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Influence of liming materials on productivity of Mangaluru melon (*Cucumis melo var. acidulous*) in coastal Karnataka

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Abstract
A field experiment was conducted during rabi season of 2024 at farmer's field of Nailady village, Brahmavar, Udupi, Karnataka, to evaluate the impact of different liming materials and magnesium sulphate on the growth, yield and quality parameters of Mangaluru melon (*Cucumis melo var. acidulous*) under acidic soil condition of coastal Karnataka. The study involved ten treatments with three replications *viz*., Package of practice (T_1), lime and dolomite applications at 50 and 100% equivalent to exchangeable acidity and their combinations with magnesium sulphate at levels of 10 and 20 kg ha^{-1}. Among all treatments, T_4 (POP + lime at 50% exchangeable acidity + 20 kg ha^{-1} $MgSO_4$) recorded the highest performance across the growth, yield and quality parameters: Vine length (201.30 cm), Number of leaves (44.33), Number of branches (6), fruit length (21.73 cm), fruit diameter (14.27 cm), Individual fruit weight (1.25 kg), yield per hectare (21.53 ton ha^{-1}), shelf life (111.10 days) and ascorbic acid content (27.43 mg 100 g^{-1}). Treatment T_3 (POP + lime at 50% exchangeable acidity + 10 kg ha^{-1} $MgSO_4$) also showed significantly improved results, indicating the synergistic role of magnesium sulphate with liming materials in acidic soils of coastal Karnataka. In contrast, T_1 (POP) and T_{10} (farmer's practice) exhibited the lowest values across parameters, reaffirming the negative impact of untreated soil acidity on crop performance. Treatments involving dolomite (T_8 and T_9) showed modest improvements over control, but were less effective than pure lime with magnesium sulphate application. Notably, applying lime equivalent to 50 and 100% exchangeable acidity without magnesium sulphate (T_5) underperformed compared to lime treatments with $MgSO_4$ application, suggesting over liming may suppress nutrient uptake. Overall, the study suggests that amending soil with lime at 50% exchangeable acidity combined with magnesium sulphate of 20 kg ha^{-1} significantly enhances the growth, yield and nutritional quality of Mangaluru melon, making it a viable soil management practice for acidity prone coastal regions.

Keywords: Mangaluru melon, exchangeable acidity, package of practice, coastal Karnataka

Introduction
Mangaluru melon (*Cucumis melo* var. *acidulous*) is extensively grown and consumed in the coastal regions of Karnataka, Kerala, Tamil Nadu and Andhra Pradesh states of India. In Karnataka, it is popularly known as Mangaluru southekayi, as it is mainly consumed in Mangaluru, Udupi and Uttara kannada the coastal districts of Karnataka. Since, it belongs to the melon group rather than cucumber; it was renamed as Mangaluru melon (Shet *et al.*, 2022) [14]. It is used in preparing famous south indian cuisines like sambar and lentil soup cooked with vegetables. Mangaluru melon is an ideal summer vegetable crop for fresh vegetable and for pickling. Besides its nutritional and medicinal value, it has a long storage life under ambient conditions and they are non-climacteric in nature. It contains high amounts of ascorbic acid (juice content: 33.75%, pulp content: 20%), carotene (0.5 mg 100 g^{-1}), reducing sugar (2.46%), non-reducing sugar (3.43%) and total sugar (4.96%) (Hiremata *et al.*, 2023) [9].

Soil acidification is also one of the major constraints to crop production in many regions of the world including India especially in coastal regions which receive high rainfall. Around 49 M ha out of total arable land in India is occupied by acid soils. Soil acidification is the process through which soil pH declines causing soils to be acidic. It is caused by hydrogen ions (H^+) being discharged into soils during the cycling of carbon (C), nitrogen (N), sulphur (S) and fertilizer reactions which trigger the displacement and leaching of base cations and enhance the solubility of toxic elements *i.e.*, aluminium (Al^{3+}) and manganese (Mn^{2+}). As soil acidity increases (pH decreases), the concentrations of aluminium (Al^{3+}) and hydrogen (H^+) cations in the soil increase while base cations such as calcium (Ca^{2+}), magnesium (Mg^{2+}), potassium (K^+) and sodium (Na^+) are leached out of the soil. Soil acidification processes are buffered by the presence of basic cations in the soil, and deficiency of these basic cations is a major concern because they play an active role in soil acid neutralization and plant development. Acidic soils negatively impact agricultural productivity and occupy approximately 30 to 40 percent of agricultural land globally.

