

# Soil application for apple



## Study details

Research institution: University of Horticulture and Forestry, Institute of Soil Science

Researchers: Dr. YS Parmar and Dr. Pardeep Kumar

Date: 2024 and 2025

Location: Solan, Himachal Pradesh, India

Crop variety: Red Velox

Soil before study start:

pH: 6.45

OC: 1.24%

EC: 0.14 dSm<sup>-1</sup>

N: 298.44 kg/ha

P: 70.89 kg/ha

K: 258.05 kg/ha

Ca: 3.15 (cmol (p+) kg<sup>-1</sup>)

Mg: 2.22 (cmol (p+) kg<sup>-1</sup>)

B: 0.44 mg kg<sup>-1</sup>

Cu: 1.38 mg kg<sup>-1</sup>

Mn: 5.35 mg kg<sup>-1</sup>

Zn: 2.22 mg kg<sup>-1</sup>

Fe: 13.24 mg kg<sup>-1</sup>

## Synergy between calcium and boron

Calcium and boron are nutrients that play key roles in plant nutrition and plant physiology. Both nutrients, when supplied adequately to plants, provide greater productivity and quality of grains and fruits. In the literature, the main functions of calcium and boron in plant nutrition and plant physiology are associated with pollen tube growth and development, cell wall formation, pollen germination, pollen tube growth, flower and fruit formation, and flower and fruit viability.



# Soil application for apple



## Study details

Plant age: 7 years

Number of selected plants: 78

Spacing: 2.5m x 1m

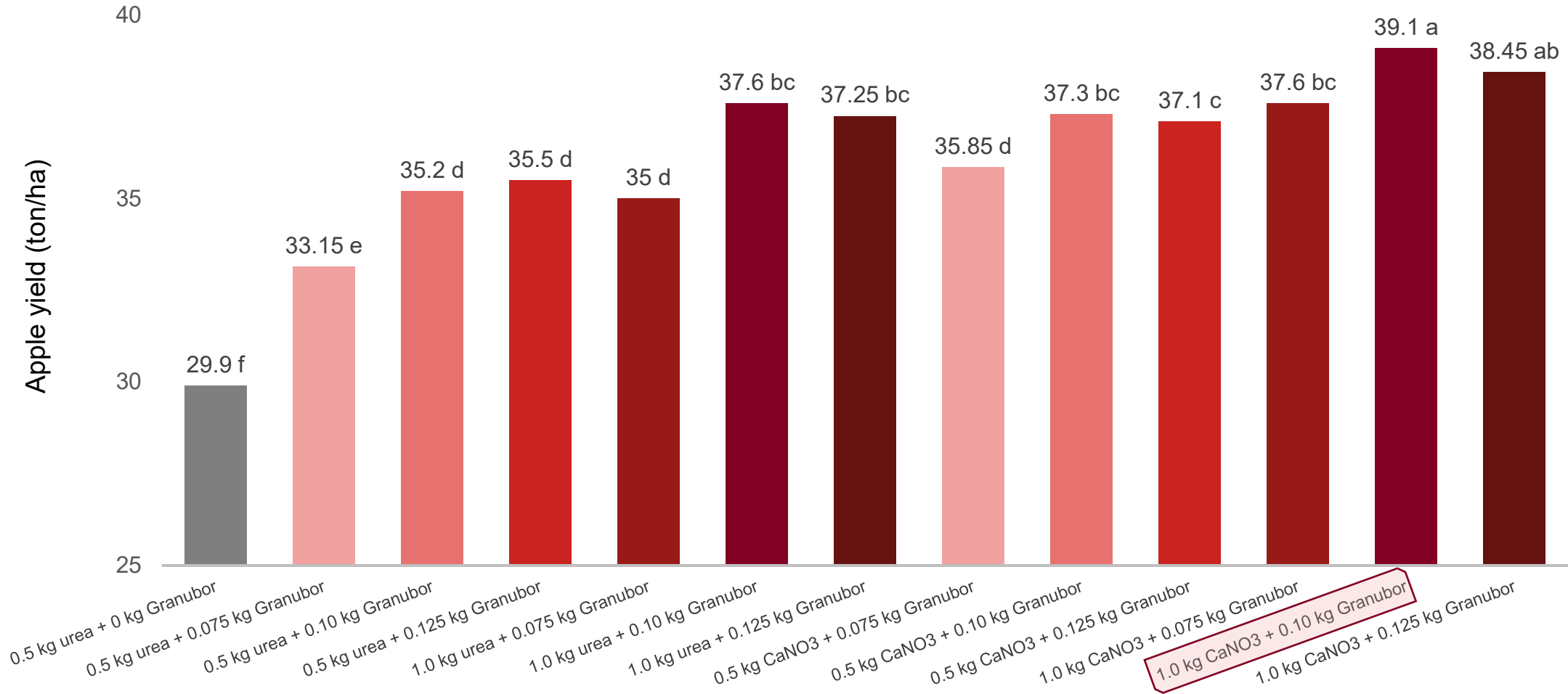
Fertilizer: *Granubor*<sup>®</sup>, urea, and nitrogen + calcium (CaNO<sub>3</sub>)

