

Introduction

- Soil fumigation and cover crop are important practices before potato planting to suppress soilborne disease/nematodes in the Columbia Basin.
 - Typical fumigants include Metam sodium (MS), Telone, Chloropicrin (CP).
 - Mustard is a typical cover crop because of its natural biofumigant properties.
 - Wheat is also planted to reduce soil erosion and suppress weeds.
- Fumigants may suppress non-target microorganisms and impact soil health and nutrient availability, but the effect are largely unknown.
- Little information is available on the effect of cover crops on the soil health of potato fields in the Columbia Basin.

Objectives:

- Compare the impact of various fumigant materials and different cover crops on the soil health, nitrogen dynamics, crop growth, and potato productions.
- Investigate the interactive effects of soil fumigation and cover crop in the potato cropping system.
- Introduce the best options among the selected treatments (fumigation and/or cover crop) to crop industries.

Materials and Methods

- A field trial was conducted on fine sandy loam soil at the field facility of Hermiston Agricultural Research and Extension Center.
- Split-plot design with Four replications. The main plot (with soil fumigants) size is 100 ft x 11 ft. Subplot (with cover crops) size: 20 ft x 11 ft.
- In late August 2024, cover crops (wheat, pea, mustard, arugula, and no cover crop control) were planted; all the crops germinated fast and grew well.
- In late November 2024, the cover crops were terminated, and all the plants were tilled under and then integrated into the surface 20 cm.
- In mid-March 2025, soil was fumigated with Telone, MS, CP, and no fumigant control; all the fumigants were applied by shank injection.

