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Calcium-Based Fertilizer's Impact on Cucumber (*Cucumis sativus* L.) Growth and Yield Attributes

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ABSTRACT: The current study was conducted during the 2019–20 kharif season at the Research Farm, College of Agriculture, OUAT, Bhawanipatna. To investigate the impact of calcium-based fertilizer on cucumber yield parameters, a total of seven treatments were employed in a Randomized Block Design (RBD) with three replications. When compared to RDF-only treatments, all of the treatments markedly increased cucumber growth, yield, and attributed attributes. When comparing the several treatments, the application of RDF + Calci-king @ 2 kg at 25 DAT and 40 DAT (T5) resulted with the highest plan height and flower setting.

Keywords: Ca^{+2}, Cucumber, Flowering, flower setting, Fruit yield.

INTRODUCTION

One of the Cucurbitaceae family's most widely grown vegetable crops is the cucumber (*Cucumis sativus* L.). Quality cucumber production is essential due to its economic significance as a high-value vegetable crop in both domestic and foreign markets, as consumer preferences increase (Jakhar *et al*., 2016). Plant growth, nutrition, and cell wall deposition are all significantly impacted by calcium, a macronutrient. Reduced calcium levels in plants have an impact on their growth and development. Calcium is a soil amendment that enhances water penetration, lowers soil salinity, and preserves the chemical equilibrium of the soil, all of which contribute to better crop growth, development, and production (Shafeek *et al*., 2013; Siddique *et al.*, 2017).

Cell walls, which make up 60–70% of the tissue overall, are largely composed of calcium (Ca). It supports the preservation of membrane permeability and cell wall integrity. Many enzymes require calcium as a basic component (Akinci and Simsek 2004). Supplemental calcium application raised the K content and lowered the Na content of plant sections (Dabuxilatu, 2005). It is regarded as a crucial mineral component that controls fruit quality and prolongs its shelf life after harvest by reducing physiological problems such internal breakdown, bitter pit, and water core. Calcium (Ca^{2+}), a multipurpose signaling ion, acts at several locations in several signaling cascade networks. In horticultural crops, it plays a significant regulatory role. Gene expression is altered by these pathways, which receive signals from a variety of biotic and abiotic sources (Dodd *et al.*, 2010). As a vital plant nutrient, Ca^{2+} actively contributes to membrane function, cellular signaling responses, and cell wall construction. A lack of calcium slows down growth, reduces leaf size and yield, and in severe cases, causes young leaves to necrotize (Hao and Papadopoulos 2004; Gustavo *et al.* 2020). This study was conducted with the goal of enhancing cucumber yield and quality by calcium supplementation.

MATERIALS AND METHODS

During the 2019/20 kharif season, this study was conducted at the Research Farm, College of Agriculture, OUAT, Bhawanipatna. With seven treatments and three replications, the experiment was set up using Randomized Block Design (RBD). The purpose of this field study was to increase cucumber quality and productivity in response to seven treatments.

Notations	Treatments
T1	Control
T2	RDF + Calci-king @ 5 lit at 25 DAT
T3	RDF + Calci-king @ 5 lit at 40 DAT
T4	RDF + Calci-king @ 5 lit at 60 DAT
T5	RDF + Calci-king @ 2.5 lit at 25 DAT and 40 DAT
T6	RDF + Calci-king @ 2.5 lit at 25 DAT and 60 DAT
T7	RDF + Calci-king @ 1 lit at 25 DAT 2 lit at 40 DAT and 2 lit at 60 DAT

The medium-to-black soil used in the experiment had a pH of 6.7 and 0.42 percent organic carbon. The soil had a high potassium content (385.5 kg/ha), a medium amount of accessible phosphorus (17.36 kg/ha), and a low amount of available nitrogen (218.7 kg/ha). In each treatment plot, cucumber seeds were manually sown. Using the soil dressing approach, a base dose of NPK (40-60-60) kg/ha was applied to each treatment plot. Additionally, other cultural customs were followed as advised for the cultivation of cucumbers. Plant height, bloom appearance, and other growth metrics were observed and documented. Fruit length, fruit girth, fruit weight, and flower setting at 35, 50, and 70 days after harvest were the quality parameters that were noted. Number of fruits/plant (picking wise), number of fruits/plant, fruit yield/plant, and yield/ha were the yield metrics that were recorded. A statistical analysis was performed on the collected data.

RESULTS AND DISCUSSION

The administration of several quantities of calcium-based fertilizer had a substantial impact on the plan height, flower attractiveness, and flower setting (Table 1). In comparison to RDF Calci-king @ 2 kg at 25 DAT and 60 DAT (T6), RDF + Calci-king @ 1 kg at 25 DAT, 2 kg at 40 DAT and 2 kg at 60 DAT (T7), and RDF + Calci-king @ 2 kg at 60 DAT (T7), the data indicated that taller plants were recorded with the application of RDF + Calci-king @ 2 kg at 25 DAT and 40 DAT (T5). However, when RDF alone (without calcium) was applied, smaller plants were seen.

