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Research Article

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Effect of Kyminasi Crop Booster Device on Growth and Yield of Wheat Crop

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Abstract

Crop booster (CB) is a technological alternative applied to agriculture that has been created to improve the efficiency of the plant. Its irrigation system optimizes both quantity and quality, helping plants grow stronger and healthier, as well as improving the availability of nutrients in the soil. Eight treatments were used: C1 (no fertilizers, no pesticides, 50% water reduction (WR)), K1 (only CB, no fertilizers, no pesticides, 50% WR), C2 (conventional practices), K2a (CB + 10% reduction in fertilizers and pesticides, 50% WR), K2b (CB + 25% reduction in fertilizers and pesticides, 50% WR), K2c (CB + 40% reduction in fertilizers and pesticides, 50% WR), and K2d (CB + 55% reduction in fertilizers and pesticides, 50% WR) and K2e (CB + 75% reduction in fertilizers and pesticides, 50% WR). This technology notably increased the number of tillers (+ 34%), and spike length (+ 7.4%) related to C2. The maximum number of filled grains per spike (55.4) and maximum plant height (77.54 cm) were found in C2, which was statically at par with K2a filled grain per spike (52.8) and plant height (74.12 cm), as K2a had 10% reduction of fertilizers with CB. These findings highlight the potential of CB to improve crop yield with fewer dosages of fertilizer, although it is a new technology, and its benefits remain an area of study.

Keywords

Crop booster, Wheat, Yield, Reduced fertilizers

Introduction

A key concern in agriculture is feeding the expanding population and protecting the environment from climate change. To feed a growing global population, food production and security are crucial issues, as food output may need to be doubled by 2050. Thus, more innovative and effective approaches for increasing agricultural productivity (e.g., food production) are required to meet the growing demand for food [1]. One of the numerous challenges of modern agriculture is the need for a substantial increase in output to meet the requirements of an expanding human population. The principal grains that are cultivated worldwide are rice (*Oryza sativa* L.), maize (*Zea mays* L.), wheat (*Triticum aestivum* L.), and barley (*Hordeum vulgare* L.) [2]. Before the COVID-19 pandemic, there was a surge in food security. In 2019, it was estimated that 25.9% of the world's population, which is approximately 2 billion, moderates to severe food insecurity, increasing from 22.4% in 2014. Additionally, grain output has been impacted by harsh weather for several years [3].

The urbanization trend is expected to accelerate in developing countries by 2050. Currently, 49% of the world's population lives in urban areas, which is expected to rise to 70% by 2050 [4]. The quality and quantity of crops depend on climate, and soil characteristics. Major characteristics, such as nutrient availability, soil type, soil health, insect resistance, and quality and quantity of irrigation, determine its adaptability and the quality of certain crops. In most cases, crop characteristics and yields may vary within the same farm plot. Therefore, site-specific analysis or precision farming techniques are needed to achieve optimal yields [5, 6]. While it is true that a technological irrigation system can solve some issues that exist in the field, the implementation of technological resources can increase its production efficiency [7].

The CB technology implemented in the irrigation system optimizes both the quantity and quality of the yields, helping the plants grow stronger and healthier with less fertilizer and pesticide. Increases soil health and nutrient availability, increases root density, and balances nutrient utilization and utilization by plants. The CB is a technology based on the use of a micro transmitter. This produces a high number of resonant wave frequencies of the same type as those produced by the vibration of the atoms of the plant, affecting its health and performance physically and chemically. It utilizes the water of parcel irrigation to transport the frequencies that the plant species needs to develop; that is, the water acts as an information carrier to provide the data stored in the micro transmitters to the plants [8].

Different wavelengths, strengths, and durations of electromagnetic radiation can trigger specific reactions in plants, such as phototropism (growth to light), photoperiodism (regulation of flowering time), and gravitropism (response to gravity). Electromagnetic radiation, particularly light, regulates the internal biological clocks of plants, regulating various physiological processes, such as stomatal opening and closing, nutrient uptake, and hormone production [9]. The impact of sound waves on plant biology is evident: the cell cycle, leaf vibrations, and protoplasmic movement in cells [10]. In addition, sound frequency technology has been demonstrated to stimulate leaf stomata opening, enhancing the plant's emergence from spray fertilizer. Furthermore, sound waves effectively facilitate herbicide absorption, allowing for a 50% reduction in herbicide and biocide use on mature weeds. Furthermore, sound waves can decrease the reliance on chemical fertilizers and pesticides [11]. CB allows the health of the soil to improve because it promotes the ionic exchange of minerals and helps to avoid the leaching of the nutrients present in it, causing an increase in the availability of micronutrients. In addition, there is an increase in the activity of nitrogen-fixing bacteria, whose function is to convert the nitrogen present into nitrates and nitrites, prevent excessive evaporation of nitrogen from wet soils and increase root density, which causes the soil compaction characteristics to decrease [8].