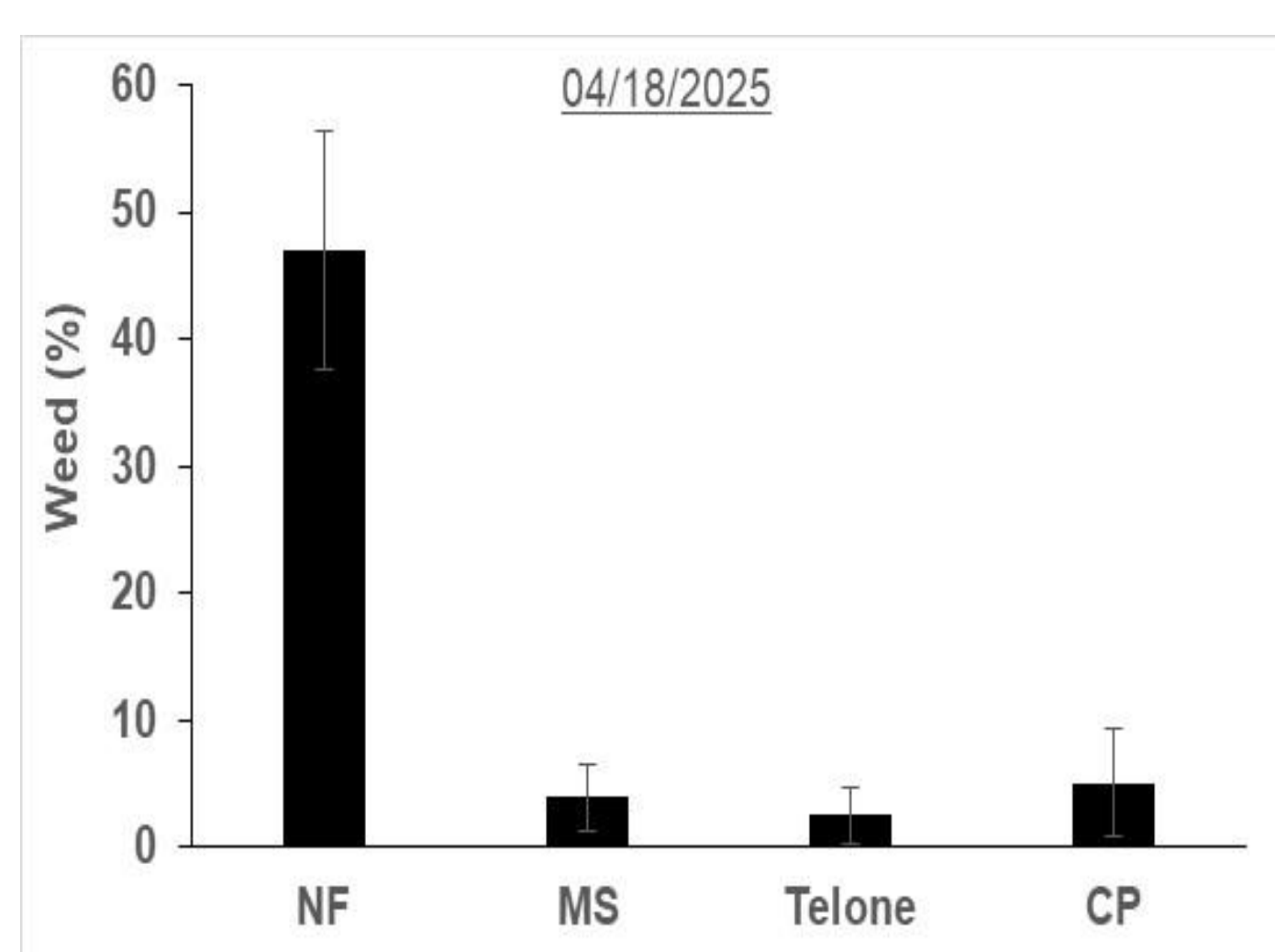
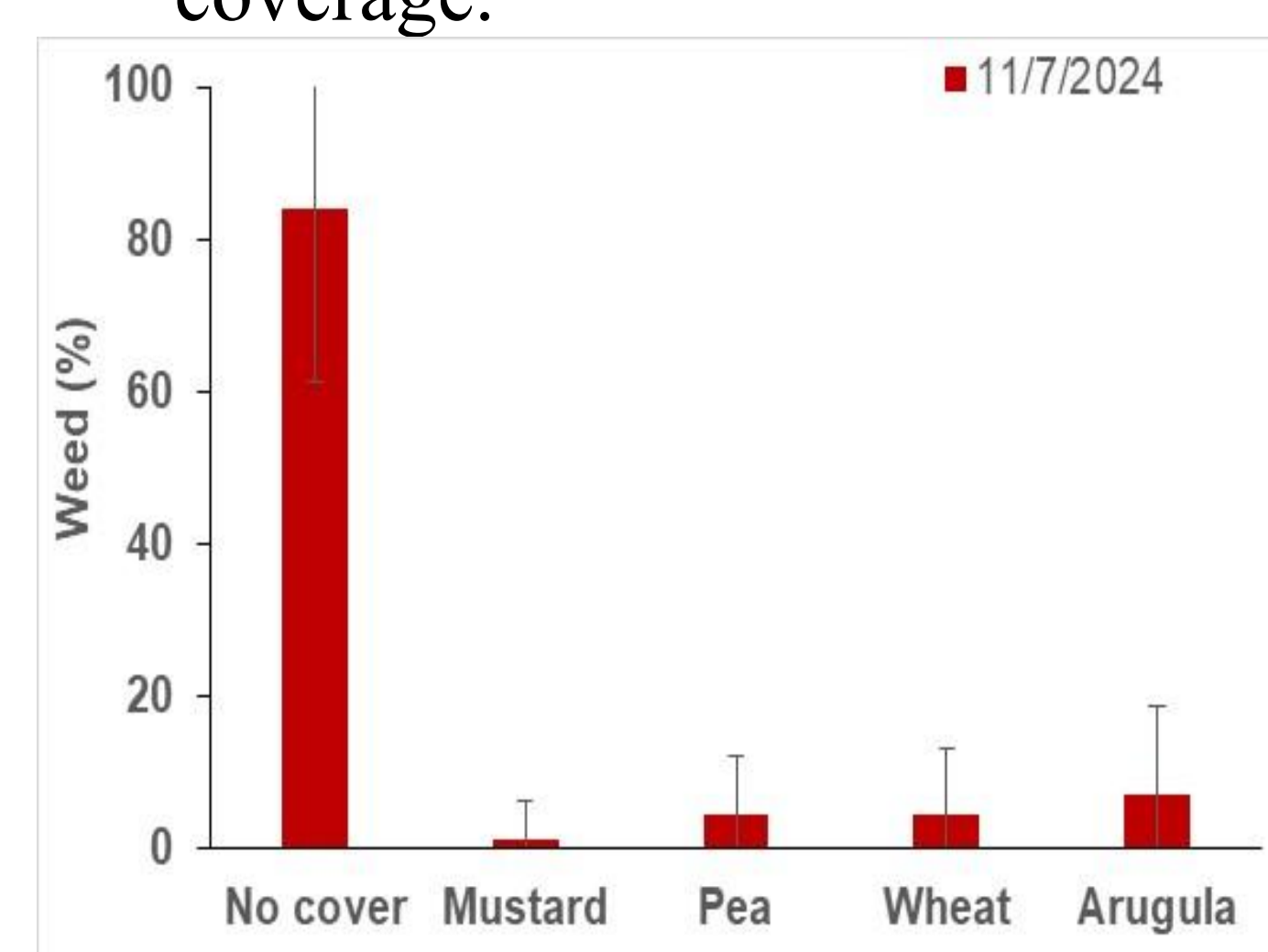
