

## Abstract

Root development is a critical factor influencing nutrient uptake, plant stability, and overall crop performance. In corn, the crown roots contribute significantly to anchoring the plant and absorbing nutrients, while brace roots provide additional support and stability, especially under adverse conditions. Cover crop interseeding, defined as planting cover crops alongside a primary crop, could alter the corn root system, potentially benefiting corn performance. The objective of this study was to investigate the effects of cover crops such as buckwheat, pigeonpea, and white clover—and their mixture, interseeded at low, medium, and high seeding rates under conventional and reduced till conditions, on the number and length of brace and crown roots of corn. Cover crops were interseeded at the V4-V5 corn growth stage, and root samples were collected at corn's physiological maturity. Under conventional till, corn brace root number increased when interseeded with pigeonpea at low seeding rate, compared to no-cover crop and fertilizer conditions. Similarly, the corn crown root number increased when interseeded with the cover crop mixture at standard seeding rate compared to no-cover crop conditions under conventional till. Cover crops did not impact corn brace and crown root numbers under reduced tillage conditions. Further, cover crop and tillage treatment did not have an impact on corn brace and crown root lengths. Overall, while some positive impacts of cover crops on root development were observed, trends were not consistent across all treatments. This suggests that positive belowground interactions from cover crop interseeding may take time to manifest.

## Introduction

The corn root system is vital for nutrient uptake, water absorption, and plant stability. Mature corn root system (Fig. 1) consists of brace and crown roots, each playing a unique role. Crown roots, from the stem base, anchor the plant and absorb nutrients and water from deeper soil layers. Brace roots, from aboveground nodes, provide additional support and help uptake resources from the upper soil layers. Alterations in the root system can impact resource uptake efficiency. For example, increased brace and/or crown roots improve stability and resource uptake.

Cover crop interseeding involves planting cover crops alongside the main crop, allowing them to grow during the main crop's season. This provides continuous ground cover, improves soil structure, increases organic matter, and promotes beneficial soil microorganisms. These benefits could enhance root growth and resource uptake in the main crop. However, careful management of cover crops is crucial to maximize the belowground interactions.