Methodology: Two field experiments (one based on soil application and other on foliar application of boron) were conducted during a two-year period. The apple plants selected for the experiments were uniform in size and vigor. They also received uniform doses of fertilizers, according to university recommendations (as per POP) and as per treatments applied. The experiments were laid out in randomized block design (RBD) with three replications.

Statistical analysis: Statistical analysis was conducted using SPSS (version 14.0) and Microsoft Excel 2021. Analysis of variance (ANOVA) was employed to determine the significance of variations among treatments, while significant differences between treatment means were identified using the Critical Difference (CD<sub>0.05</sub>) and Duncan Multiple Range Test (DMRT) at a 5% significance level.



# Apple yield (ton/ha)



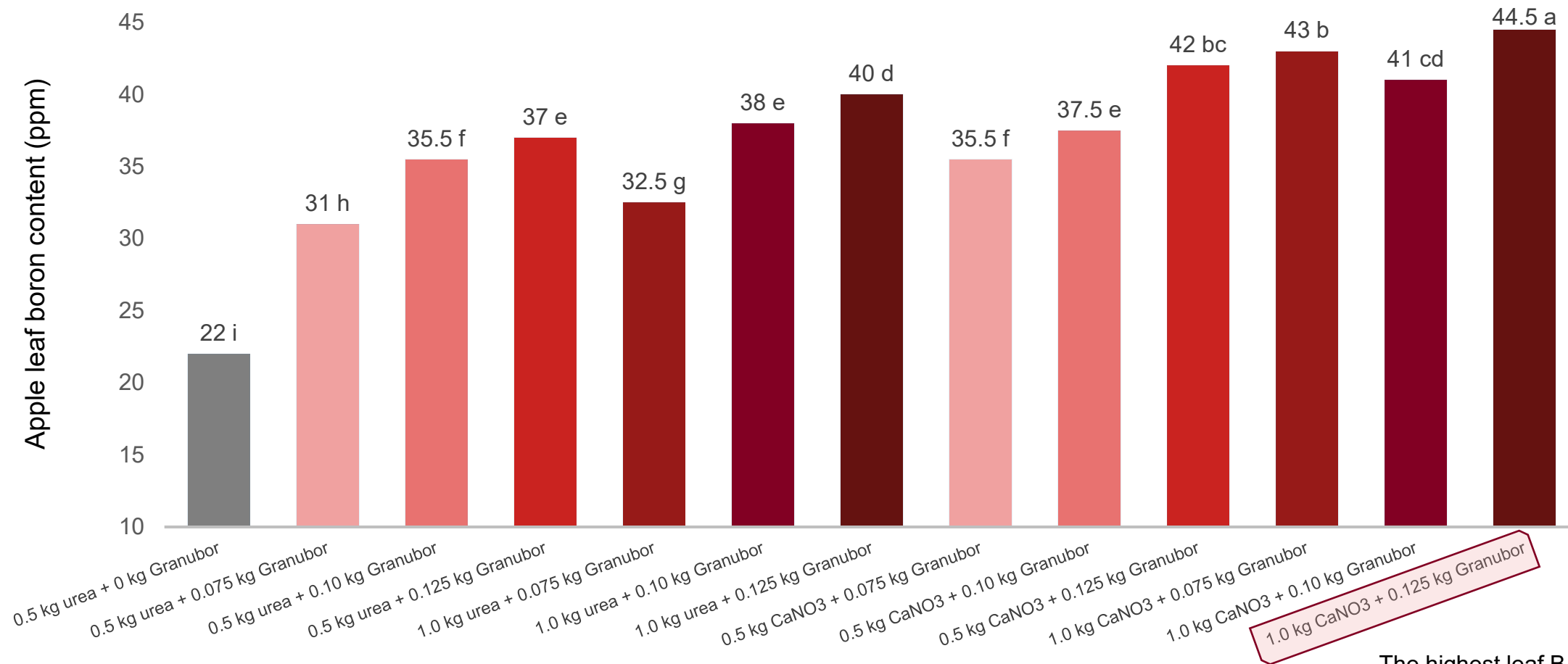
1.0 kg CaNO3 + 0.10 kg Granubor

The highest yield resulted in gains of 30.8% compared to the control



\*Treatments: Fertilizer doses applied per plant/year

# Apple leaf boron content (ppm)

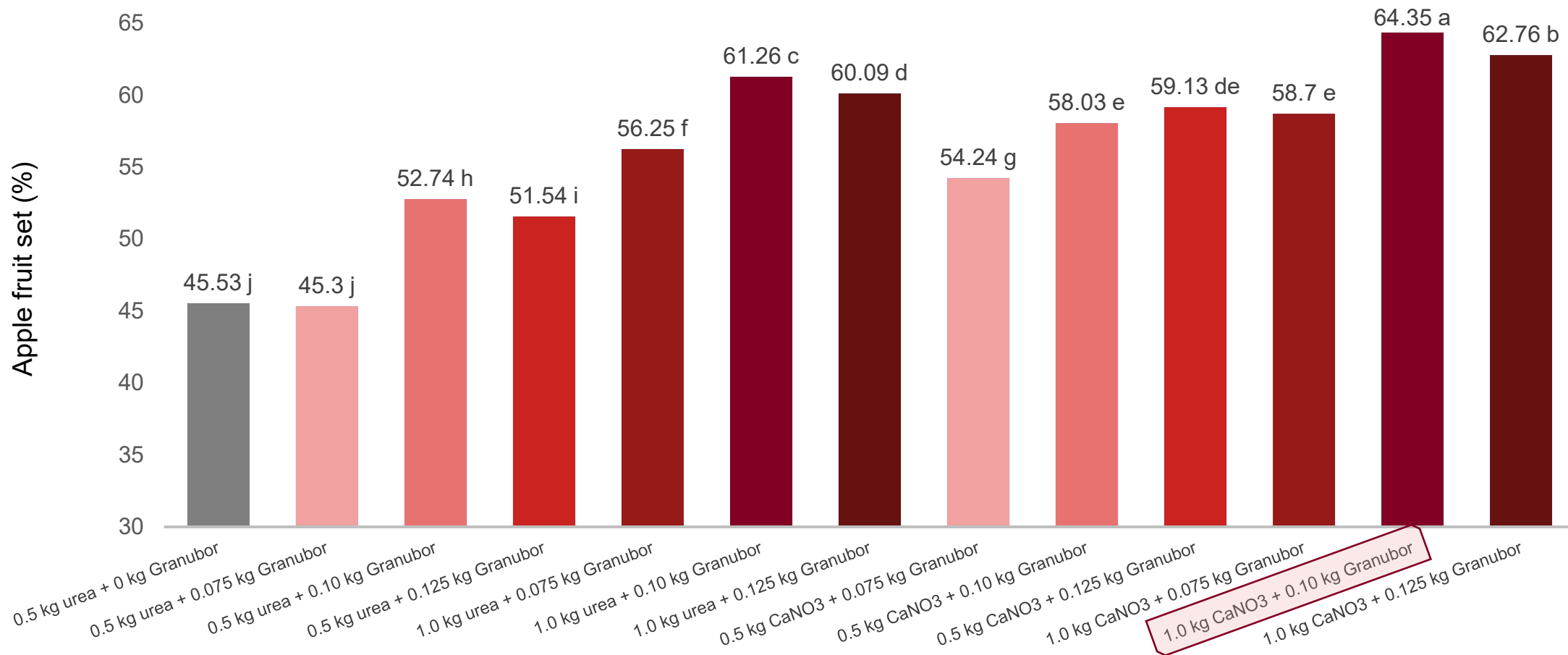


The highest leaf B content resulted in a 102.3% increase in leaf B compared to the control