Materials and Methods

CB

CB is a silicon and metal based micro transmitter. The micro transmitters require no power source and emit no signals when not activated by flowing water. The micro transmitters are easy to install and operate for two years before requiring replacement. It was installed on a metal pipe. The number and type of transmitter used were proportional to the flow rate. Specifically, rates above 75 gallons per min (gpm) (CB by Kyminasi Plants, Harvest Harmonics, USA).

Experimental design

The field experiment was carried out in the rabi season of 2023 at agriculture research farm of Lovely Professional University, Punjab, India. PBW 126 varieties of wheat were used for present investigation. Different doses of fertilizer were applied to the soil with and without CB irrigation water. Total number of treatments were 8; C1 (no fertilizers, no pesticides, 50% WR), K1 (only CB), no fertilizers, no pesticides, 50% (WR)), C2 (conventional practices), K2a (CB + 10% reduction in fertilizers and pesticides, 50% WRs), K2b (CB + 25% reduction in fertilizers and pesticides, 50% WRs), K2c (CB + 40% reduction in fertilizers and pesticides, 50% WRs), K2d (CB + 55% reduction in fertilizers and pesticides, 50% WRs), and K2e (CB + 75% reduction in fertilizers and pesticides, 50% WRs).

Plant attributes

Plant height was measured with a wooden ruler from the ground level to the flag leaf of randomly selected wheat plants, and the mean height was measured. The plant height was measured at 45, 60 and 90 DAS. The number of tillers was also calculated at 45, 60 and 90 DAS. The length of each spike was measured with a wooden ruler. The spike was removed from the plant and placed on a black chart, after which the height was recorded. The number of grains per panicle was also counted with the help of a seed counter. Harvesting was performed from a one-meter square area from each plot. Threshing was performed with the help of a thresher to extract grains from spikes. The test weight of 1000 grains were calculated with the help of a weighing machine.

Soil analysis

Soil sample collected from each plot to a depth of 15 cm after harvesting of crop. The various parameters of the soil are examined. The electrical conductivity and pH were measured with the Hana HI 9813-6 portable pH/EC meter, and organic carbon (OC) was calculated using Walkley and Black method [12, 13]. Kjeldahl's technique was used to assess total nitrogen [14]. The concentrations of sulphur and phosphorus were calculated calorimetrically [15]. while the available potassium had been calculated using flame photometry [16]. Other micronutrients, such as calcium (Ca), magnesium (Mg) and boron (B), were measured using atomic absorption spectroscopy [17].

Statistical analysis

The data were analyzed via R Studio software via analysis of variance at a significance threshold of $p < 0.05$ to identify differences between group means. Origin Pro software was used to construct graphical representations of the data, allowing for easier visual examination of the findings.

Results

Effect on growth and yield attributes

The application of different doses of fertilizer with CB irrigation water had a significant effect on growth attributes. The plant height significantly improved ($p > 0.05$) at 90 DAS in K2a, followed by K2b > K2c > K2d > C2 > K2e (Figure 1). Plant height was more at 45 DAS in K2b (+ 9.1%) as compared to C2. K2b has a 25% reduction of fertilizer with CB water and C2 was conventional practices of cultivation rather than result was good in K2b at 45 DAS as shown in figure 1. Plant heights of K2c and C2 were at par and had a similar kind of result at 45 DAS.

There was a significant impact of CB on the number of tillers at 30, 60 and 90 DAS. The number of tillers at 30 and 60 DAS was greater in K2b than in C2, although K2b had a 25% reduction in fertilizer, and C2 had 100% recommended dosages of fertilizers. Interestingly, K1 (only CB with no fertilizers) had more tillers than C1 (normal water with no fertilizer). In both K1 and C1, no fertilizer was applied, but compared with C1, K1 had (+20%) more tillers. At 90 DAS, there was a significant impact on the number of tillers by. The number of tillers was maximum in K2b (7.2) followed by C2 (5.4) > K2a (5.2) > K2c (3.8) > K1 (3.6) > C1 (3) > K2d (3) > K2e (2.2) (Figure 2). Also, there was a significant effect of CB on spike length. The spike length was (+ 7.4 %) greater in K2a-related C2. Spike length was maximum in K2a (16.1 cm), followed by C2 (15 cm) > K2a (12.2 cm) > K2c (8 cm) > K1 (7.8 cm) > C1 (6 cm) > K2d (6 cm) > K2e (4 cm) (Figure 3a and figure 3b). Spike length followed the same trend as the number of tillers in C1 and K1. In K1, the spike length was (+ 30%) greater than that in C1, followed by K2e.