Amelioration of soil acidity constitutes an important aspect of acidic soil management. Application of lime along with other management practices are needed to address soil acidity. Apart from increasing yield, application of lime enhances the efficiency of applied fertilizers, improves the effectiveness of some herbicides, protects the environment and increases the net profit of farmers.

Magnesium is one of the essential macronutrients of plant that plays a vital role in plant nutrition and overall development. As the central atom in the chlorophyll molecule, magnesium is directly involved in photosynthesis, enabling plants to convert sunlight into energy efficiently. In addition to chlorophyll formation, magnesium is crucial for the activation of numerous enzymes involved in carbohydrate metabolism, protein synthesis and nucleic acid formation. It helps in the translocation of photosynthates from leaves to other parts of the plant, ensuring proper growth and development of roots, fruits, and seeds.

Magnesium also contributes to the structural stability of ribosomes and assists in maintaining the integrity of plant cell membranes. Its mobility within the plant allows it to be redistributed where needed most, particularly under nutrient stress. Without adequate magnesium, plants exhibit reduced photosynthetic activity, leading to stunted growth and chlorosis, especially in older leaves. Magnesium Deficiency often results in interveinal yellowing of leaves and poor crop yield. It is especially common in acidic soils of coastal Karnataka region. To prevent such deficiencies, proper soil management practices such as the application of magnesium containing fertilizers like magnesium sulphate or dolomite are recommended. Thus, magnesium is indispensable for healthy plant growth and optimal agricultural productivity.

Coastal Karnataka is a narrow strip of land nestled between the Western Ghats and the Arabian Sea, forming a distinct physiographic division of Karnataka. This region comprises three main districts: Udupi, Dakshina Kannada and Uttara Kannada. Characterized by undulating terrain and high rainfall, the coastal belt support lush vegetation and rich biodiversity. Numerous rivers originating from the Western Ghats such as the Sharavathi and Nethravathi traverse the region before draining into the sea. The area features a humid tropical climate, dense forests, estuaries and backwaters making it ecologically significant.

2. Material and Methods

An experiment entitled "Influence of liming materials on productivity of Mangaluru melon (*Cucumis melo* var. *acidulous*) in Coastal Karnataka" was carried out during the rabi season of 2024-25 at a farmer's field located in Nailady village, Brahmavar taluk, Udupi district. The study area falls under the coastal agro-climatic zone (Zone-X) of Karnataka. The experimental site is geographically positioned at 13°54' N latitude and 74°80' E longitude. The climate of Udupi is characterized as tropical wet and dry (savanna type-Aw). The district experiences an average annual temperature of 29.15 °C, which is about 3.18 percent higher than the national average. During the experimental period, the average rainfall was 347.8 mm, with a maximum temperature of 33.02 °C and a minimum of 19.76 °C. The site recorded an average daily sunshine duration of 6.99 hours**,** a mean relative humidity of 76.03 percent, and an average wind speed of 2.10 m s^{-1} during the crop growing season. The experiment was laid out in a Randomized Complete Block Design (RCBD) with ten treatments replicated thrice.

The initial soil sample from the experimental field was collected and analysed for physical and chemical properties. The results are given in the Table 1. The initial soil properties of the experimental field, both physical and chemical are indicative of its fertility status and its suitability for crop production. The soil is classified as a sandy loam, based on its soil textured composition. The pH of soil is 5.30, which is acidic in nature. Electrical conductivity was very low (0.096 dS m^{-1}), indicating low soluble salt content. Soil organic carbon content was 4.11 g kg^{-1}.