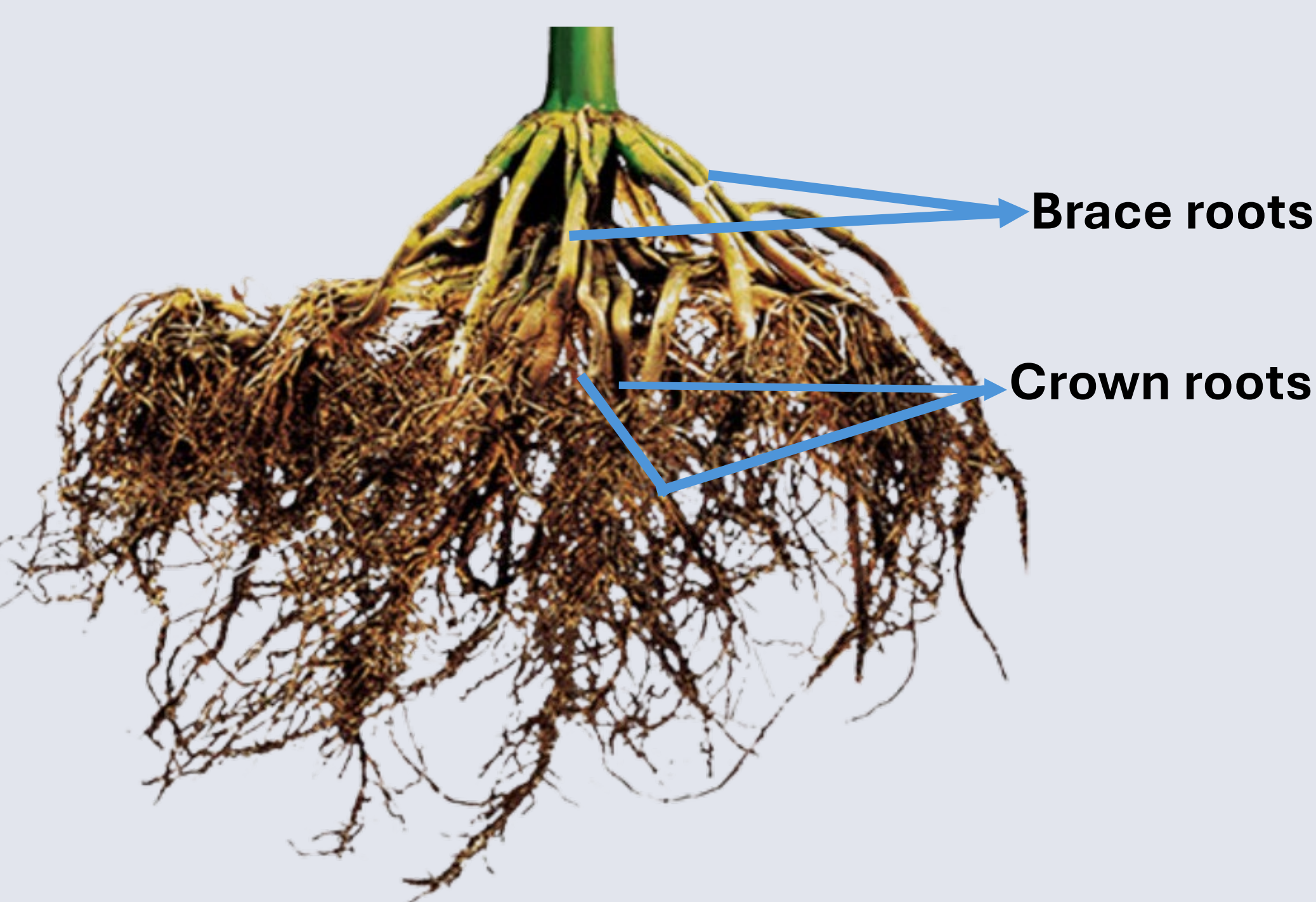
