1} and test weight was observed under application of 10% G sap+RDF (15.81 and 3.45 g) followed by10% K sap+RDF (15.54 and 3.26 g). While minimum number of capsules plant^{-1} and test weight was observed under application of water alone (10.57 and 2.48 g).

3.4. Seed and stover yields

Seed yield and stover yield were in different treatments was presented in Table 2. Data revealed that all the combination of K sap as well as G sap with recommended dose of fertilizer recorded significantly higher seed yield and stover yield. The maximum seed yield and stover yield were recorded with the application of RDF with 10% G sap (4.72 and 62.36 q ha^{-1}) followed by application of RDF+10% K sap (4.55 and 59.92 ha^{-1}). The minimum seed yield and stover yield were recorded under RDF+water spray (3.19 and 46.11 q ha^{-1}). Erulan et al. (2009) reported that sea weed extract enhanced the growth parameters such as shoot length, root length, leaf area, fresh weight, dry weight and yield.

Table 2: Effect of different treatments on yield attributes and yields of berseem (Mean of two year 2012 and 2013)

Treatments	Crude fiber yield (q ha^{-1})	No. of branches shoots at seed harvest	No. of capsules plant^{-1}	Test weight (g)	Seed yield (q ha^{-1})	Stover yield (q ha^{-1})
	Mean	Mean	Mean	Mean	Mean	Mean
RDF+2.5% K sap	13.65	10.07	12.81	2.95	3.59	51.80
RDF+5% K sap	14.01	10.31	12.96	3.03	4.33	56.23
RDF+7.5% K sap	14.37	10.6	14	3.16	4.44	58.01
RDF+10% K sap	15.15	11.06	15.54	3.26	4.55	59.92
RDF+2.5% G sap	13.91	10.44	14.2	2.96	3.66	51.72
RDF+5% G sap	14.30	10.53	14.65	3.08	4.47	55.81
RDF+7.5% G sap	14.84	10.87	15.12	3.2	4.63	61.63
RDF+10% G sap	15.42	11.22	15.81	3.45	4.72	62.36
RDF+water spray	12.92	8.65	10.57	2.48	3.19	46.11
50% RD+6.25% K sap	14.37	10.56	13.37	3.08	4.05	51.82
SEm±	0.04	0.002	0.15	0.003	0.52	0.92
CD (p=0.05)	0.12	0.04	0.45	0.01	1.56	2.32

4. Conclusion

Highest GFY and DMY were recorded with the application of RDF with 10% G sap (613.45 and 83.24 q ha^{-1}) followed by application of RDF+10% K sap (607.35 and 82.01 q ha^{-1}), similarly the maximum seed yield and stover yield were recorded with the application of RDF with 10% G sap (4.72 and 62.36 q ha^{-1}) followed by application of RDF+10% K sap (4.07 and 60.59 q ha^{-1}), respectively due to presence of growth promoting hormones (Auxins, Cytokinins, Gibberellins), trace elements, vitamins, amino acids, antibiotics and micronutrients in these saps.

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