The available macronutrients status was measured, with 422.32 kg ha^{-1} of available N, 39.34 kg ha^{-1} of available P_2O_5 and 185.50 kg ha^{-1} of available K_2O. Exchangeable Ca and Mg were 1.78 cmol (p^+) kg^{-1} and 0.46 cmol (p^+) kg^{-1}, respectively, while available S of 14.97 mg kg^{-1} was recorded. The micronutrients analysis showed Fe status of 38.53 mg kg^{-1}, Mn of 4.92 mg kg^{-1}, Zn of 2.08 mg kg^{-1} and Cu of 4.35 mg kg^{-1}.

The ten treatments were as follows

T_1: Package of practice (N: P_2O_5: K_2O = 125**:**93.75**:**62.5 kg ha^{-1})

T_2: T_1 + Lime equivalent to 50% exchangeable acidity

T_3: T_1 + Lime equivalent to 50% exchangeable acidity + 10 kg magnesium sulphate

T_4: T_1 + Lime equivalent to 50% exchangeable acidity + 20 kg magnesium sulphate

T_5: T_1 + Lime equivalent to 100% exchangeable acidity

T_6: T_1 + Lime equivalent to 100% exchangeable acidity + 10 kg magnesium sulphate

T_7: T_1 + Lime equivalent to 100% exchangeable acidity + 20 kg magnesium sulphate

T_8: T_1 + Dolomite application equivalent to 50% exchangeable acidity

T_9: T_1 + Dolomite application equivalent to 100% exchangeable acidity

T_{10}: Farmers Practice (50 kg DAP + 75 kg potash)

2.1 Growth parameters recorded at 15 DAS, 30 DAS and at harvest

2.1.1 Vine length (cm)

Vine length was measured and recorded by randomly selected and tagged five plants from ground level to the tip of the vine at 15 and 30 DAS and at harvest. The mean vine length was worked out and expressed in centimeters (cm).

2.1.2 Number of leaves per vine

Number of fully developed leaves from tagged plants are measured and recorded from each individual treatment plot of experimental field at 15 and 30 DAS and at harvest. The mean was worked out and expressed.

2.1.3 Number of days taken for first flowering
Days taken for first flower initiation was recorded from the date of sowing to the date of first flower setting in tagged plants from each treatment and average were expressed in number of days.

2.2 Yield and yield attributing parameters at harvest
2.2.1 Number of days taken for fruit initiation
Days taken for fruit initiation was recorded from the date of sowing to the date of first fruit initiation in tagged plants from each treatment and average were expressed in number of days.

2.2.2 Fruit length (cm)
Matured and marketable fruits are harvested from each tagged vines of each treatment and length are measured by using the meter scale. The average is measured and expressed in centimeters.

2.2.3 Fruit diameter (cm)
Matured and marketable fruits are harvested from each tagged vines of each treatment and the fruit diameter is measured by using the meter scale. The average is measured and expressed in centimeters.

2.2.4 Average weight of individual fruit (kg)
Matured and marketable fruits are harvested from each tagged vines of each treatment and weight of individual fruits are taken and average value is worked out and expressed in kilo grams (kg).

2.2.5 Fruit yield per plot (kg plot^{-1}) and per hectare
All the matured and marketable fruits of net plots of each treatment are harvested and weight is taken individually. Based on this, fruit yield per plot was calculated and expressed in kg plot^{-1} and t ha^{-1}.