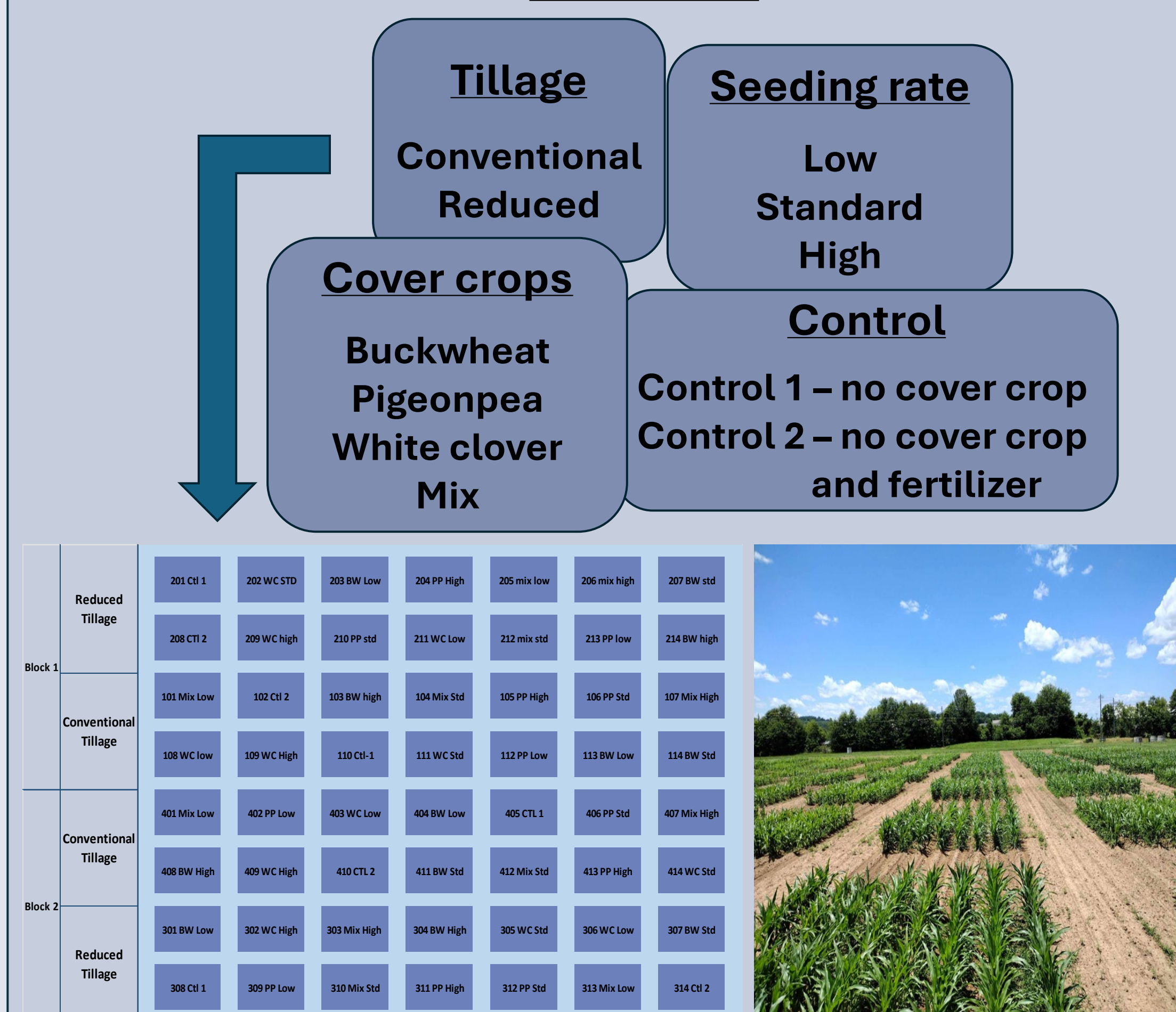