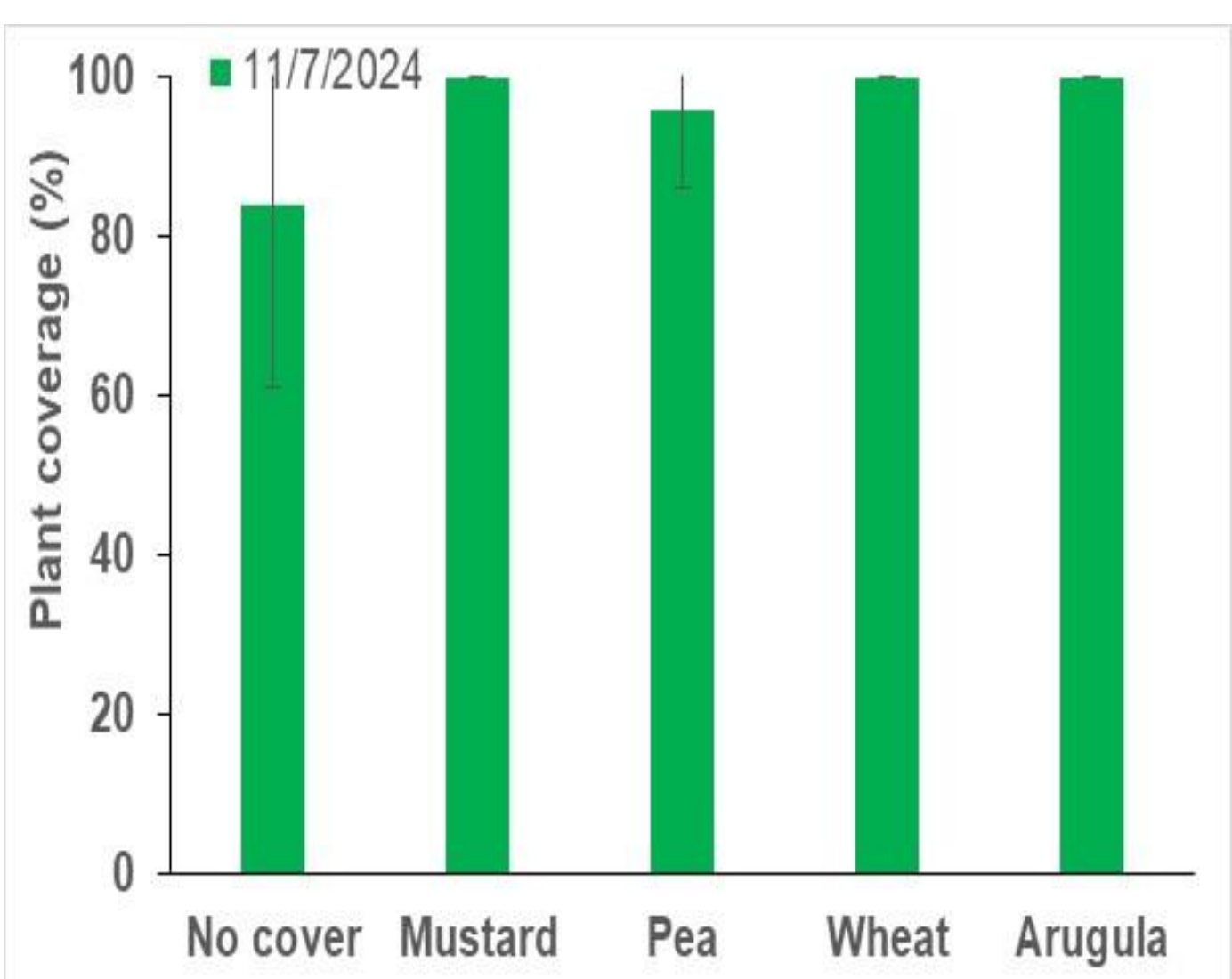