2.3 Quality parameters
2.3.1 Ascorbic acid (mg 100 g^{-1})
Ascorbic acid content (vitamin C) was determined by 2,6-dichlorophenol indophenol visual titration method. It was expressed in milligram per 100 grams
(mg 100 g^{-1}).
Five-gram fresh sample was taken in a beaker with four percent oxalic acid and the sample was crushed with glass rod. Then suspension was filtered through filter paper in a volumetric flask to get supernatant liquid and made up to a known volume (100 ml) with four percent oxalic acid. Five ml of this supernatant liquid was added with 10 ml of four percent oxalic acid and titrated against 2,6-dichlrophenol indophenols dye.
The ascorbic acid content was calculated by using following formula;

$$\text{Ascorbic acid}(\text{mg } 100 \text{ g}^{-1}) = \frac{0.5}{\text{V1(ml)}} \times \frac{\text{V2(ml)}}{5 \text{ ml}} \times \frac{100 \text{ ml}}{\text{Wt. of the sample}} \times 100$$

Where,
V1 ml-Dye consumed for standardization.
V2 ml-Dye consumed by plant sample extract.

2.3.2 Shelf life
The fruits collected on the day of harvest were kept under ambient condition to study the shelf-life. Initial weight was recorded and loss in fresh weight was recorded once in two days (room conditions). The number of days taken for first visual rotting symptoms or 15 percent loss in fresh weight was recorded as shelf life and expressed in number of days.

3. Results and Discussion
3.1 Growth parameters
3.1.1 Vine length
Data presented in Table 1 reveal the influence of liming materials and magnesium sulphate application on vine length of Mangaluru melon at different growth stages. The results indicated that vine length did not vary significantly among treatments at 15 DAS; however, substantial differences were observed at later stages. At 15 DAS, the highest vine length (31.46 cm) was recorded in treatment T_4 (POP + lime equivalent to 50% exchangeable acidity + 20 kg magnesium sulphate). At 30 DAS, application of liming materials and magnesium sulphate significantly influenced vine length, with treatment T_4 again recording the highest value (75.10 cm), which was significantly superior to other treatments and statistically on par with T_3 (72.57 cm), while the lowest value (49.67 cm) was observed in T_{10} (Farmer's practice). At harvest, the maximum vine length (201.30 cm) was recorded in T_4, which remained significantly superior over all other treatments and statistically on par with T_3 (191.7 cm), whereas T_{10} recorded the minimum vine length (145 cm).

3.1.2 Number of branches per plant
Data presented in Table 1 shows the effect of liming materials and magnesium sulphate application on the number of branches per plant in Mangaluru melon at different growth stages. The results revealed that there was no significant variation in the number of branches at 15 DAS, while a substantial influence of treatments was observed at later stages. At 15 DAS, the highest number of branches (2.77) was recorded in treatment T_4 (POP + lime equivalent to 50% exchangeable acidity + 20 kg magnesium sulphate), followed by T_3 (POP + lime equivalent to 50% exchangeable acidity + 10 kg magnesium sulphate) with 2.50 branches, whereas the lowest values were observed in T_{10} (1.25) and T_1 (1.32). At 30 DAS, the application of liming materials and magnesium sulphate significantly influenced the number of branches, with T_4 again recording the maximum value (3.43), which was significantly superior to all other treatments and on par with T_3 (3.30), while T_{10} registered the lowest number of branches (1.92). At harvest, treatment T_4 continued to show the highest number of branches (6.00), which was significantly superior to other treatments and statistically comparable with T_3 (5.86), whereas the minimum number of branches (4.26) was recorded in T_{10} (Farmer's practice).

3.1.3 Number of leaves per plant
Data on the number of leaves per plant of Mangaluru melon as influenced by liming materials and magnesium sulphate application at different growth stages are presented in Table 1. The results revealed that there was no significant variation in the number of leaves at 15 DAS; however, a marked influence of treatments was observed at later stages of growth. The highest number of leaves at 15 DAS (8.4) was recorded in treatment T_4 (POP + lime equivalent to 50% exchangeable acidity + 20 kg $MgSO_4$ ha^{-1}), followed by T_3 (8.1), while the lowest number (5.77) was noted in T_{10}

(Farmer's practice). At 30 DAS, application of liming materials and magnesium sulphate significantly influenced leaf number. Treatment T_4 recorded the maximum number of leaves (21.1), which was statistically on par with T_3 (20.1), whereas T_{10} registered the lowest number (12.7). At harvest, the maximum number of leaves was observed in T_4 (44.3), which was on par with T_3 (43.0). In contrast, T_{10} (Farmer's practice) recorded the significantly lowest number of leaves (29.8).

