Original Research Article

"Influence of sea weed extract (*Kappaphycus alverzii*) and Zinc on growth and yield of Blackgram(*Vigna mungo L.*)"

Abstract

A field experiment was conducted in Crop Research Farm, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Science, Prayagraj,(U.P), during the *zaid* season of 2022 with the objective to study the "Influence of sea weed extract (*Kappaphycus alverzii*) and Zinc on growth and yield of Blackgram(*Vigna mungo* L.)" . The soil in the experimental plot was sandy loam in texture, pH(6.9), low in organic carbon (0.112%),available N(278.93kg/ha), available P (10.80kg/ha) and available K (206.4kg/ha).The layout of the experiment was done in a Randomized block design with nine treatments which is replicated thrice. The 3 levels of concentration of sea weed extract(*Kappaphycus alverzii*) (2%,3%,4%) and three levels of zinc (15,20,25 kg/ha).Growth and yield parameters namely plant height, *dry* weight, pods/plant, number of seeds/pod,test weight, seed yield, Stover yield, harvest index were collected from this experiment. Results revealed that significantly higher plant height (24.2cm), dry weight (4.9), pods/plant (21.2), seeds/pod (5.7), seed yield (637.0 kg/ha), Stover yield (873 kg/ha) were recorded with treatment combination of 4%*K sap* + $ZnSO_4$ 25 kg/ha (treatment 9). Maximum gross return (82819.00 INR/ha), net returns (55880.00 INR/ha),and benefit cost (2.07) were obtained highest in the treatment combination of 4%*K sap* + $ZnSO_4$ 25 kg/ha (treatment 9).

Keywords: Economics; sea weed extract; zinc.

Introduction

Pulses are commonly known as food legumes which are secondary to cereals in production and consumption in India. Pulses are an integral part of many diets across the globe and they have great potential to improve human health, conserve our soils, protect the environment and contribute to global security.

India is the largest producer and consumer of pulse contributes 25% of global production,27% of world consumption and imports 14% of pulses in the world. Pulse account for around 20% of the area under food grains and contribute around 7-10% of total food grain production in the country. The area under pulse has increased from 19m ha^{-1} in 1950-51 to 25m ha^{-1} in 2013-2014, including an increase of 31%where as production of pulse during the same period has increased from 8.41 million ha^{-1} an increase of over 100% (Agri. Statistics at a Glance 2014). In 2015-16 16.47 million tones (4^{th} Advance Estimation for 2015-16) and estimate production for 2016-17 about 17.82 million tones (Agriculture statistics Division: DES,DAC &FW and DoC).

Sea weeds belong to a rather ill defined assemblages of plants known as algae. The term "seaweed" itself does not have any taxonomic value, but is rather a popular term used t0 describe the common large attached (benthic) marine algae found in the groups of Chlorophyceae, Rhodophyceae, Phaeophyceae or green, red and brown algae, respectively.

Sea weed extracts have been marketed for several years as a fertilizer additives and beneficial results from their use have been reported. Many claims have been made for seaweed extracts including better germination and deeper root development, increased frost resistance increased nutrient uptake and changes in plant tissue composition, increased resistance to fungal diseases, reduced incidence of insect attack, higher yields, longer shelf life of produce and improved animal health when livestock is grazed or treated crops or pasture. It has been shown that the performance of sea weed manure is superior to the conventional organic manure viz., farm yard manure.

Liquid extracts derived from marine algae have been used over the past 40yrs on various crops to promote growth and development. Interest in these sea weed concentrates (SWC) in agricultural system is focused on their use as an inexpensive source of naturally occurring plant growth regulator.

Zinc is the one of the essential plant micronutrients and its important for the crop productivity is similar to that of the major nutrients. Zn deficiency induces flower abortion and ovule infertility, leading to low seed set and substantial yield reductions. Zinc plays an

important role in formation of chlorophyll and growth hormones. Zinc is also an essential plant nutrient for plant growth and development. Micronutrients are essential for plant growth; Zinc is one of the seven pillars of nutrition and is needed for the growth of plant, animals and humans. Lack of zinc causes deficiency in formation of RNA and protein. Therefore, the plant with lack of zinc poor in amount of protein.Zinc sulphate is a major source of Zn and sulfur and is being used worldwide . There are three methods for application of micronutrients which are soil application, seed treatment and foliar application. Zn is involved in auxin metabolism like, tryptophan synthesis, tryptamine metabolism.