- Potato Russet Burbank was planted in late April and harvested in September.
- Sampling & Measurement:

- Crop (cover crops and potato) growth and biomass, weed infestation, and potato yield and quality.
- Soil Health Test (Haney Test with 31 indicators: Physical, Chemical, and Biological).
- Microbial community structure (PLFA test)
- Microbial communities, soilborne diseases, and nematodes)

Results

Cover crop growth:



- The plot without cover crop was heavily covered by weeds

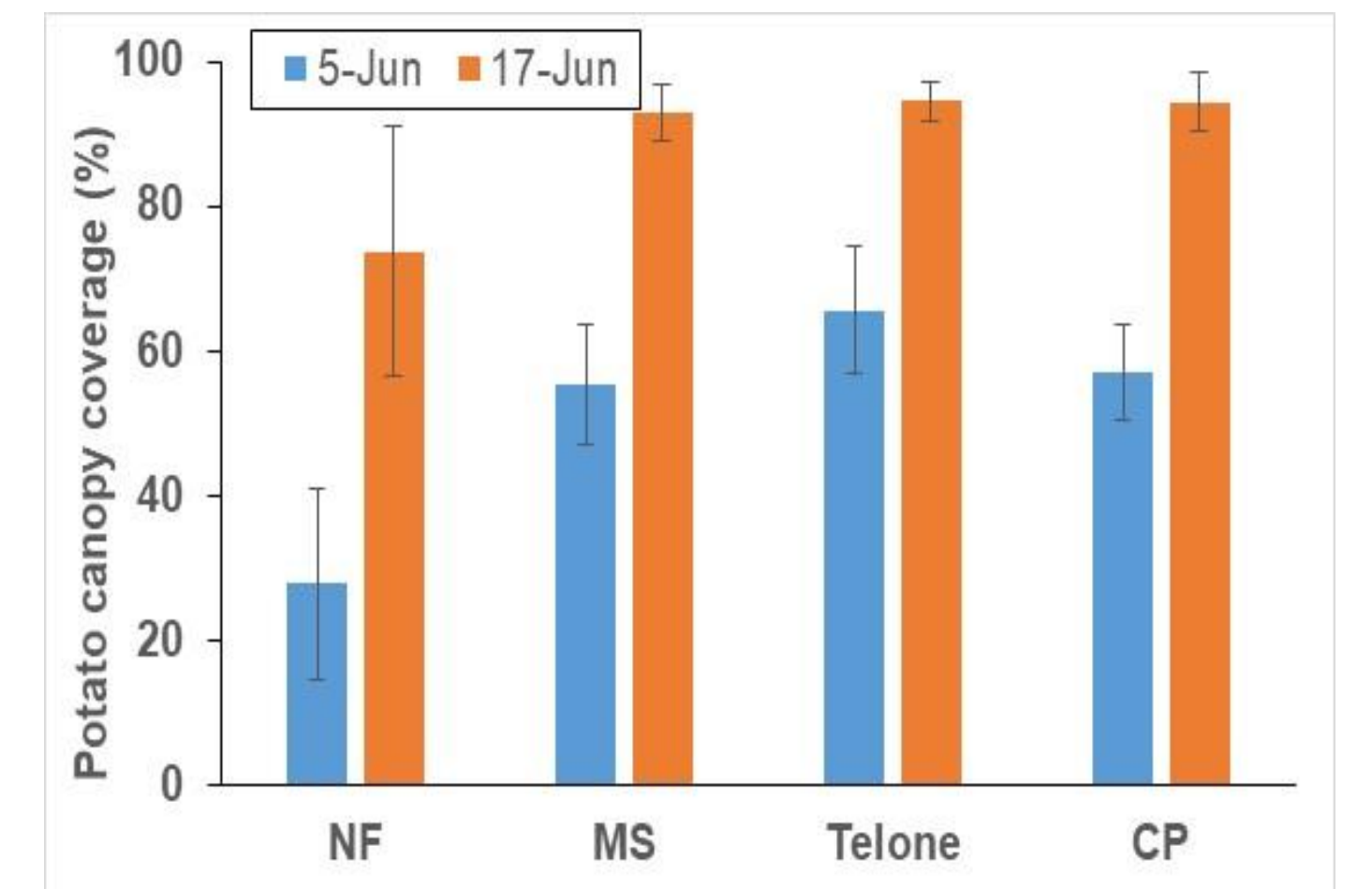
- Soil fumigation significantly controlled weed infestation.