The improvement in growth parameters with liming can be attributed primarily to the amelioration of soil acidity, which is known to adversely affect root growth and nutrient availability. The application of lime neutralizes exchangeable acidity and enhanced the availability of macronutrients such as nitrogen, phosphorus, calcium and other essential nutrients for promoting vegetative growth (Haynes and Mokolobate, 2001) [4]. Furthermore, the inclusion of magnesium sulphate played a crucial role in enhancing growth parameters. Magnesium is a central atom in the chlorophyll molecule and is indispensable for photosynthesis. Improved chlorophyll content enhances the plant's photosynthetic efficiency and carbohydrate production, thereby supplying more assimilates for shoot growth (Mengel and Kirkby, 2001) [11].

Table 1: Effect of liming materials and magnesium sulphate application on growth parameters of Mangaluru melon

Treatments	Vine length (cm)			Number of Branches			Number of leaves		
	15 DAS	30 DAS	Harvest	15 DAS	30 DAS	Harvest	15 DAS	30 DAS	Harvest
T_1	20.45	50.77	149.5	1.32	2.00	4.33	5.93	13.33	31.67
T_2	20.95	51.47	155.6	1.50	2.17	4.51	6.23	13.77	32.73
T_3	30.76	72.57	191.7	2.50	3.33	5.86	8.17	20.10	43.00
T_4	31.46	75.10	201.3	2.77	3.43	6.00	8.43	21.10	44.33
T_5	23.34	56.93	166.2	1.78	2.45	4.88	6.87	15.63	35.67
T_6	27.94	62.97	179.7	2.13	2.86	5.37	7.50	17.77	39.13
T_7	28.53	66.23	181.6	2.20	3.02	5.47	7.53	18.27	40.20
T_8	20.74	51.10	152.9	1.42	2.10	4.43	6.13	13.50	32.57
T_9	25.75	57.50	168.5	1.83	2.58	4.99	6.87	15.93	36.07
T_{10}	19.84	49.67	145.0	1.25	1.92	4.26	5.77	12.77	29.87
S. Em ±	2.99	1.74	3.3	0.33	0.08	0.12	0.64	0.58	0.92
CD @ 5%	NS	5.17	9.9	NS	0.24	0.36	NS	1.72	2.74

Values are mean of three replications. DAS = Days after sowing. S.Em ± = Standard error of mean; CD (P = 0.05) = Critical difference at 5% probability level.

3.2 Yield parameters

3.2.1 Number of days taken for first flowering

Reduction in number of days to initiate flowering in Mangaluru melon crop was noticed where liming materials and magnesium sulphate was applied as compared to control treatment. Significant difference was observed with regard to number of days taken for first flowering. The treatment T_4 (POP + lime equivalent to 50% exchangeable acidity + 20 kg magnesium sulphate) shown early flowering at 24.66 days, which is on par with treatment T_3 (POP + lime equivalent to 50% exchangeable acidity + 10 kg magnesium sulphate) which recorded 25 days and T_7 (POP + lime equivalent to 100% exchangeable acidity + 20 kg magnesium sulphate) showed 25.95 days for first flowering. The treatment T_{10} (Farmer's practice) recorded a greater number of days (29.35) for first flowering followed by T_1 (Package of practice) with 29 days for first flowering.