CB had a significant effect on the number of filled grains per spike. Maximum number of filled grains found in C2 (55.4), followed by K2b (52.8) > K2a (52.4) > K2d (43.8) > C1 (41.4) > K2c (39.6) > K2e > (37.2) > K1 (26.6) (Figure 4a). With respect to the number of filled grains, the number of filled grains also decreased as the amount of fertilizer decreased. CB also improved the test weight K2a, which was (+0.89%) greater than that of C2. CB significantly affected the maximum test weight in K2a (46.6), followed by C2 (45) > K2b > (42.3) > C1 (36.3) > K2e (35.3) > K2c (33.6) > K1 (30.6) (Figure 4b).

Compared with the other treatments, the CB also had a greater effect on the yield of C2. In C2 and Ka2, there was a slight variation of 2.7% yield q/ha. Compared with K2a, C2 has a +2.7% yield. The maximum yield was obtained in C2 (56.01 q/ha), followed by Ka2 (54.5 q/ha) > K2b (45.7 q/ha) > C1 (39.15 q/ha) > K2c (37.6 q/ha) > K2d (32.03 q/ha) > K2e (30.93 q/ha) > K1 (22.51 q/ha) (Figure 4c).

Effect on soil attributes

Soil attributes play a crucial role in crop production. There was a very slight change in the soil pH and EC after the application of CB irrigation water. C1 has (+34.7%) more OC than C2 does. The maximum percentage of OC was found in C1 (0.62), followed by K2e (0.60) > K2c (0.53) > K2a (0.50) > C2 (0.46) > K1 (0.45) > K2d > (0.41) K2b > (0.40). CB impacts the soil pH, EC and OC (Figure 5).

Macronutrient availability (N, P, and K) significantly changes due to CB irrigation water. The maximum nitrogen was found in C1 (236.54 kg/ha) followed by K2e (235.25 kg/ha) K2c (218.45 kg/ha), > K2a (215.15 kg/ha) > K1 (211.6

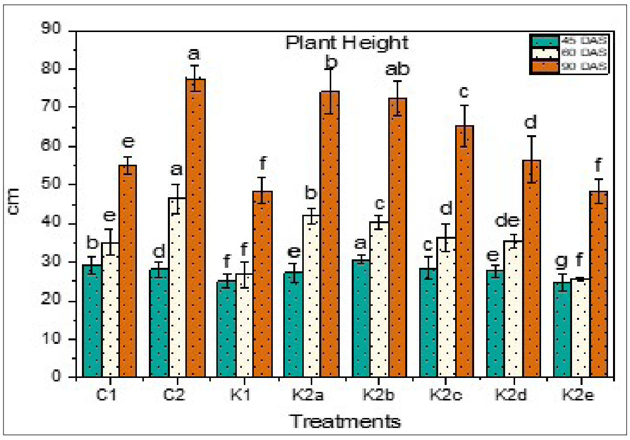

Figure 1: Impact of CB on plant height of wheat at 45, 60, and 90 DAS. Different lowercases indicate significant differences between treatments (p < 0.05).

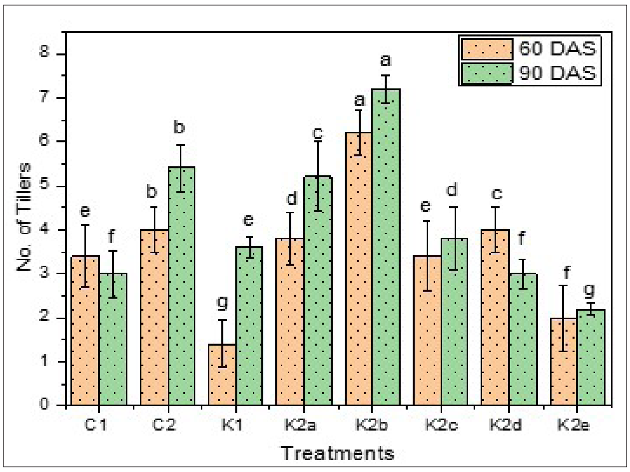

Figure 2: Impact of CB on number of tillers of wheat at 60 and 90 DAS. Different lowercases indicate significant differences between treatments (p < 0.05).