Potato growth:



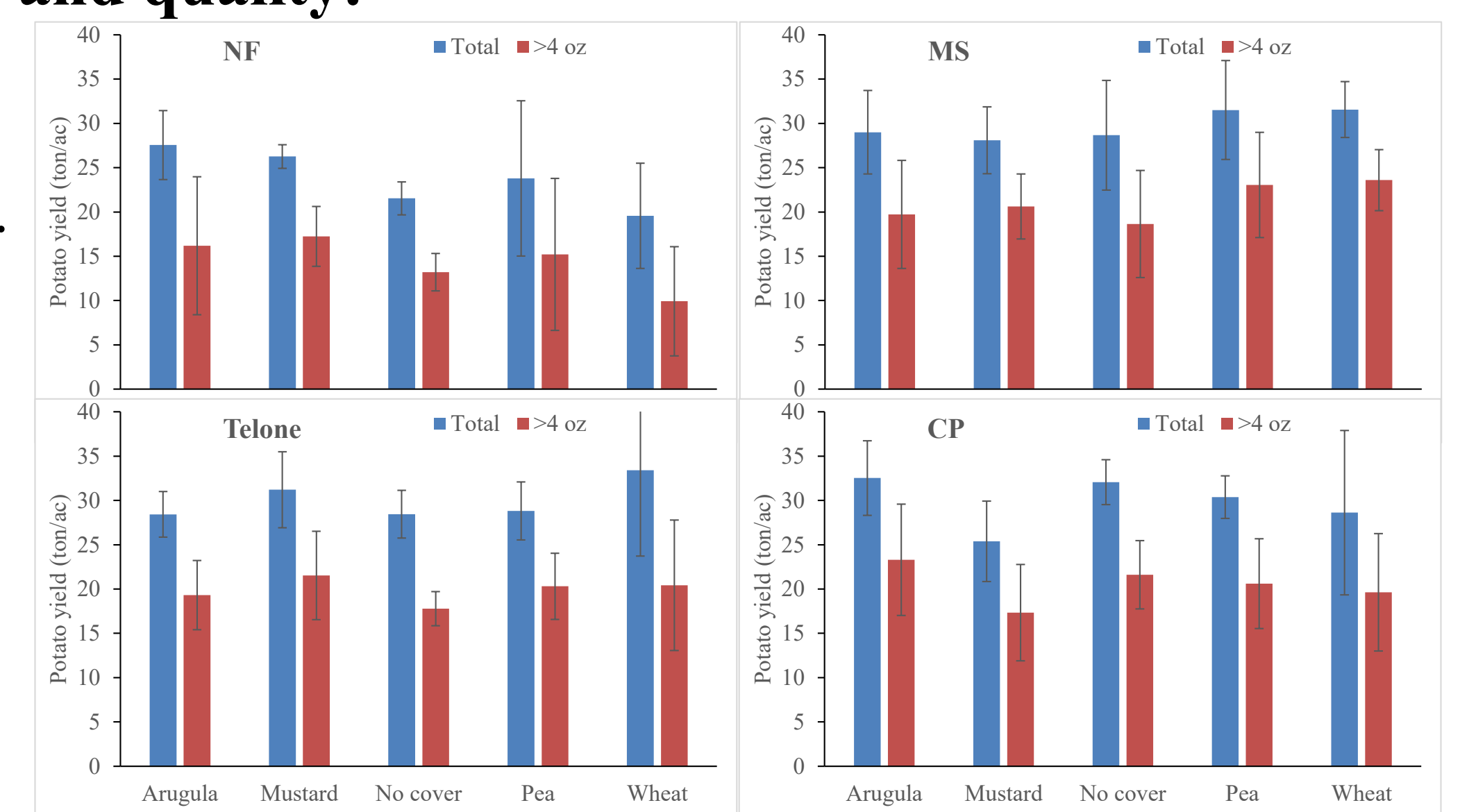
Potato growth under different fumigation treatments. (Observed on June 5, 2025)