\*Treatments: Fertilizer doses applied per plant/year

# Apple fruit set (%)

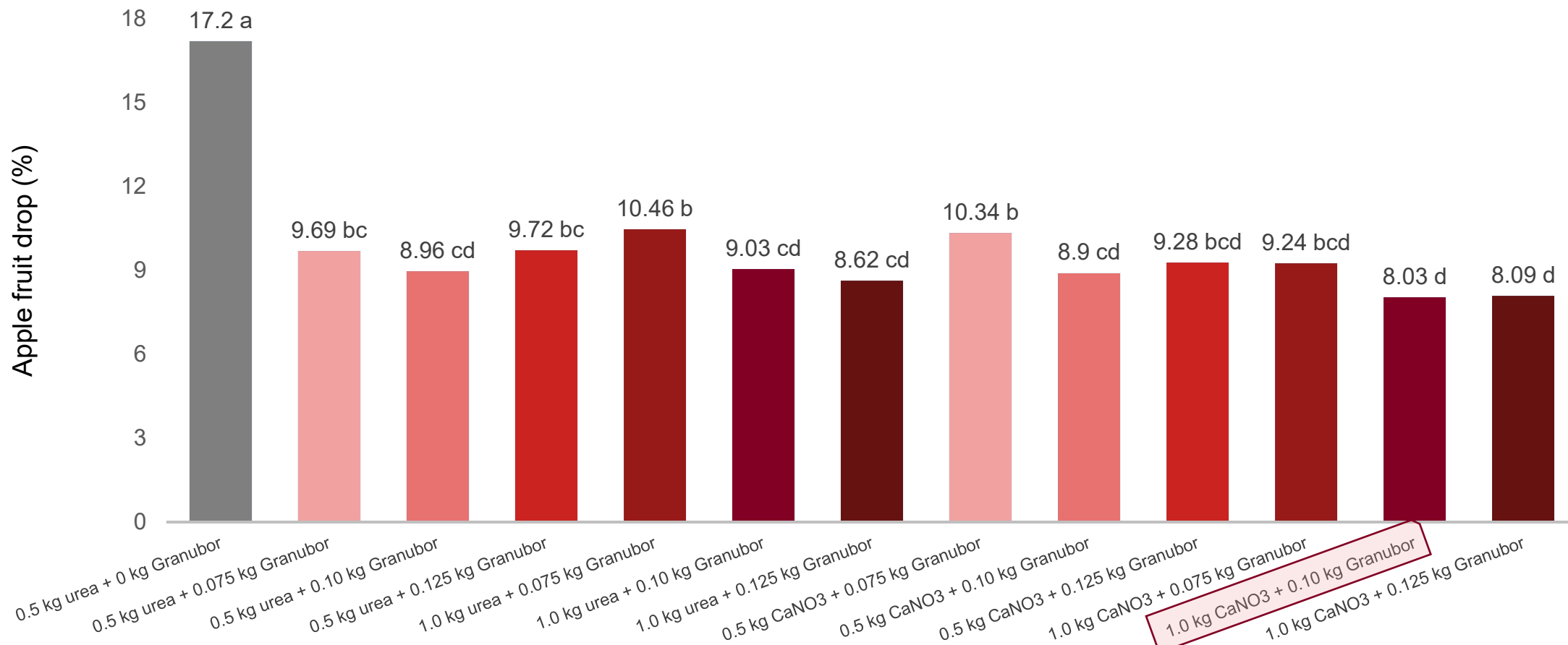


The best performance in terms of apple fruit set resulted in 41.3% better fruit set compared to the control