The outcome supported the findings of Rab and Haq (2012), who found that a 0.3% calcium application rate considerably raised plant height. As compared to RDF Calci-king @ 2 kg at 25 DAT and 60 DAT (T6), RDF Calci-king @ 1 kilogram at 25 DAT, 2 kg at 40 DAT and 2 kg at 60 DAT (T7), and RDF + Calci-king @ 2 kg at 60 DAT, the highest flower setting at 35, 50, and 70 DAS was noted under RDF + Calci-king @ 2 kg at 25 DAT and 40 DAT (T5). The application of RDF + Calci-king @ 2 kg at 25 DAT and 40 DAT (T5), followed by T7, T6, T4, and T2, resulted in the shortest number of days (31.50) to flower appearance. On the other hand, RDF alone (T1) recorded the higher number of days (33.0) taken into consideration for bloom appearance. According to Natesh *et al.* (2005), macronutrients have a positive impact on chile growth, and the ideal dosage of these nutrients has a major impact on the number of days till flowering. According to Tegopati *et al*. (1997), calcium chloride preserved a higher total chlorophyll concentration, which may impact the cucumber plant's flowering days. These outcomes were consistent with those of Siddique *et al.* (2017); Jan *et al*. (2013). The administration of varying dosages of calcium-based fertilizer had a substantial impact on the production characteristics and yield of cucumbers (Table 2). RDF + Calci-king @ 2 kg at 25 DAT and 40 DAT (T5) had significantly higher yield parameters than the other treatments, including fruit length (15.85 cm), fruit girth (12.06 cm), fruit weight (146.83 g/fruit), and fruit number/plant (16.50). These yield parameters were statistically similar to those of RDF + Calci-king @ 2 kg at 25 DAT and 60 DAT (T6) and RDF + Calci-king @ 1 kg at 25 DAT, 2 kg at 40 DAT, and 2 kg at 60 DAT (T7). The application of RDF + Calci-king @ 2 kg at 25 DAT and 40 DAT (T5) likewise produced the highest fruit production (324.67 q/ha), which was statistically comparable to that of RDF + Calci-king @ 2 kg at 25 DAT and 60 DAT (T6) and RDF Calci-king @ 1 kg at 25 DAT, 2 kg at 40 DAT, and 2 kg at 60 DAT (T7). However, the RDF treatment produced the cucumbers with the lowest yield characteristics and yield. This outcome is consistent with that of El-Tohamy *et al.* (2006), who discovered that pepper plants sprayed with calcium chloride retained a higher level of total chlorophyll.

This in turn might affect flower number and fruit setting of cucumber. The results were in agreement with that of Chapagain and Menzies (2003) observed that application of Calcium can significantly increase the reproductive growth and yield. These results are in line with the findings of Al-Hamzawi (2010); Siddique *et al.* (2017); Gustavo *et al*. (2020).

Table 1.

Sr. No.	Treatments	Fruit Length (cm)	Fruit breadth (cm)	Fruit Weight (g)	No. of Fruits/ plant	Fruit yield (q/ha)
T1	Control	13.75	11.25	135.55	13.54	257.6
T2	RDF + Calci-king @ 5 lit at 25 DAT	14.87	11.33	136.95	14.25	264.5
T3	RDF + Calci-king @ 5 lit at 40 DAT	14.96	11.84	137.52	14.56	267.8
T4	RDF + Calci-king @ 5 lit at 60 DAT	15.22	12.56	145.68	15.75	275.6
T5	RDF + Calci-king @ 2.5 lit at 25 DAT and 40 DAT	16.04	13.62	154.92	16.95	310.6
T6	RDF + Calci-king @ 2.5 lit at 25 DAT and 60 DAT	15.43	12.84	149.62	14.98	295.4
T7	RDF + Calci-king @ 1 lit at 25 DAT 2 lit at 40 DAT and 2 lit at 60 DAT	15.62	13.02	148.99	15.65	296.3
	SEm±	0.32	0.11	0.48	0.49	5.36
	C.D at 5%	0.98	0.35	1.36	1.57	16.87

Table 2.

Sr. No.	Treatments	Plant Height (cm)	Days to Flowering	Flower Setting		
				35 DAS	50DAS	70 DAS
T1	Control	138.79	34.96	2.98	12.25	2.89
T2	RDF + Calci-king @ 5 lit at 25 DAT	145.96	32.65	3.56	12.81	3.27
T3	RDF + Calci-king @ 5 lit at 40 DAT	152.78	32.85	3.76	12.79	3.42
T4	RDF + Calci-king @ 5 lit at 60 DAT	151.96	31.22	3.95	13.26	4.17
T5	RDF + Calci-king @ 2.5 lit at 25 DAT and 40 DAT	162.32	30.86	4.02	16.21	5.56
T6	RDF + Calci-king @ 2.5 lit at 25 DAT and 60 DAT	157.69	32.45	3.85	14.21	4.87
T7	RDF + Calci-king @ 1 lit at 25 DAT 2 lit at 40 DAT and 2 lit at 60 DAT	156.98	31.94	3.91	13.97	5.18
	SEm±	0.94	0.34	0.11	0.29	0.24
	C.D at 5%	2.98	0.96	0.34	0.91	0.76

CONCLUSION

It is determined that applying RDF + Calci-king @ 2.5lit at 25 DAT and 40 DAT could result in increased cucumber growth characteristics and productivity. However, the application of RDF + Calci-king @ 2 kg at 25 DAT and 40 DAT resulted in a shorter time to blossom appearance (30.86 days). RDF + Calci-king @ 2 kg at 25 DAT and 40 DAT (T5) produced fruit with significantly higher yield metrics, including fruit length (16.04 cm), girth (13.62 cm), weight (154.92 g/fruit), and number of fruit/plant (16.95), as well as fruit yield (310.6 q/ha). This was statistically comparable to RDF + Calci-king @ 1 kilogram at 25 DAT, 2 kg at 40 DAT, and 2 kg at 60 DAT (T6) and RDF + Calci-king @ 2 kg at 25 DAT and 60 DAT (T7).

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