MATERIALS AND METHODS

The experiment was carried out during *zaid* season of 2022 at the CRF (Crop Research Farm) SHIATS, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh. The crop Research Farm is situated at 25.24 42 N latitude, 81.50 56 E longitude and at an altitude of 98m above mean sea level. This area is situated on the right side of the river Yamuna and by the opposite side of Prayagraj City. All the facilities required for crop cultivation were available. The experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 6.9), low in organic carbon (0.112%), available N (278.93 Kg/ha), available P (10.8 Kg/ha) and available K (206.4 Kg/ha). The crop was sown on 26th February 2022 using Shekar 2 variety. The experiment was laid out in Randomized Block Design comprised of 3 replications and total 9 treatments viz. T1 – 2%*K sap* + $ZnSO_4$ 15 kg/ha, T2 – 2%*K sap* + $ZnSO_4$ 20 kg/ha, T3 – 2%*K sap* + $ZnSO_4$ 25 kg/ha, T4 – 3%*K sap* + $ZnSO_4$ 15 kg/ha, T5 – 3%*K sap* + $ZnSO_4$ 20 kg/ha, T6 – 3%*K sap* + $ZnSO_4$ 25 kg/ha, T7 – 4%*K sap* + $ZnSO_4$ 15 kg/ha, T8 – 4%*K sap* + $ZnSO_4$ 20 kg/ha, T9 – 4%*K sap* + $ZnSO_4$ 25 kg/ha. All nutrients were applied into the soil in the form of Urea, Single super phosphate (SSP) and Muriate of potash (MOP). Entire dose of P and K was applied basal for respective plots, half dose of N (as urea) was applied as basal, one-fourth at 30 days after sowing and remaining one-fourth at the time of flowering. Zinc levels are(15,20,25kg/ha) was applied as soil application along with NPK fertilizers before sowing and sea weed extract(*Kappaphycus alverzii*) was applied as foliar application after 20DAS. The growth parameters were recorded at periodical intervals of 15,30,45,60 DAS from the randomly selected five plants in each treatment. Statistically analysis was done for all the parameters in one way Anova and mean compared at 5% probability level of significant results.

Result and Discussion

Effect of Sea weed extract and zinc on growth parameters of Blackgram are given in table 1.

Plant height

At 60 days interval significantly maximum plant height was recorded in the treatment-9 with the combination of 4%*K sap* + $ZnSO_4$ 25 kg/ha (24.2cm). However, treatment-6 with combination of 3%*K sap* + $ZnSO_4$ 25 kg/ha (22.9

cm) were found to be statistically at par with 4%*K sap* + $ZnSO_4$ 25 kg/ha. The increase in plant height of plants under zinc treatment may be due to its effect in the metabolism of growing plants, which may effectively explain the observed response of zinc application. Favourable responses of zinc application on plant height are similar in findings of **Shanti *et al.*(2008).** The application of two different seaweed liquid extracts (SLE) on bean plant (*Phaseolus vulgaris* cv. Paulista), which enhanced the vegetative growth at lower concentrations of 25% of *Fucus spiralis* and 25% of *Ulva rigida* was found to have maximum influence on growth parameters like shoot and root length **(Latique *et al.*,, 2013)**.

Dry matter accumulation

At 60 DAS, significantly higher plant dry weight (4.9 g/plant)) was recorded with the treatment 4%*K sap* + $ZnSO_4$ 25 kg/ha. However, the treatment 4%*K sap* + $ZnSO_4$ 20 kg/ha (4.3 g/plant) were found to be statistically at par with 4%*K sap* + $ZnSO_4$ 25 kg/ha. Zinc plays an activator of several enzymes in plants and it is directly involved in the biosynthesis of growth substances such as Auxin thereby producing more plant cells and enhanced dry matter**.** The increase in shoot characteristics dueto the auxins content in the seaweed extracts which have an effective role in cell division and enlargement; this leads to increase the shoot growth, leaf area and plant dry weight **(Gollan and Wright, 2006)**

YIELD PARAMETERS

Effect of Sea weed extract and Zinc on yield parameters of Blackgram are given in table 2.