- Distinct differences in potato growth were found between fumigation- and non-fumigation treatment.
 - Initially, lower potato coverage in the NF plots than the fumigated plots, but the differences disappeared with time.



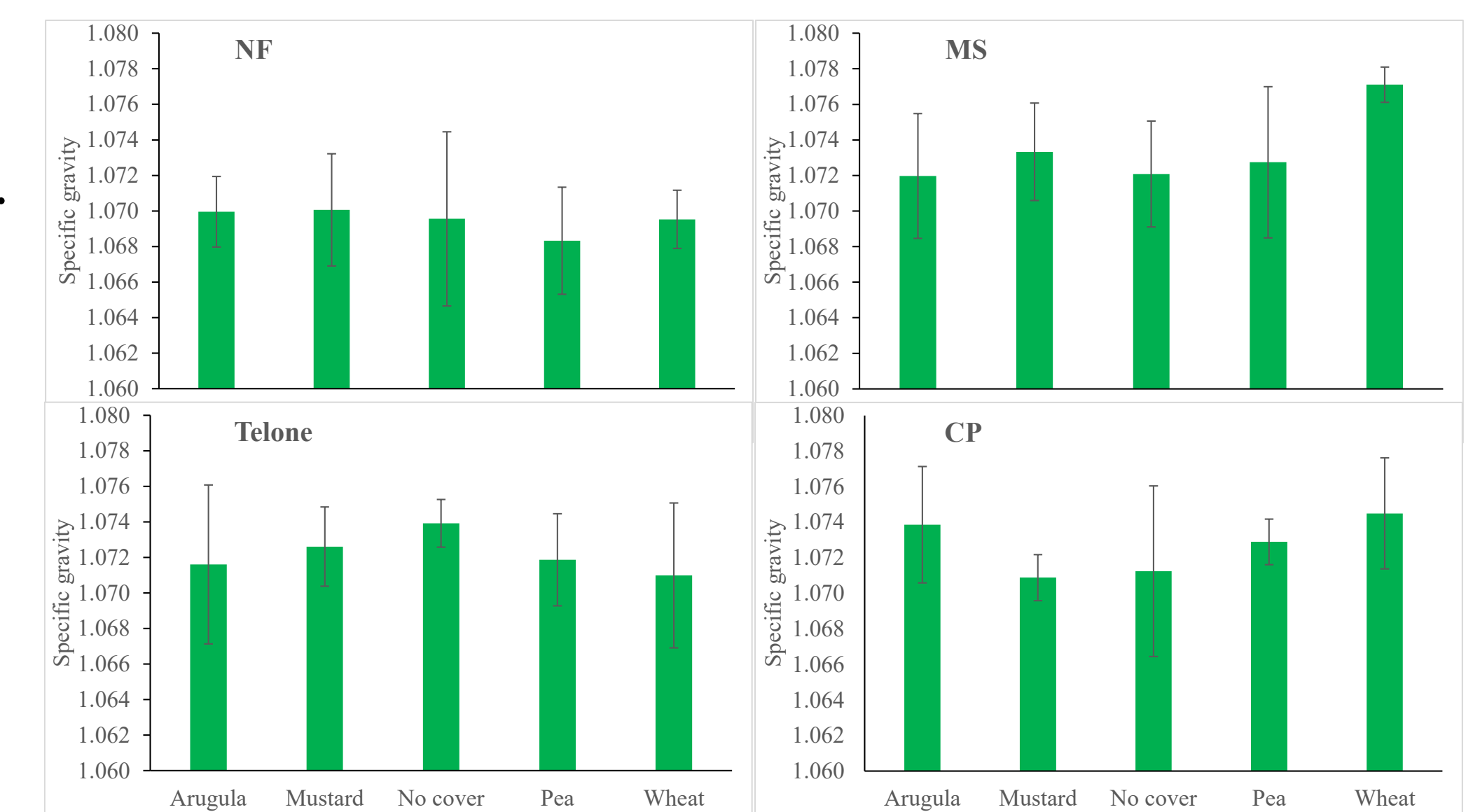
Potato production and quality:

- Yields:
 - Fumigation > No-fumigation.



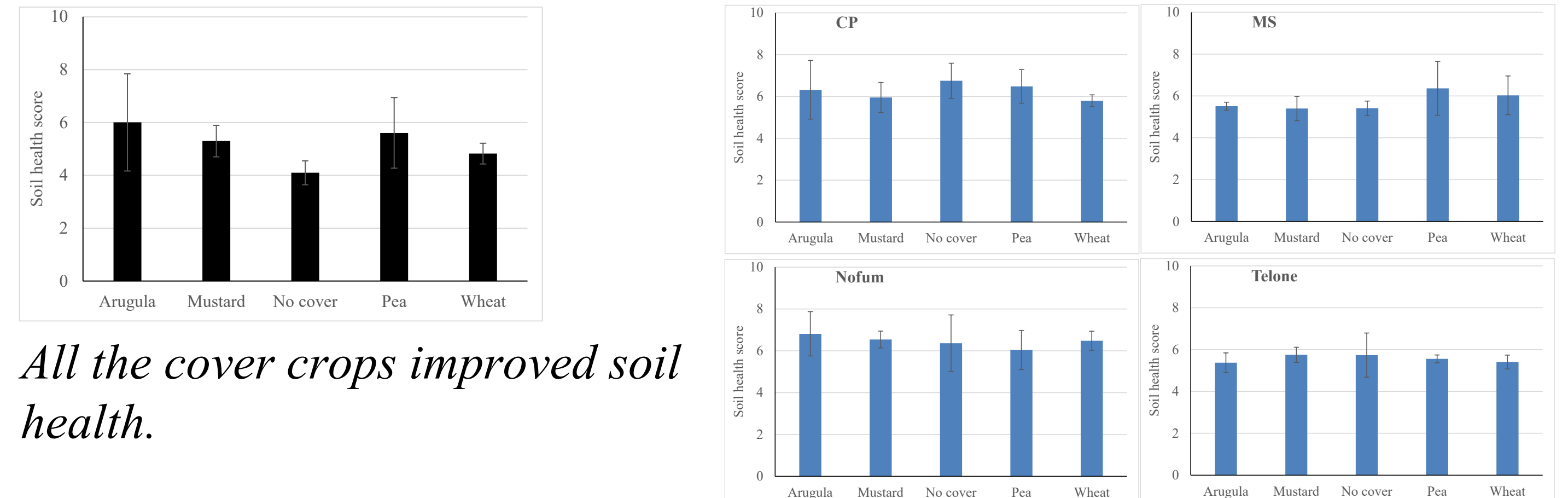
- Mustard, Arugula > no cover in NF plots.

- Specific gravity:
 - Fumigation > No-fumigation.



- No differences among cover crops.

Soil health score:



- All the cover crops improved soil health.

- Soil fumigation generally reduced soil health score.

- Upon potato harvest, the impact of soil fumigation on soil health score disappeared.

Summary

- Cover crops and soil fumigation suppress weed infestation.
- All soil fumigant materials improve potato growth in this trial.
- Soil fumigation tended to increase potato yield, especially marketable yield, and specific gravity.
- Mustard and arugula tended to increase potato yield under the non-fumigation condition.
- Soil health varied with the growing stages of the potato production system:
 - Being improved by cover crops, reduced by soil fumigation, and then recovered upon potato harvest.

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