Figure 1. Mature root system of a corn plant.

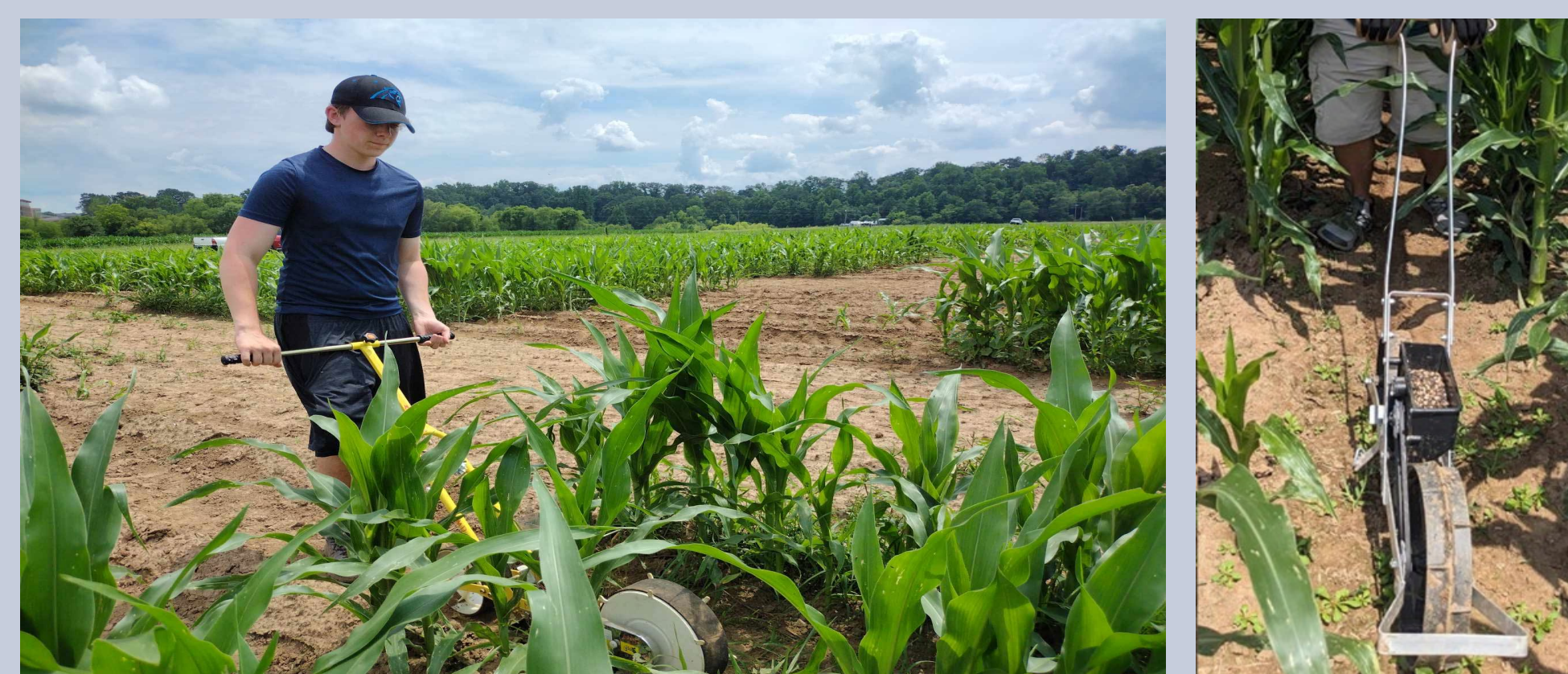
## Objectives

The objective of this study was to investigate the effects of tillage, interseeded cover crops (buckwheat, white clover, pigeonpea, and their mixture), and seeding rates on the number and length of brace and crown roots of corn.

## Methods



The field experiment had a three-factor factorial treatment design laid out in a split-plot randomized complete block design.



Cover crops were interseeded at the V4-V5 corn growth stage.



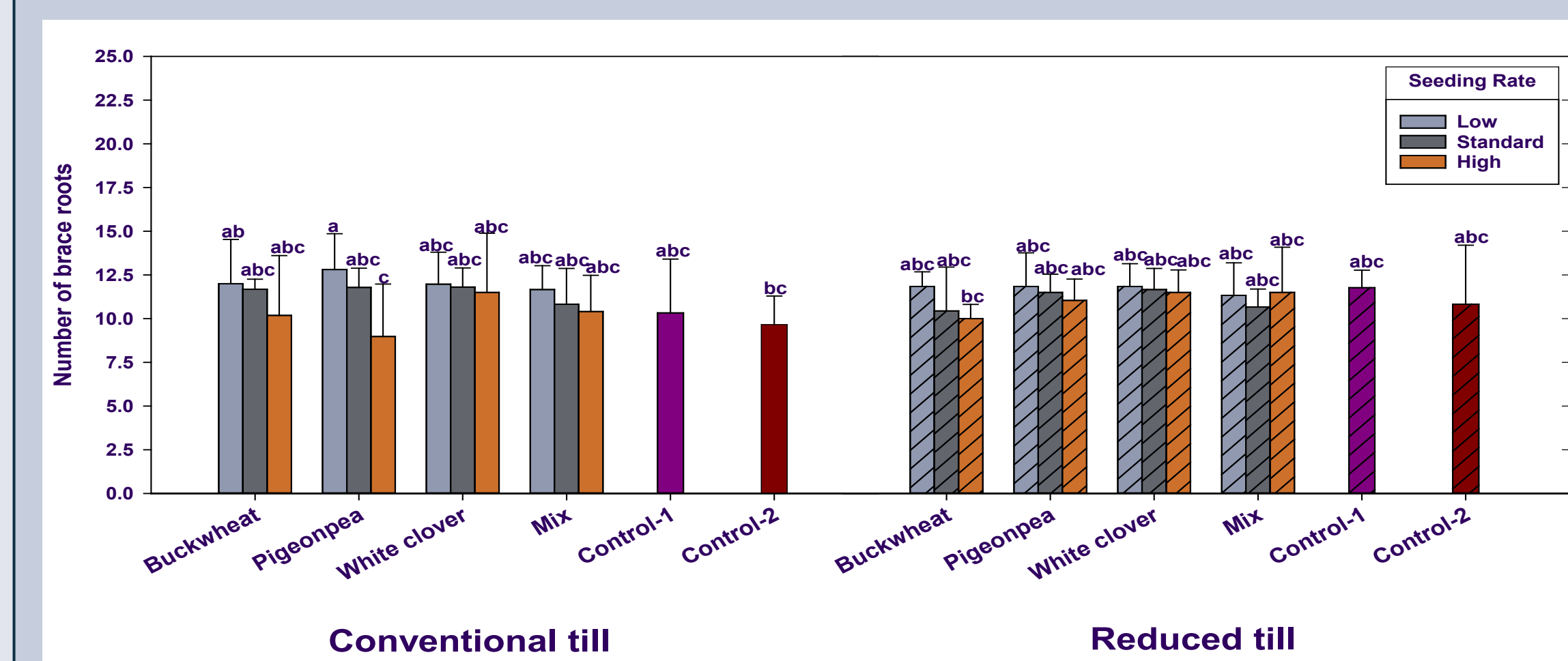
Corn field with interseeded buckwheat, pigeonpea, white clover and their mixture (from left to right) at 22 days after interseeding.