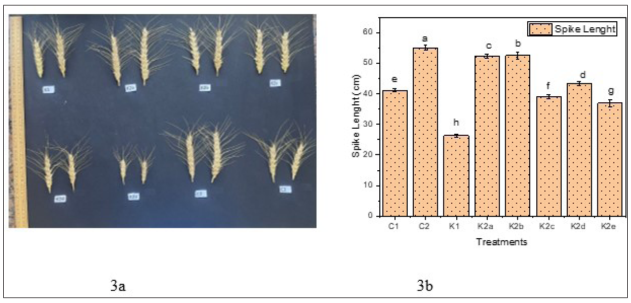

Figure 3: Impact of CB on spike length of wheat. Different lowercases indicate significant differences between treatments (p < 0.05).

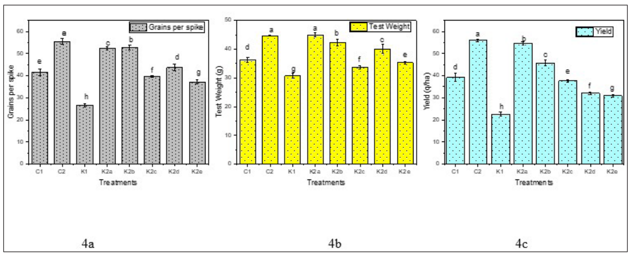

Figure 4: Impact of CB on **(a)** grains per spike, **(b)** test weight, and **(c)** garin yield. Different lowercases indicate significant differences between treatments (p < 0.05).

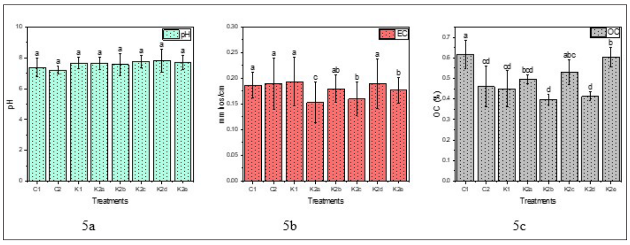

Figure 5: Impact of CB on **(a)** pH, **(b)** EC, and **(c)** OC. Different lowercases indicate significant differences between treatments ($p < 0.05$).

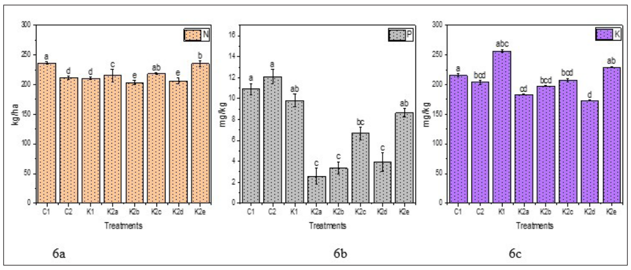

Figure 6: Impact of CB on **(a)** nitrogen, **(b)** Phosphorus, and **(c)** potassium. Different lowercases indicate significant differences between treatments ($p < 0.05$).

kg/ha) > C2 (210.8 kg/ha) > K2b (203.56 kg/ha) and K2d > (0.030) (Figure 6a). The nitrogen content followed a similar trend to the OC content. CB alters the soil's properties. CB significantly affected phosphorus in the soil. Compared with K2a, C2 had +368.9% more phosphorus in the soil. C2 (12.10 mg/kg) has the maximum phosphorus in soil, followed by C1 (10.92 mg/kg) > K1 (9.81 mg/kg) > K2e (8.65 mg/kg) > K2c (6.6 mg/kg) > K2d (3.93 mg/kg) > K2b (3.36 mg/kg) > K2a (2.58 mg/kg) (Figure 6b). The maximum mg/kg of potassium was detected in C1 (256.6) compared with the other treatments. C2 has (+ 11.3%) more potassium than K2a does (Figure 6c).