3.2.2 Number of days taken for first fruit setting

Reduction in number of days to initiate fruiting in Mangaluru melon crop was noticed where liming materials and magnesium sulphate was applied as compared to control treatment. Significant difference was observed with regard to days taken for first fruiting. The treatment T_4 (POP + lime equivalent to 50% exchangeable acidity + 20 kg magnesium sulphate) shown early fruiting at 29.33 days followed by the treatment T_3 (POP + lime equivalent to 50% exchangeable acidity + 10 kg magnesium sulphate) which recorded 30 days and T_7 (POP + lime equivalent to 100% exchangeable acidity + 20 kg magnesium sulphate) showed 30.83 days for first fruiting. The treatment T_{10} (Farmer's practice) recorded a greater number of days (34.33) for first fruiting followed by T_1 (Package of practice) with 33.75 days for first fruiting.

The observed earliness in flowering and fruiting under these treatments can be attributed to the amelioration of soil acidity and the improved availability of calcium and magnesium, both of which are essential for enzymatic activation, membrane integrity and hormonal balance. Magnesium plays a direct role in photosynthesis as the central atom of the chlorophyll molecule, while calcium is crucial for cell wall development key processes for the transition to reproductive growth (Fageria and Baligar, 2008; Marschner, 2012) [7, 13].

3.2.3 Fruit length

The effect of application of liming materials and magnesium sulphate on fruit length of Mangaluru melon fruits is given in Table 2. The length of Mangaluru melon fruits was significantly influenced by the application of liming materials and magnesium sulphate. Among different treatments T_4 (POP + lime equivalent to 50% exchangeable acidity + 20 kg magnesium sulphate) shows the highest fruit length of 21.73 cm and is on par with the treatment T_3 (POP + lime equivalent to 50% exchangeable acidity + 10 kg magnesium sulphate) with value of 20.93 cm. Significantly lower fruit length was recorded in treatment T_{10} (14 cm). The increase in fruit length under lime and magnesium application can be attributed to improved nutrient uptake, particularly Ca and Mg, which play critical roles in cell elongation and expansion during fruit growth (Kirkby and Pilbeam, 1984; De and Mitcham, 2012) [10, 12].

3.2.4 Fruit diameter

The effect of different treatments on fruit diameter of Mangaluru melon fruits is given in Table 2. The fruit diameter of Mangaluru melon fruits was significantly influenced by the application of liming materials and magnesium sulphate. Among different treatments T_4 (POP + lime equivalent to 50% exchangeable acidity + 20 kg magnesium sulphate) shows the highest fruit diameter of 14.27 cm was found out to be significantly best treatment compared to all other treatments. And the treatment T_3 (POP + lime equivalent to 50% exchangeable acidity + 10 kg magnesium sulphate) was found to be on par with T_4 treatment with value of 13.57 cm. Significantly lowest fruit diameter of 8.40 cm was recorded in treatment T_{10} (Farmer's practice). The superiority of T_4 over all other treatments can be attributed to the combined effects of liming and magnesium sulphate application, which ameliorate soil acidity and improve the availability of Ca and Mg which are key nutrients involved in cell expansion and fruit growth (Fageria and Baligar, 2008; Kirkby and Pilbeam, 1984) [7, 10].

3.2.5 Weight of individual fruit

The effect of different treatments on average weight of individual fruit of Mangaluru melon fruits is given in Table 2. The weight of individual fruit of Mangaluru melon fruits was significantly influenced by the application of liming materials and magnesium sulphate. Among different treatments T_4 (POP + lime equivalent to 50% exchangeable acidity + 20 kg magnesium sulphate) shows the highest average weight of individual fruit with 1.25 kg was found out to be the best treatment compared to all other treatments. And the treatment T_4 was found to be on par with treatment T_3 (POP + lime equivalent to 50% exchangeable acidity + 10 kg magnesium sulphate) with 1.18 kg. Significantly lowest weight of individual fruit was recorded in treatment T_{10} (0.63 kg). The weight of individual fruits varied notably across treatments, reflecting the combined effect of liming and magnesium sulphate application which enhanced the fruit biomass by improving nutrient availability, especially calcium and magnesium, which are essential for cell wall structure and translocation of photosynthates to developing fruits (Römheld and Kirkby, 2010) [6]. Magnesium acts as the central atom in chlorophyll and facilitates carbohydrate partitioning, thereby promoting fruit growth (Cakmak and Yazici, 2010) [5].