At corn's physiological maturity

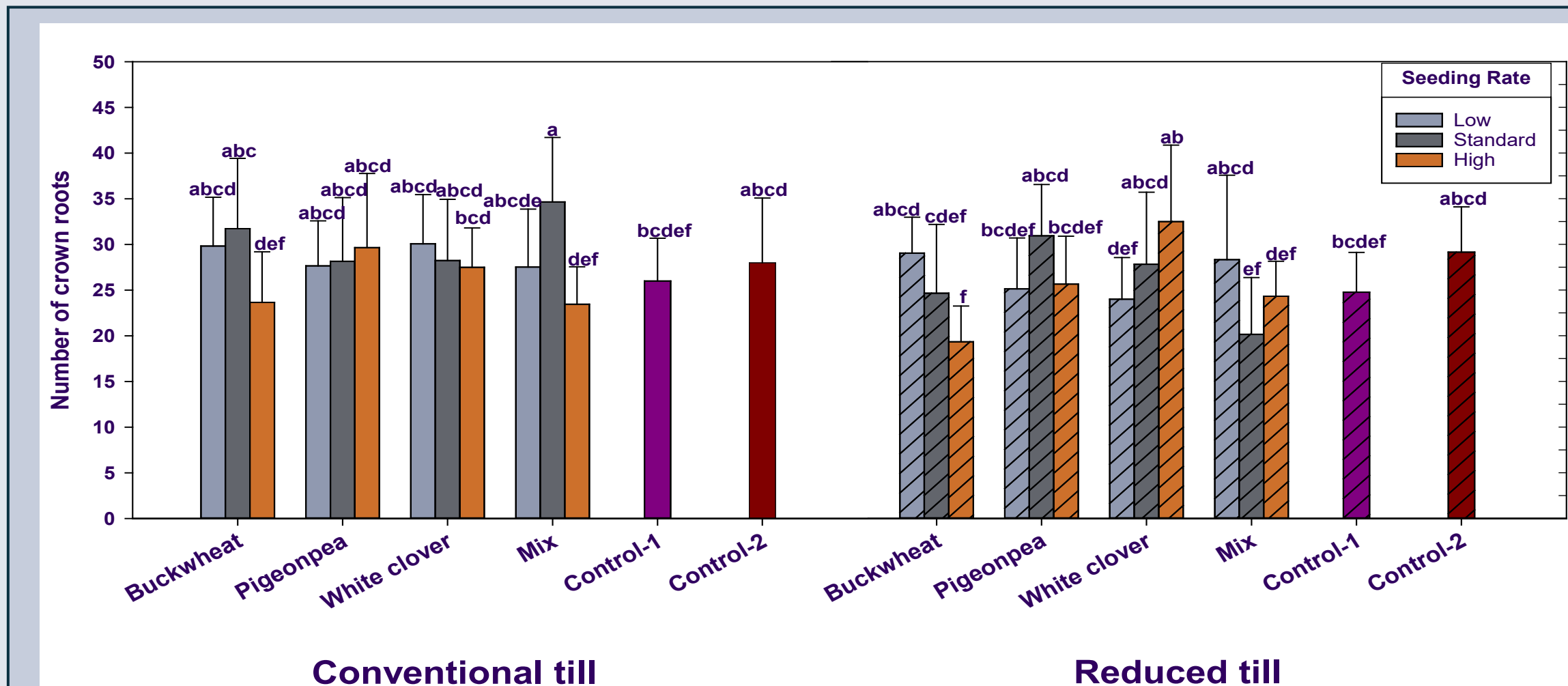


A. Corn root samples excavated using a shovel from soil profile occupying a volume of 755.2 in<sup>3</sup> (8 x 8 x 11.8 inch) B. Excavated corn root still enclosed in soil C. Cutting clean root to separate and count brace and crown roots D. Measuring brace root length, and E. crown root length