CB alters the properties of soil and affects the quantity of Ca, B, and Mg. The concentration of Ca was maximum in K1 (166.4 mg/kg), followed by K2e (131 mg/kg) > K2d (125.73 mg/kg) > K2c (124.1 mg/kg) > K2a (122.4 mg/kg) > C2 (115.1 mg/kg) > K2b (110 mg/kg) > C1 (102.5 mg/kg) (Figure 7a). The concentration of B in mg/kg maximum in K2a (2.65 mg/kg), followed by K2d (2.3 mg/kg) > K1 (2.2 mg/kg) > K2c (2.1 mg/kg) > K2b (2.1 mg/kg) > K2e (2.02 mg/kg) > C2 (1.85 mg/kg) > C1 (1.71 mg/kg) (Figure 7b). The concentration of Mg in mg/kg maximum in K2e (8.6 mg/kg), followed by K1 (8.09 mg/kg) > C2 (7.96 mg/kg) > K2c (7.8 mg/kg) > C1 (7.5 mg/kg) > K2d (4.4 mg/kg) > K2b (3.6 mg/kg) > K2a (2 mg/kg) (Figure 7c).

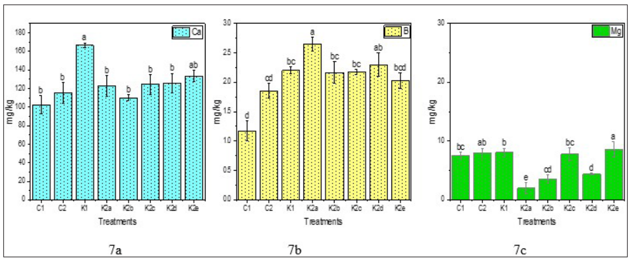

Figure 7: Impact of CB on **(a)** Ca, **(b)** B, and **(c)** Mg. Different lowercases indicate significant differences between treatments ($p < 0.05$).

Discussion

CB emits the frequencies that help plants increase growth. An experiment was conducted, and a sonic boom was used to emit a specific frequency. Sound boom stimulation can affect plant metabolism at the cell level and increase the size and number of stomata in each leaf, resulting in a rate of water absorption and nutrient accumulation in the soil. This phenomenon can be quickly observed in terms of root growth, seed germination, plant growth, and yield. This experiment revealed a positive effect on the growth of mustard plants. Similar results were found for the CB. The CB also increased the number of tilers in K2a compared with that in C2 at 45 DAS and 90 DAS [18].

Wheat plant height was more in CB irrigation water as compared to normal irrigation water. At 45 DAS, plant height was more in K2b (25% reduction in fertilizers + CB water) than in C2 (100% fertilizer + normal irrigation water). They exposed Rideau winter wheat to different frequencies with the help of speakers and reported that 5.00 kHz improved the dry weight and shoot length [16]. Sound waves of different frequencies had dual effects on the root development of Actinidia chinensis plantlets, with significant differences ($p < 0.05$). Sound waves stimulate root activity, total length and number of roots, whereas the permeability of cell membranes decreases [19].

CB improved the height of spikes in K2b (+ 7.3%) as compared to C2. Similar results were reported by Qi et al. [20] at the College of Water Conservancy and Civil Engineering, China Agricultural University, Beijing, P.R. China. Experiments were conducted on strawberry plants with sound waves. They reported that, after sound wave stimulation, strawberry plants grew stronger than greener and shifted to an earlier time, approximately one week, to ripen. Strawberry resistance against disease and insect pests was also found to be increased. Experiments have also shown how sound wave stimulation can promote the growth of plants [20].

CB improved the yield in K2a; there was a 10% reduction in fertilizer with CB irrigation water, but the result was like that in C2, which was 100% of the recommended dosage of fertilizer. The yields of lettuce, spinach, cotton, rice and wheat increased by 19.6, 22.7, 11.4, 5.7, and 17.0%, respectively. Sound waves can also enhance the plant immune system. It has been concluded that spider mites, aphids, gray molds, late blight and virus infection of tomatoes in greenhouses have decreased [20].

Planting nutritional elements is highly important for plant growth and development. Micro- and macro nutritional elements are essential for vital events, such as cell growth and reproduction, in plants [21]. Sound waves of different frequencies improved the uptake of micronutrients and macronutrients by snake plants, which indicates that the nutrient status in the soil changes with frequency [22].

Conclusion

In conclusion, the use of CB has considerable benefits for wheat cultivation. This study revealed that CB increases the number of plants. It improves nutrient availability in the soil so that plants can utilize more nutrients; as a result, the number of grains per spike increases, and the weight of the grains also increases. With lower dosages of fertilizer, CB can achieve results similar to the recommended dosages of fertilizers. These findings highlight the potential of CB technology. Future studies might investigate the impact of CB with different fertilizer dosages on soil health, crop production and agricultural sustainability.

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Conflict of Interest

None.

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