3.2.6 Fruit yield per hectare

Mangaluru melon yield per hectare was significantly influenced by the application of liming materials and magnesium sulphate (Table 2). Application of lime equivalent to 50 percent exchangeable acidity + 20 kg magnesium sulphate along with package of practice (T_4) recorded higher fruit yield (21.70 t ha^{-1}) and it was statistically on par with application of lime equivalent to 50 percent exchangeable acidity + 20 kg magnesium sulphate along with POP (T_3) (21.53 t ha^{-1}). In contrary, significantly lowest fruit yield was recorded in farmer's practice (T_{10}) (17.99 t ha^{-1}) followed by POP (T_1) with value of 18.11 t ha^{-1}. The highest fruit yield (21.70 t ha^{-1}) of Mangaluru melon was recorded in treatment T_4, followed by T_3 (21.53 t ha^{-1}), indicating that soil acidity amelioration combined with magnesium supplementation significantly enhanced crop productivity. Liming effectively neutralized exchangeable acidity and improved the availability of essential nutrients such as phosphorus, calcium, and magnesium (Haynes and Naidu, 1998). In contrast, the lowest yield (17.98 t ha^{-1}) was obtained in T_{10} (Farmer's practice), highlighting the deficiency of basic cationic nutrients on crop productivity.

Table 2: Effect of liming materials and magnesium sulphate application on yield parameters of Mangaluru melon

Treatments	Number of days for		Fruit length (cm)	Fruit Diameter (cm)	Weight of Individual fruit (kg)	Yield (t ha^{-1})
	First flowering	First fruiting				
T_1	29.00	33.75	14.90	8.57	0.66	18.11
T_2	28.50	33.00	15.36	8.80	0.73	19.10
T_3	25.00	30.00	20.93	13.57	1.18	21.53
T_4	24.66	29.33	21.73	14.27	1.25	21.70
T_5	27.58	32.45	16.95	10.00	0.85	19.54
T_6	26.17	31.03	18.77	11.73	0.99	20.39
T_7	25.95	30.83	19.30	12.00	1.07	20.86
T_8	28.75	33.43	15.00	8.67	0.67	18.59
T_9	27.00	32.00	17.17	10.27	0.87	20.09
T_{10}	29.35	34.33	14.00	8.40	0.63	17.98
S. Em ±	0.22	0.27	0.52	0.38	0.03	0.54
CD @ 5%	0.66	0.81	1.56	1.14	0.09	1.62

Values are mean of three replications. S.Em ± = Standard error of mean; CD (P = 0.05) = Critical difference at 5% probability level.

3.3 Quality parameters

3.3.1 Ascorbic acid content

The effect of different treatments on ascorbic acid content of Mangaluru melon fruits is given in Table 3. The ascorbic acid content of Mangaluru melon fruits was significantly influenced by the application of liming materials and magnesium sulphate. Among different treatments T_4 (POP + lime equivalent to 50% exchangeable acidity + 20 kg magnesium sulphate) shows the highest ascorbic acid content 27.43 mg 100 g^{-1} was found to be on par with T_3 (POP + lime equivalent to 50% exchangeable acidity + 10 kg magnesium sulphate) treatment with value of 25.61 mg 100 g^{-1}. Significantly lower ascorbic acid content was recorded in treatment T_1 (Farmer's practice) with value of 16.11 mg 100 g^{-1}. The increase in ascorbic acid content under T_4 could be attributed to the amelioration of soil acidity by lime and the direct role of magnesium and sulphur in improving nutrient uptake and fruit quality. Sulphur plays a role in the synthesis of certain vitamins and enzymes involved in plant metabolism, which could enhance ascorbic acid accumulation in the fruit (Sarkar *et al.*, 2020) [2].