\*Treatments: Fertilizer doses applied per plant/year

# Apple fruit drop (%)

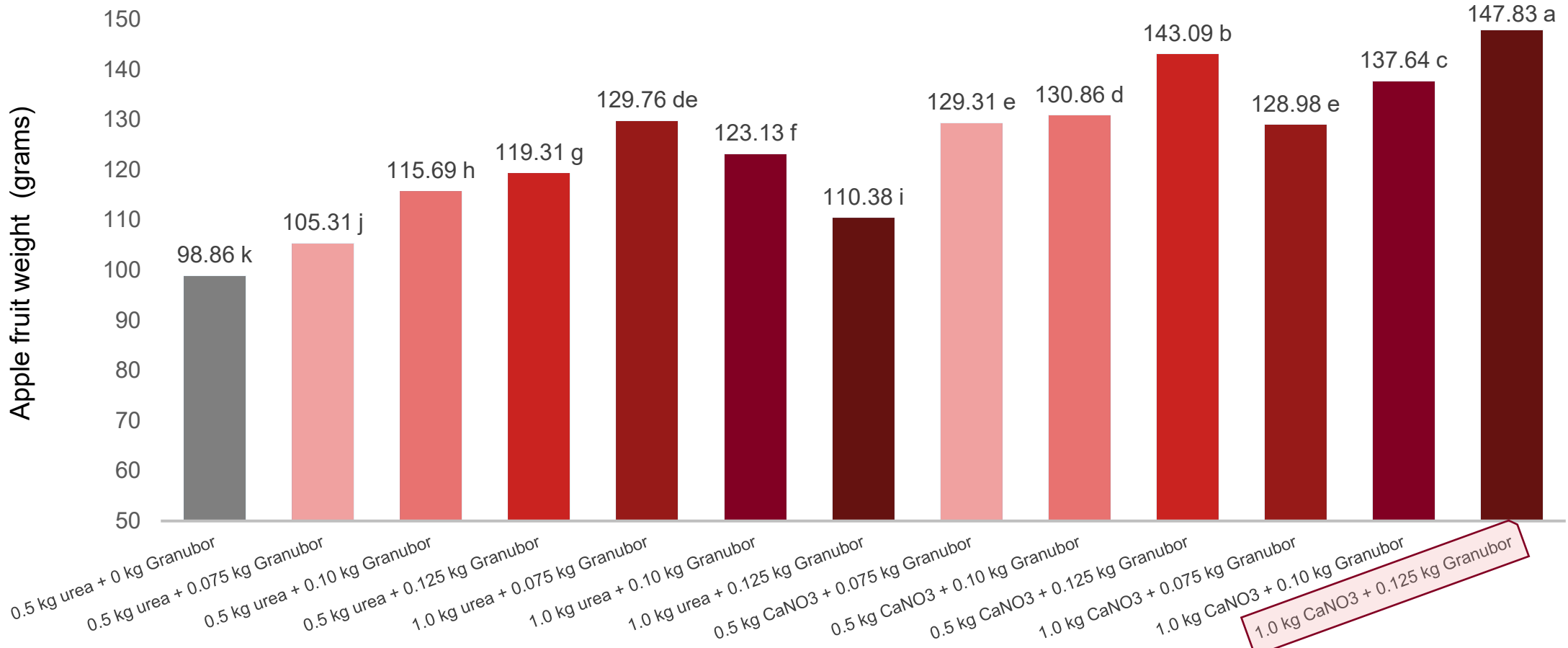


The best result in terms of apple fruit drop resulted in 114.2% fewer dropped fruits compared to control