Pods/plant

Significantly maximum pods/plant (21.2) was recorded with the treatment of application of 4%*K sap* + $ZnSO_4$ 25 kg/ha over all the treatments. However the treatment combination of 3%*K sap* + $ZnSO_4$ 25 kg/ha (19.9) was found to be statistically at par with the treatment combination of sulphur 4%*K sap* + $ZnSO_4$ 25 kg/ha. Application of sea weed extract and zinc results that increases the chlorophyll content due toinoculation that might help in increasing the rate of photosynthesis and ultimately increase theplant growth and also increases no. of pods and yield. **AbuSayem AnitaTodaw *et al* (2017)**

Seeds/pod

Significantly maximum seeds/pod (5.7) was recorded with the treatment of application of 4%*K sap* + $ZnSO_4$ 25 kg/ha over all the treatments. However the treatment combination of 3%*K sap* + $ZnSO_4$ 25 kg/ha (5.4) was found to be statistically at par with the treatment combination of 4%*K sap* + $ZnSO_4$ 25 kg/ha. Application of sea weed extract and zinc significantly increases the seeds per pod and yield.Favourable effect of sea weed extract may be due to better availability of nitrogen to plants. Zinc in chlorophyll content higher value of auxin content which helps in increased growth and yield of the crop. **Upadhyay*etal.*(2013)**

Seed yield (kg/ha)

Significantly maximum seed yield (637.0 kg/ha) was recorded with the treatment of application of 4%*K sap* + $ZnSO_4$ 25 kg/ha over all the treatments. However, the treatment 3%*K sap* + $ZnSO_4$ 25 kg/ha (567.0 kg/ha) were found to be statistically at par with 4%*K sap* + $ZnSO_4$ 25 kg/ha . Application of sea weed extract and zinc to blackgram has resulted into a significant increase in seed,yield. The synergistic effect of Zn may be due to utilization of large quantities of nutrients through their well-developed roof system and nodule which might have resulted in better plant development and ultimate yield at low initial status of available Zn. The seed yield of black gram is a function of the product of number of pods per plant, number of seeds per pod and test weight. The increase in the number of pods per plant and number of seeds per pod increased the seed yield of black gram. The above are under the findings of **AnitaTodawat *etal.*(2017)**

Stover yield (kg/ha)

Significantly maximum seed index (873.7 kg/ha) was recorded with the treatment of application of 4%*K sap* + $ZnSO_4$ 25 kg/ha over all the treatments. However, the treatment 4%*K sap* + $ZnSO_4$ 25 kg/ha (821.7 kg/ha) were found to be statistically at par with 4%*K sap* + $ZnSO_4$ 25 kg/ha. There was an overall increase in plant growth characters viz. plant height and dry matter accumulation which might have increase the stover yield. Sea weed extract plays an important role in increased stover yield. Zinc plays an important role in the production of indole acetic acid, a growth hormone where results

in higher value of auxin content which helps in increased growth and yield of the crop. **Upadhyay *et al.*(2013)**

Economics

Observations regarding Economics of different treatments of chickpea are given in table 3.Significantly higher gross return (82819.00 INR/ha) was recorded with treatment 4%*K sap* + $ZnSO_4$ 25 kg/ha.Similarly higher net returns (55880.00 INR/ha) and B:C ratio (2.07) was recorded under treatment combination of 4%*K sap* + $ZnSO_4$ 25 kg/ha

Conclusion

Based on experimental findings it may be concluded that Treatment combination of 4%*K sap* + $ZnSO_4$ 25 kg/ha recorded maximum plant height, plant dry weight, pods/plant, seeds/pod, seed yield, stover yield, gross return, highest net return and benefit: cost ratio which may be more preferable for farmers since it is economically more profitable and hence, can be recommended to the farmers.

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Table 1. Effect of Sea weed extract and Zinc on growth attributes of Blackgram.

