International Journal of Plant Production 3 (2), April 2009
ISSN: 1735-6814 (Print), 1735-8043 (Online)
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SHORT COMMUNICATION

Effect of *Kappaphycus alvarezii* (Doty) Doty ex silva. extract on grain quality, yield and some yield components of wheat (*Triticum aestivum* L.)

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Discipline of Wasteland Research
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Received 7 Oct 2008; Accepted after revision 3 March 2009; Published online 28 April 2009

Abstract

A pot experiment was conducted in rabi season 2004-05 to study the effect of *Kappaphycus alvarezii* extract applied as a foliar spray at 0.25%, 0.50% and 1.0% on wheat. Compared to control the yield of grain increased by 80.44% when, the plants were sprayed with 1.0% *K. alvarezii* extract. The nutritional quality of grain such as carbohydrate, protein and minerals also improved under the influence of treatment.

Keywords: *Kappaphycus alvarezii*; Extract; Wheat; Grain yield; Grain quality

Introduction

Beneficial effects from the use of seaweed extracts as natural regulators have included increased crop yield, delay of fruit senescence, improved overall plant vigour, improved yield quantity and quality, and improve ability to withstand adverse environmental conditions (Featonby-Smith and Van Staden, 1983). Application of seaweed extract as organic biostimulant is fast becoming accepted practice in horticulture due to its beneficial effects (Verkleij, 1992). Crop cultivation using organic fertilizers has contributed for deposition of residues, improving physical and chemical properties of soil that is important for biological development (Galbiattia et al., 2007). To meet the increasing demand of organic fertilizer many viable options have to be explored (Chhaya, 1997) and one such option is use of seaweed extracts as fertilizer (Zodape, 2001). Cytokinins have been identified in some seaweed concentrates (Sanderson and Jameson 1986; Stirk and J Van Staden, 1997) and positive responses observed in different crops with the application of seaweed extracts were attributed to this (Crouch and Van Staden, 1993). Significant

increase in the yield of crops due to foliar application of seaweed extracts has reported (Zodape et al., 2008; Rathore et al., 2008; Arthur et al., 2003).

K. alvarezii extract found to be rich in nutrients including plant growth promoting substances like IAA, kinetin, zeatine, gibberellins and never known as a fertilizer. Hence objective of this study was to exploit *K. alvarezii* extract as a source of biofertilizer and wheat was chosen being the major cereal crops grown extensively throughout India.

Materials and Methods

Experimental details

A pot experiment in randomized block design with 10 replications was conducted during rabi season of 2004-2005 at CSMCRI premises, Bhavnagar. Mixture of red soil, black soil and farm yard manure in the proportion 2:1:1 was used to fill the pots. Seeds of uniform size and colour were used for sowing.

The extract derived from fresh *K. alvarezii* (Eswaran et al., 2005) was used for the experiment (Table 1). Concentrated extract was applied to foliage at the concentrations of 0.25%, 0.50%, and 1.0% while control plants were sprayed with water. First, second and third foliar application of extract was given at vegetative, tillering and grain filling stages respectively. The data on yield and yield attributes were recorded and analyzed by analysis of variance (ANOVA).

Table 1. Chemical constituents of *K. alvarezii* extract.

Constituent of Pristine sap	Values
Nitrogen (%)	0.45 – 0.70
Phosphorus (%)	0.007 - 0.01
Potassium (%)	1.60 - 2.10
Organic matter (%)	1.05 - 1.40
Sodium (%)	0.45 - 0.70
Calcium (%)	0.04 - 0.06
Magnesium (%)	0.06 - 0.07
Manganese(ppm)	6 - 9
Iron (ppm)	100 - 160
Copper (ppm)	7 - 11
Zinc (ppm)	19 - 25
Cobalt (ppm)	2 - 5
Molybdenum (ppm)	2
Sulphate (%)	1.06 - 1.20
Chloride (%)	2.36 - 2.70
IAA (ppm)	25.14
Kinetin (ppm)	8.50
Zeatin (ppm)	20.10
Gibberellins (ppm)	27.11

Sampling and analytical determinations

Sample of the grains oven dried at 70 ^{0}C to constant weight, ground to pass through a 0.5 mm sieve and used for chemical analysis. Fat was estimated by soxhlet method using

hexane as solvent. Carbohydrate was extracted (Smith et al. 1964) and determined using spectrophotometer (Murphy, 1958). Protein was estimated by multiplying N with the factor 6.25 while N was determined by semi-micro Kjeldahl method (AOAC, 1970). Phosphorus was determined by vanadomolybdate yellow method spectrophotometrically, Na and K by flame photometer (Jackson, 1973) and minerals by inductively coupled plasma–optical emission spectroscopy (Richards, 1954). All determinations were performed in triplicate and data represented on dry weight basis as mean values ± standard deviations.