\*Treatments: Fertilizer doses applied per plant/year

# Apple fruit weight (grams)

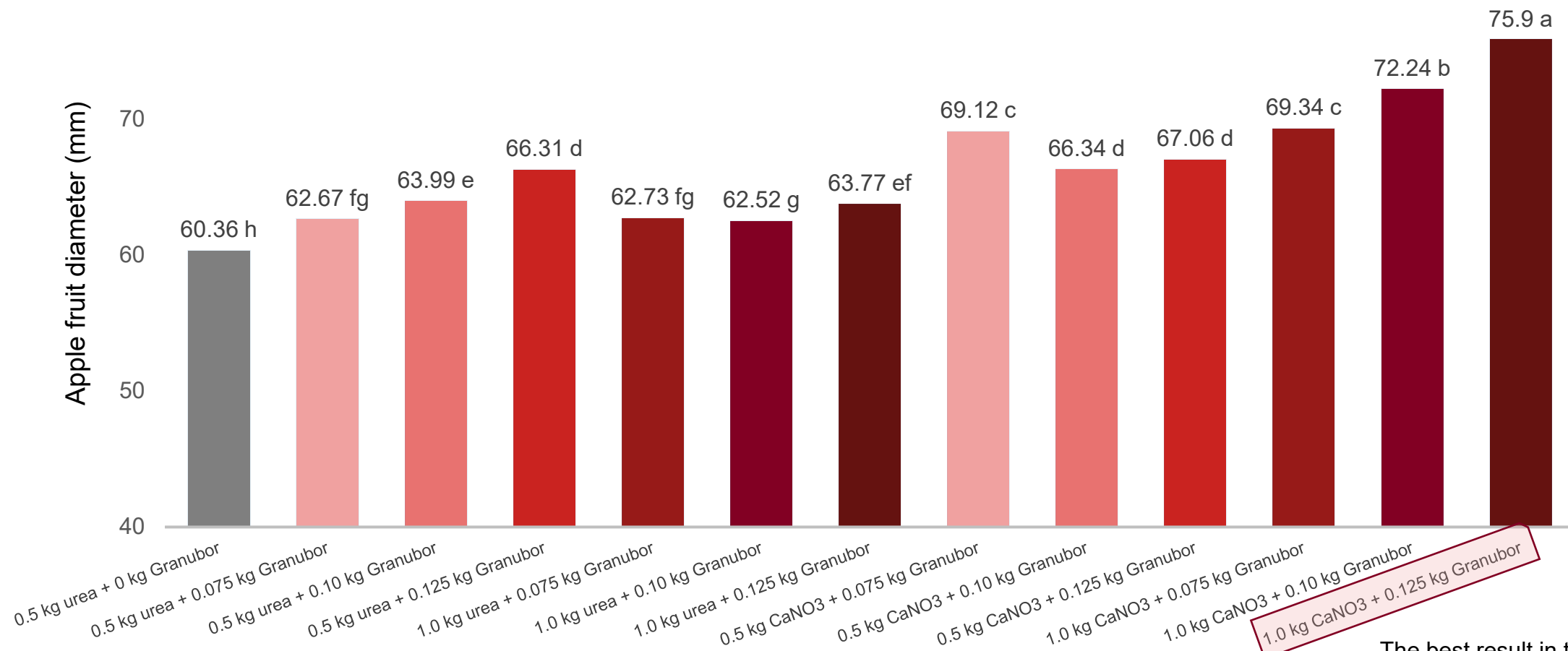


The best result in terms of apple fruit weight resulted in an average increase of 49.5% in fruit weight compared to control