3.3.2 Shelf life

The effect of different treatments on shelf life of Mangaluru melon fruits is given in Table 3. The shelf life of Mangaluru melon fruits was significantly influenced by the application of liming materials and magnesium sulphate. Among different treatments T_4 (POP + lime equivalent to 50% exchangeable acidity + 20 kg magnesium sulphate) shows the highest shelf life of 111.10 days was found to be best treatment compared to all other treatments. And the treatment T_4 was found to be on par with T_3 (POP + lime equivalent to 50% exchangeable acidity + 10 kg magnesium sulphate) treatment with value of 106.66 days. Significantly lower shelf life was recorded in treatment T_1; Farmer's practice (83.83 days). This improvement in shelf life of Mangaluru melon fruits could be due to Calcium's role in strengthening cell wall structure and membrane stability, reducing postharvest deterioration (Gransee and Führs, 2013) [1]. Moreover, liming reduces soil acidity and improving calcium uptake a nutrient closely linked to reduced fruit softening and delayed senescence (Ferguson, 1984) [8].

Table 5: Effect of liming materials and magnesium sulphate application on quality parameters of Mangaluru melon

Treatments	Ascorbic acid (mg 100 g^{-1})	Shelf life (days)
T_1: Package of practice (125:93.75:62.5 N: P_2O_5: K_2O kg ha^{-1})	16.60	83.83
T_2: T_1 + Lime equivalent to 50% exchangeable acidity	17.84	89.33
T_3: T_1 + Lime equivalent to 50% exchangeable acidity + 10 kg $MgSO_4$	25.61	106.66
T_4: T_1 + Lime equivalent to 50% exchangeable acidity + 20 kg $MgSO_4$	27.43	111.10
T_5: T_1 + Lime equivalent to 100% exchangeable acidity	18.58	93.90
T_6: T_1 + Lime equivalent to 100% exchangeable acidity + 10 kg $MgSO_4$	22.00	98.50
T_7: T_1 + Lime equivalent to 100% exchangeable acidity + 20 kg $MgSO_4$	23.81	102.66
T_8: T_1 + Dolomite application equivalent to 50% exchangeable acidity	16.89	88.33
T_9: T_1 + Dolomite application equivalent to 100% exchangeable acidity	20.11	95.20
T_{10}: Farmers Practice (50 kg ha^{-1} DAP + 75 kg ha^{-1} potash)	16.11	85.13
S. Em ±	0.75	1.68
CD @ 5%	2.25	5.04

Values are mean of three replications. S.Em ± = Standard error of mean; CD (P = 0.05) = Critical difference at 5% probability level.

4. Conclusion

The field experiment entitled "Influence of liming materials on productivity of Mangaluru melon (*Cucumis melo* var. *acidulous*) in coastal Karnataka" clearly demonstrated that the application of liming materials in combination with magnesium sulphate significantly influenced crop performance under the acidic soils of coastal Karnataka. All growth and yield attributes of Mangaluru melon, such as vine length, number of branches, number of leaves, flowering, fruit set, and fruit yield, were markedly improved under liming treatments compared to the package of practice and farmer's practice. Among the treatments, T_4 (POP + lime equivalent to 50% exchangeable acidity + 20 kg $MgSO_4$ ha^{-1}) and T_3 (POP + lime equivalent to 50% exchangeable acidity + 10 kg $MgSO_4$ ha^{-1}) consistently recorded superior vegetative growth and fruit yield, reflecting the synergistic role of calcium and magnesium in improving nutrient balance, photosynthetic efficiency and metabolic activity. Liming and magnesium application also enhanced the availability of major (N, P, K) and secondary nutrients (Ca, Mg, S), indicating improved mineralization and reduced nutrient losses through increased cation exchange capacity, while a general reduction in available Fe, Mn, Zn, and Cu was observed due to decreased solubility at higher soil pH. Overall, the combined use of liming materials in combination with magnesium sulphate effectively ameliorated soil acidity, improved soil fertility and enhanced the productivity of Mangaluru melon, thus proving to be a sustainable management practice for maintaining soil health and productivity in high-rainfall acidic soils of coastal Karnataka.

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