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Effect of spacing and seaweed extract on growth and yield of maize (*Zea mays* L.)

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Abstract

A field experiment was conducted during *Kharif* season of 2023 at Crop Research Farm Department of Agronomy. The treatment consists of three different spacing of geometry (45 cm × 25 cm, 60 cm × 15 cm and 60 cm × 20 cm) and three levels of Seaweed Extract (5% RDF, 10% RDF and 15% RDF) and along with NPK and a control (120-60-40 NPK kg/ha). The research should significant effect on different growth parameters and yield parameters i.e., plant height (178.37 cm), dry weight (83.4 g), number of cobs/plant (1.60), number rows per cob (16.99), number grains per row (29.27), seed index (22.45 g), grain yield (5.61 t/ha) and stover yield (11.82 t/ha). Crop sown at Spacing of 60 cm × 15 cm + Seaweed Extract at 15% RDF is recommended.

Keywords: Spacing, maize, yield, growth and seaweed extract

Introduction

Maize is one of the world major food crop, feeding the human since ages, it has higher value of food, use as a forage, feed for livestock, poultry and cheaper source of raw material for agro based industry. Maize is used for food and fodder, and it is also required by numerous industries. About 35% in food processing (corn flakes, popcorn, etc.) and other sectors (starch, dextrose, corn syrup, corn oil, etc.) in India. Because of its monoecious character, superior carbon dioxide assimilation capacity, wider flexibility, and high yielding potential, maize is known as the 'Queen of Cereals' (Begam *et al.*, 2018) ^[1]

It is cultivated throughout the year in all the seasons and grown around the globe. The nutritional value of maize is high as it contains 72% starch, 10% protein, 8.5% fibre, 4.8% oil, 3.0% sugar and 1.7% ash.

Optimum crop geometry is one of the important factors for higher productivity, by virtue of which there is efficient utilization of underground resources and also harvesting maximum solar radiation which in turn results in better photosynthesis (Monneveux *et al.*, 2005) ^[5]. Optimum plant population is vital for maintaining to exploit maximum natural resources such as nutrient, sunlight, soil moisture and to ensure maximum economic grain yield per production area. It exerts decisive influence on maize growth and yield, which outcome timely inception of vegetative and reproductive development (Koirala *et al.*, 2020) ^[3]

Seaweed sap also a good source of potassium and phosphorus, potassium helps in regulating the water status of the plants and controls the opening and closing of stomata and help in photosynthesis, whereas phosphorus helps in root growth (Singh *et al.*, 2019) ^[8]. While the extracts from *Kappaphycus alvarezii* (K sap) contain good amount of indole acetic acid (23.4 mg/ L), gibberelin (27.8 mg/L) and kinetin + zeatin (31.9 mg/ L), while the extracts from *Gracilaria edulis* (G sap) contain significant amount of phosphorous (278.5 mg/L), sodium (1952 mg/L), iron (12.7 mg/L) and manganese (32.9 mg/L) (Rathore *et al.*, 2009) ^[7].

Materials and Methods

A experiment was conducted during *Kharif* 2023 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagaraj (U.P.). The soil of the experimental field was sandy loam in texture, slightly alkaline reaction (pH 7.4) with low level of organic carbon (0.32%), available N

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(188.3 Kg/ha), P (34.5 kg/ha) and K (87 kg/ha). The treatment consists of three different spacing geometry (45 cm x 25 cm, 60 cm x 15 cm, 60 cm x 20 cm) and seaweed extract (5%, 10%, 15%). There were 10 treatments each replicated thrice. The Experiment was laid out in Randomized Block Design. It was Sown in 7th Aug 2023 with Seed rate of 20-25 kg/ha. Recommended doses of nitrogen, phosphorous and potassium were applied.

Results and Discussion

Growth Parameters

The significant higher plant height (178.37 cm) and dry weight (83.4 g) was recorded in Spacing 60 cm x 15 cm + Seaweed Extract 15% RDF. However, Spacing 60 cm x 20 cm + Seaweed Extract 15% RDF was found to be statistically at par with Spacing 60 cm x 15 cm + Seaweed Extract 15% RDF.

The spatial configuration influences the efficient interception of radiant energy, thereby promoting proliferation and growth over a short period. Higher dry matter likely ensured an adequate supply of metabolites for developing reproductive structures. Similar results were found by Singh *et al.* (2015) [9] and Thavaprakash *et al.* (2008) [10]. Using seaweed extracts increases plant height and thereby increases dry weight of maize plants. These extracts contain bio-active compounds that improve plant growth, nutrient absorption, and physiological

processes, resulting in increased biomass by Krishnaraj *et al.* (2015) [4].