\*Treatments: Fertilizer doses applied per plant/year

# Apple fruit diameter (mm)

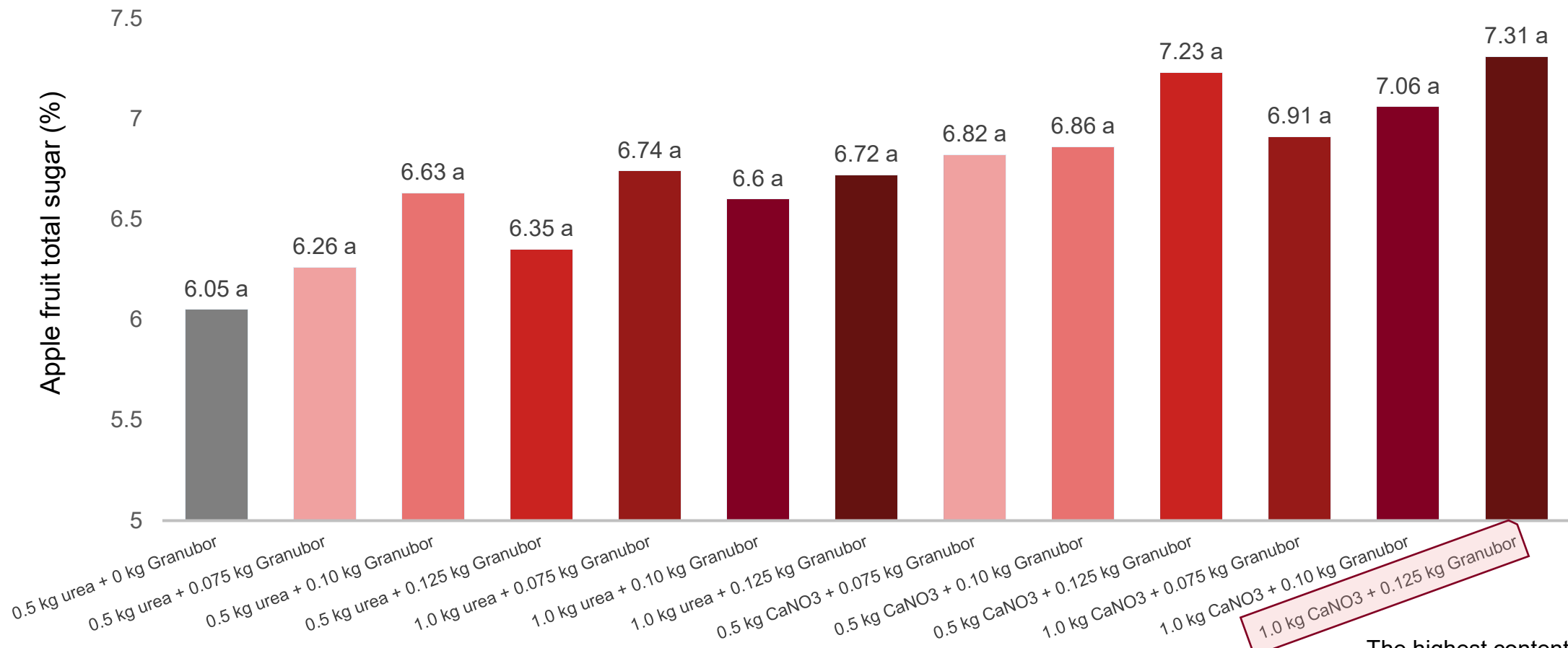


The best result in terms of apple fruit diameter resulted in an average increase of 25.7% in fruit diameter compared to control