Results and Discussion

Yield and yield attributing characters

The yield of grain and quality was influenced by applications of *K. alvarezii* extract. Compared to control the yield of grain has increased irrespective of concentrations and maximum was 80.44% for the plants sprayed with 1.0 % *K. alvarezii* extract. The values of yield contributing characters like number, weight and length of spike as well as 100 grain weight were significantly higher for the plants received 1.0% *K. alvarezii* extract (Table 2). Foliar applications of *K. alvarezii* extract significantly increased the biomass especially root biomass supporting that the treatment has beneficial effect on root development of the crop. This is in conformity with the results obtained for wheat by application of Biozyme (Singh and Chandel, 2005).

Table 2. Effect of *K. alvarezii* extract on yield attributing characters and yield of wheat var. GW 322.

Treatments	No. of spikes /pot	Weight of spike/ pot (g)	Grain yield/pot (g)	Spike length (cm)	Number of grains/ spike	Total biomass (g)	Shoot biomass (g)	Root biomass (g)	100 grain weight (g)
Control	12.30	15.57	8.59	8.41	39.20	12.87	11.75	1.12	2.20
0.25%	14.60	19.40	10.51	8.47	35.00	16.75	15.36	1.38	2.48
0.50%	15.30	20.69	11.50	8.53	37.00	15.44	14.01	1.43	2.74
1.0%	16.90	26.85	15.50	8.57	37.90	19.99	18.06	1.93	2.94
CD 1%	2.30	4.69	3.19	NS	NS	2.99	2.73	0.40	0.12
5%	1.71	3.47	2.36	NS	NS	2.22	2.02	0.30	0.09

The increased yield and yield attributes may be due to the presence of some growth promoting substances such as IAA and IBA, gibberellins, cytokinins, micronutrients, vitamins and amino acids (Challen and Hemingway, 1966). Growth hormones like cytokinin and gibberellins have been detected in the extract of *K. alvarezii* which might be responsible for beneficial effects in the present study. Significant increase in seed yield of black gram (Venkataraman and Mohan, 1997) and marketable bean by 24% has been reported with the foliar application of seaweed extract (Temple and Bomke, 1989). The promotive effects of seaweed application in the present investigation might be due to increased root proliferation and establishment; thereby plants were able to mine more nutrients even from distant places and deeper soil horizons, in balanced proportion.

Besides, seaweed extract, regulated the plant bio-physiological activities which collectively resulted in maintaining higher photosynthetic activities (Singh and Chandel, 2005).

Nutritive quality of grains

Compared to control, plants sprayed with 1.0% *K. alvarezii* extract showed increase (Table 3 and 4) in nutritional quality of wheat as: carbohydrate, 39.20; protein, 21.74; and fat, 31.64%. Similarly macro and micro nutrients also increased in the range 15.86%-75.02% and 1.28%-20.0% respectively under the influence of *K. alvarezii* extract treatment. Enhancement in the content of vitamin C, (Khemnar and Chaugule, 2000), N of beans (Beckett et al., 1994) and sugar of sugar beet (Blunden et al., 1979) has been reported with the application of seaweed extract.

Table 3. Effect of *K. alvarezii* extract on carbohydrates, protein and fat content in grains of wheat var.GW 322.

Treatments	Carbohydrate %	Crude Protein %	Fat %
Control	50.214 ± 1.994	18.318 ± 1.757	1.150 ± 0.050
0.25%	52.220 ± 2.230	19.943 ± 1.850	1.300 ± 0.200
0.50%	69.349 ± 3.499	19.943 ± 1.713	1.350 ± 0.050
1.00%	69.897 ± 3.141	24.113 ± 2.394	1.400 ± 0.050

Table 4. Effect of *K. alvarezii* extract on macro and micro nutrients content (mg/100g) in grains of wheat var. GW 322.

Treatments	Na	K	P	Ca	Mg	Fe	Zn	Mn	Cu	Mo
Control	41.190 ±4.010	497.740 ±27.540	480.500 ±18.300	200.300 ±14.900	150.000 ±16.400	5.530 ±1.290	5.733 ±0.422	3.943 ±0.457	0.783 ±0.077	0.100 ±0.011
0.25%	46.340 ±3.840	514.900 ±19.300	511.780 ±26.520	232.400 ±12.100	158.000 ±8.750	5.900 ±1.090	5.773 ±0.327	4.370 ±0.376	0.813 ±0.018	0.110 ±0.015
0.50%	46.340 ±2.940	473.710 ±17.490	545.230 ±15.990	281.900 ±11.300	163.600 ±14.400	5.240 ±0.760	6.073 ±0.078	4.223 ±0.368	0.753 ±0.052	0.120 ±0.001
1.00%	72.090 ±1.950	576.690 ±28.510	567.270 ±16.970	291.200 ±15.050	192.000 ±14.650	5.700 ±0.450	6.253 ±0.853	4.453 ±0.437	0.793 ±0.007	0.120 ±0.011

Conclusions

This is the first report for yield and quality enhancement in wheat due to foliar application which might be due to the presence of microelements and plant growth regulators present in the extract of *K. alvarezii.* Hence the extract can be used as a supplemental fertilizer for various crops.

Acknowledgements

Thanks are due to Dr. Eswaran for providing *K. alvarezii* extract and Mr. M.R. Rajyaguru for technical assistance.

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