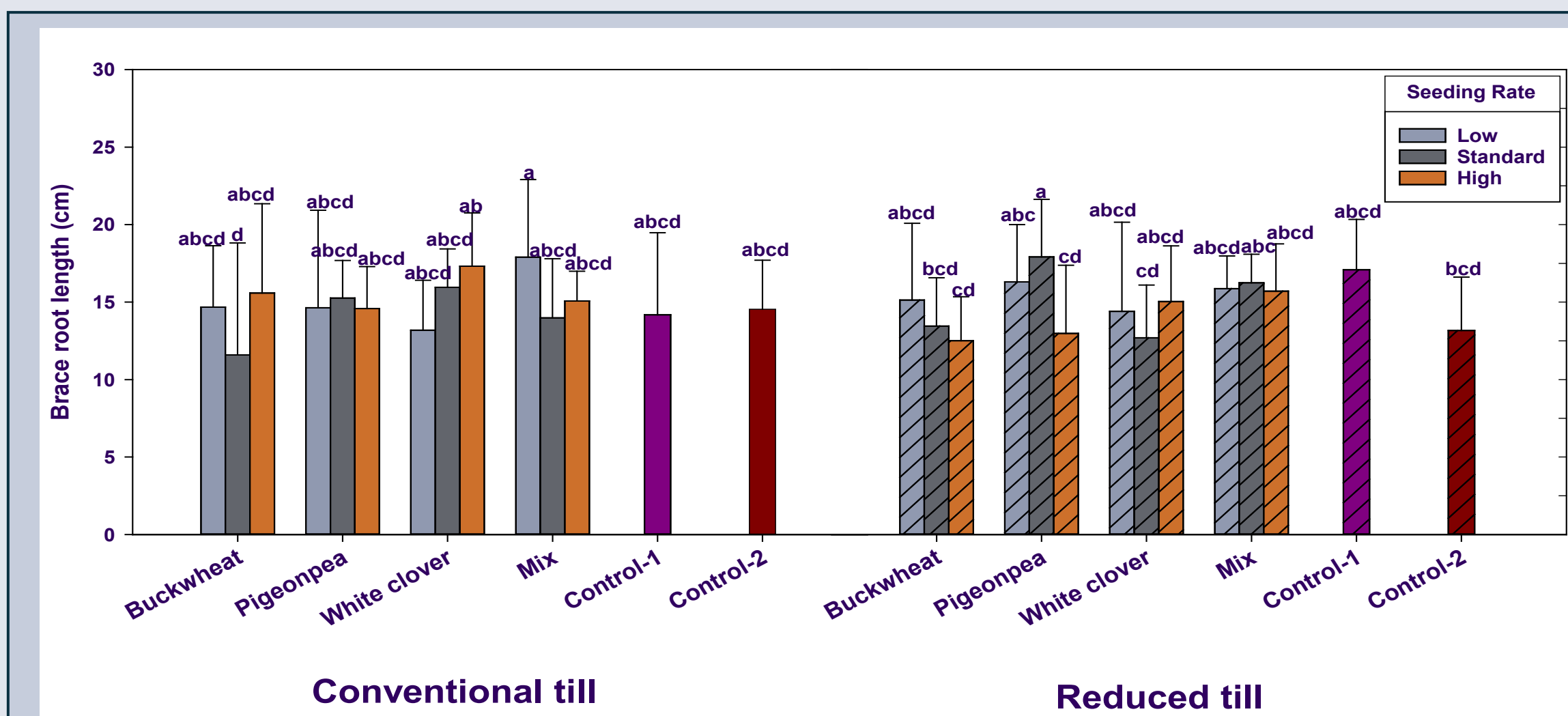
## Results



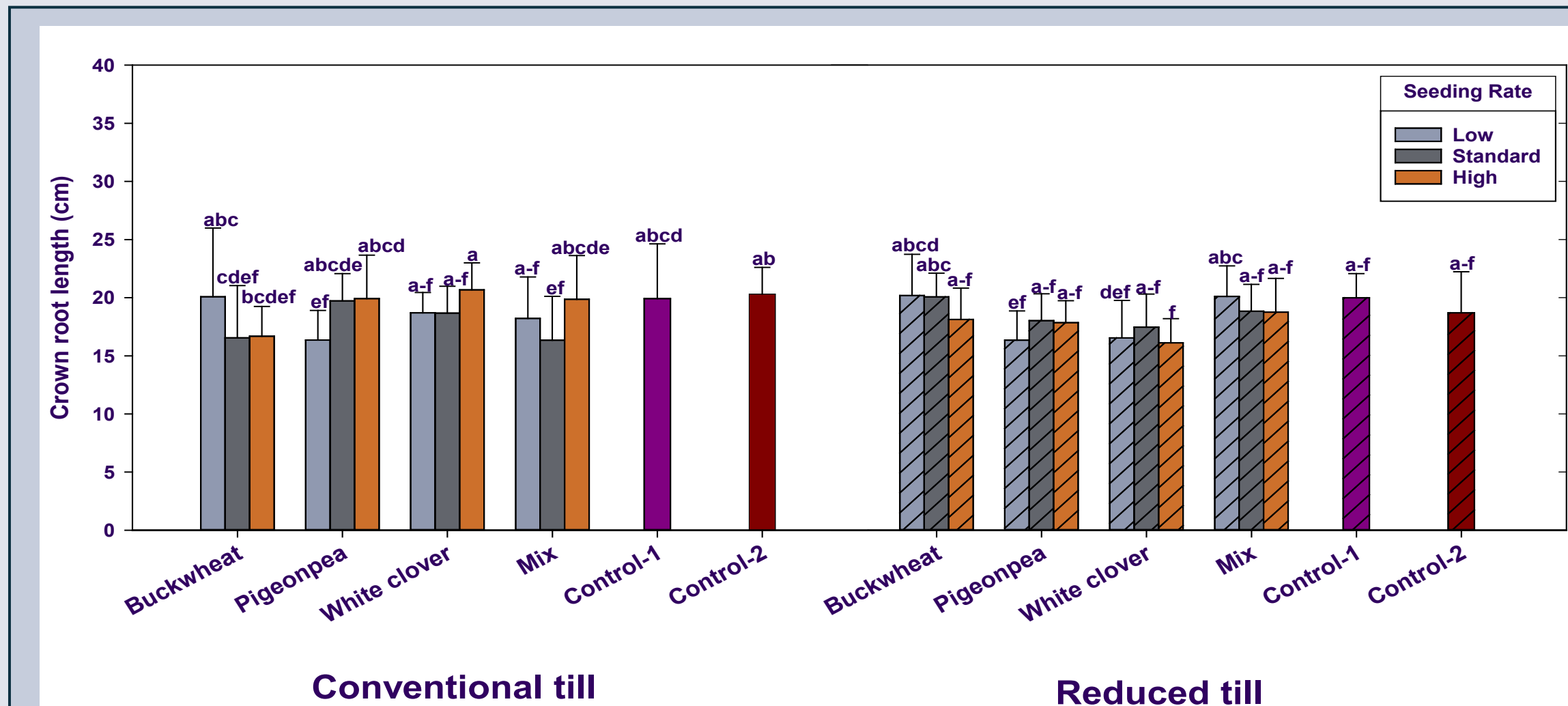
- Under conventional till, number of brace roots of corn was statistically higher when interseeded with pigeonpea at low seeding rate compared to control 2.
- The number of brace roots was not statistically different among all treatments including controls under reduced tillage condition.



- Under conventional till, number of crown roots of corn was statistically higher when interseeded with the mixture at standard seeding rate compared to control 1.



- Cover crop and tillage treatment did not have an impact on corn's brace root length.



- Cover crop and tillage treatment did not have an impact on corn's crown root length.

## Conclusions

While some positive impacts on root development were observed, trends were not consistent across all treatments. This suggests that positive belowground interactions from cover crop interseeding may take time to manifest, as these results are based on the first year of the study. Future research should continue to monitor these interactions over multiple growing seasons to determine the long-term effects of cover crop interseeding on corn root development and overall crop performance. Additionally, understanding the specific conditions under which these interactions are beneficial or detrimental will be crucial for optimizing cover crop management practices.