\*Treatments: Fertilizer doses applied per plant/year

# Apple fruit total sugar (%)

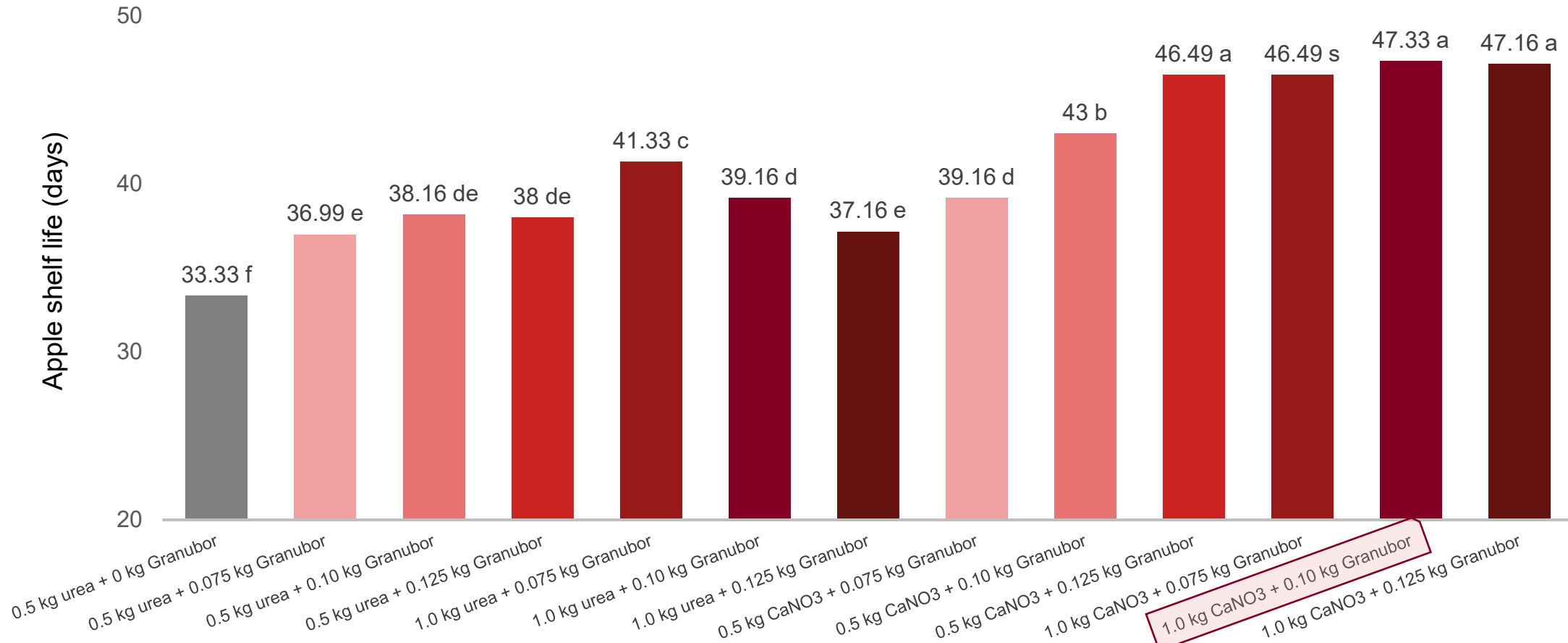


The highest content of fruit sugar resulted in gains of 20.8% compared to the control



\*Treatments: Fertilizer doses applied per plant/year

# Apple shelf life (days)



The best performance in terms of apple shelf life resulted in 41.5% longer shelf life compared to the control



\*Treatments: Fertilizer doses applied per plant/year



## Conclusions

The investigation revealed that soil application of *Granubor* at 100 and 125 g/apple tree in combination with calcium nitrate ( $\text{CaNO}_3$ ) at 1 kg/apple tree, was found to be most effective for maximizing apple yield and quality closely followed by the application of *Granubor* at 100 and 125 g/apple tree along with urea at 1 kg/apple tree.

The superior performance of these treatments is driven by the synergistic effects of calcium and boron, which optimize nutrient availability, improve fruit set, and minimize fruit drop to ultimately maximize apple productivity. As essential nutrients for apple trees, calcium and boron fundamentally regulate reproductive growth and structural development. Both elements are directly involved in pollen germination, pollen tube growth, cell wall formation, and the overall viability and formation of flowers and fruits.