S.No.	Treatments	At 45 DAS			
		Plant height (cm)	Plant dry weight (g/plant)	CGR ($g/m^2/day$) 30-45 DAS	RGR (g/g/day) 30-45 DAS
1	2% *K sap*+$ZnSO_4$ 15kg/ha	19.5	1.0	1.2	0.1
2	2% *K sap*+$ZnSO_4$ 20kg/ha	19.8	1.1	1.6	0.1
3	2% *K sap*+$ZnSO_4$ 25kg/ha	17.1	1.0	1.2	0.1
4	3% *K sap*+$ZnSO_4$ 15kg/ha	17.3	1.3	1.6	0.1
5	3% *K sap*+$ZnSO_4$ 20kg/ha	19.4	1.3	1.6	0.1
6	3% *K sap*+$ZnSO_4$ 25kg/ha	20.0	1.4	1.8	0.0
7	4% *K sap*+$ZnSO_4$ 15kg/ha	19.9	1.2	1.5	0.1
8	4% *K sap*+$ZnSO_4$ 20kg/ha	19.7	1.2	1.3	0.0
9	4% *K sap*+$ZnSO_4$ 25kg/ha	**22.4**	**1.5**	**1.9**	0.0
	F-Test	S	S	NS	S
	SEm±	0.77	0.02	0.05	0.00
	CD (P=0.05)	2.32	0.06	-	0.01

Table 2 Effect of sea weed extract(*Kappaphycus alverzii*) and Zinc yield attributes of Black gram

S. No	Treatments	Pods/plant	Seeds/pod	Test weight(g)	Seed yield(kg/ha)	Stover yield(kg/ha)	Harvest index(%)
1.	2% *K sap*+$ZnSO_4$ 15kg/ha	17.00	5.33	33.90	524.3	790.0	39.9
2.	2% *K sap*+$ZnSO_4$ 20kg/ha	18.00	5.00	34.80	460.7	797.3	36.6
3.	2% *K sap*+$ZnSO_4$ 25kg/ha	17.4	5.20	35.50	521.7	794.7	39.6
4.	3% *K sap*+$ZnSO_4$ 15kg/ha	18.4	5.30	34.00	470.3	771.7	37.8
5.	3% *K sap*+$ZnSO_4$ 20kg/ha	18.3	5.20	35.20	537.0	777.0	40.8
6.	3% *K sap*+$ZnSO_4$ 25kg/ha	19.9	5.40	36.10	567.0	821.7	40.6
7.	4% *K sap*+$ZnSO_4$ 15kg/ha	16.0	4.10	34.70	514.7	766.0	40.1
8.	4% *K sap*+$ZnSO_4$ 20kg/ha	18.0	4.80	34.70	464.3	783.7	37.2
9.	4% *K sap*+$ZnSO_4$ 25kg/ha	21.2	5.70	36.40	637.0	873.7	42.2
	F test	S	S	S	S	S	NS
	SEm (±)	0.78	0.28	0.60	25.13	6.51	1.24
	CD (5%)	2.33	0.83	1.80	75.35	19.52	-

Table 3 Effect of Sea weed extract(*Kappaphycus alverzii*) and zinc on economics of Black gram

S. No	Treatments	Cost of cultivation (INR/ha)	Gross return (INR/ha)	Net return (INR/ha)	B:C ratio
1.	2% *K sap*+$ZnSO_4$ 15kg/ha	26280.00	68159.00	41879.00	1.59
2.	2% *K sap*+$ZnSO_4$ 20kg/ha	26305.00	59891.00	33587.00	1.27
3.	2% *K sap*+$ZnSO_4$ 25kg/ha	26330.00	67821.00	41491.00	1.57
4.	3% *K sap*+$ZnSO_4$ 15kg/ha	26580.00	61139.00	34559.00	1.30
5.	3% *K sap*+$ZnSO_4$ 20kg/ha	26605.00	69810.00	43205.00	1.62
6.	3% *K sap*+$ZnSO_4$ 25kg/ha	26630.00	73710.00	47080.00	1.76
7.	4% *K sap*+$ZnSO_4$ 15kg/ha	26880.00	66911.00	40031.00	1.48
8.	4% *K sap*+$ZnSO_4$ 20kg/ha	26905.00	60359.00	33459.00	1.24
9.	4% *K sap*+$ZnSO_4$ 25kg/ha	26930.00	82819.00	55880.00	2.07

Data not subjected to statistically analyzed