Yield Parameters

Spacing 60 cm x 15 cm + Seaweed Extract 15% RDF (1.60) was recorded higher significant values of number of cobs per plant, number of rows per cob, number of grains per row, grain yield, and stover yield. However, Spacing 60 cm x 20 cm + Seaweed Extract 15% RDF were found statistically at par with the Spacing 60 cm x 15 cm + Seaweed Extract 15% RDF.

Harvest index showed no significant correlation among different treatments

Wider spacing reduces competition among plants for essential resources such as water, nutrients, and sunlight. With more resources available per plant, each maize plant can allocate more energy towards plant development leading to an increase in yield parameters like number of cobs per plant, number of rows per cob, number of grains per row, grain yield and stover yield. Similar results were found by Rahman *et al.* (2016) [6]. Application of seaweed extract increases root proliferation and establishment, there by plants were able to mine more nutrients even from distant places and deeper soil horizons, in balanced proportion and photosynthetic activities which results in increasing yield by Dilavarnaik *et al.* (2017) [2].

Table 1: Effect of Spacing and Seaweed Extract on growth parameters of Maize

Treatment No	Treatments	Plant height (cm) At 80 DAS	Plant dry weight (g/plant) At 80 DAS
1	Spacing 45 cm x 25 cm + Seaweed Extract 5% RDF	166.90	71.8
2	Spacing 45 cm x 25 cm + Seaweed Extract 10% RDF	171.50	73.9
3	Spacing 45 cm x 25 cm + Seaweed Extract 15% RDF	160.87	80.7
4	Spacing 60 cm x 15 cm + Seaweed Extract 5% RDF	160.67	77.0
5	Spacing 60 cm x 15 cm + Seaweed Extract 10% RDF	167.34	81.4
6	Spacing 60 cm x 15 cm + Seaweed Extract 15% RDF	178.37	83.4
7	Spacing 60 cm x 20 cm + Seaweed Extract 5% RDF	157.78	73.4
8	Spacing 60 cm x 20 cm + Seaweed Extract 10% RDF	166.07	79.3
9	Spacing 60 cm x 20 cm + Seaweed Extract 15% RDF	178.13	82.2
10	Control – (120-60-40 N-P-K Kg/ha)	154.90	67.9
	SEm(±)	4.87	3.26
	CD (p=0.05)	11.65	5.69

Table 2: Effect of Spacing and Seaweed Extract on yield attributes and yield of Maize

S No	Treatments	Number of cobs per plant	Number of rows per cob	Number of grains per row	Grain yield (t/ha)	Stover yield (t/ha)	Harvest index (%)
1.	Spacing 45 cm x 25 cm + Seaweed Extract 5% Recommended Dose	1.02	14.46	27.03	4.93	11.56	29.94
2.	Spacing 45 cm x 25 cm + Seaweed Extract 10% Recommended Dose	1.10	14.52	27.53	4.95	10.95	31.20
3.	Spacing 45 cm x 25 cm + Seaweed Extract 15% Recommended Dose	1.40	15.55	28.13	5.22	11.69	30.96
4.	Spacing 60 cm x 15 cm + Seaweed Extract 5% Recommended Dose	1.23	14.15	27.80	5.01	11.26	30.95
5.	Spacing 60 cm x 15 cm + Seaweed Extract 10% Recommended Dose	1.47	16.64	28.30	5.30	10.73	33.11
6.	Spacing 60 cm x 15 cm + Seaweed Extract 15% Recommended Dose	1.60	16.99	29.27	5.61	11.82	32.31
7.	Spacing 60 cm x 20 cm + Seaweed Extract 5% Recommended Dose	1.16	13.94	27.67	4.95	10.81	31.41
8.	Spacing 60 cm x 20 cm + Seaweed Extract 10% Recommended Dose	1.37	15.47	27.80	5.13	11.62	30.70
9.	Spacing 60 cm x 20 cm + Seaweed Extract 15% Recommended Dose	1.53	15.91	28.70	5.41	11.80	31.47
10.	Control RDF (N-P-K 120-60-40 Kg/ha)	1.31	14.83	24.23	4.83	9.25	34.34
	SEm (±)	0.07	0.64	0.83	0.16	0.49	1.34
	CD (p=0.05)	0.21	1.90	2.46	0.46	1.44	-

Conclusion

It is concluded that seaweed extract at 15% Recommended Dose and spacing of 60 cm row to row and 15 cm plant to plant (Treatment 6) recorded highest yield in maize.

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