

# Using Cover Crop Mixtures to Reduce Nitrate Leaching and Fertilization in Potato Production

## Block 2

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### Rationale

Tuber yield and quality of potatoes are highly affected by soil N fertility levels. Often, farmers over-apply nitrogen fertilizer to ensure against yield loss, which results in increased costs of production, it is estimated that about 40% of potato production costs is related to N fertilizer application. On the other hand, high mobility of nitrate in the soil profile makes it susceptible to leach to the lower soil levels resulting in water contamination and environmental concerns. Soil fertility practices such as tailoring N fertilizer rate and selecting appropriate type of cover crops in rotation with potato can not only reduce nitrate leaching but enhance profitability by cutting fertilizer costs. By scavenging such large quantities of nitrate, cover crops contribute to protecting water quality and decrease enormous health care costs caused by nitrate contaminated water. Therefore, the objectives of this study were to (i) evaluate influence of different cover crop mixtures on minimizing nitrate leachate caused by excess N fertilization and (ii) to study nutrient density and tuber yield of potatoes as affected by cover crop mixtures and N fertilizer.

### Materials and Methods

Five cover crop mixtures including oat/peas, rye/peas, daikon/peas, daikon/rye, and daikon/oat, were planted in late August at the research farm of University of Massachusetts, Amherst in 2013 and 2014. Prior to planting cover crops, nitrate collector units filled with nitrate absorbent resin were prepared and buried below the cover crop root zone based on plant species in the mixtures (Figure 1). Nitrate absorbent units were collected at different intervals and before cover crop termination in the winter and were later analyzed in the lab for nitrate determination (Figure 2). Early in the spring, cover crop residues were disked, potato seeds were planted, and four N fertilizer levels (0, 50, 100, and 150 kg ha<sup>-1</sup>) were banded in rows at the time of planting. Potatoes were harvested in early August and separate tuber samples were taken to calculate yield and nutrient density.

### Results

The results of the first year of this experiment indicated that cover crop mixtures reduced the amount of nitrate leaching compared with no cover crop plots. The highest amount of nitrate leachate was collected from no cover crop plots followed by peas-forage radish (P+FR) mixtures. Nitrate leaching was minimum in rye-forage radish (R+FR) compared with other mixtures and there was not a significant difference between rye-peas (R+P) and oat-peas (O+P) mixtures (Figure. 3). Cover crop mixtures produced higher yield compared with no cover crop plots. While the highest level of N increased tuber yield in no cover crop plots, mixtures produced higher tuber yield at lower N rates, the highest tuber yield was obtained from oat-forage radish (O+FR) (25.8 ton ha<sup>-1</sup>) and oat-peas (O+P) (26.1 ton ha<sup>-1</sup>) mixtures, fertilized at 100 kg N ha<sup>-1</sup>. Application of 150 kg N ha<sup>-1</sup> decreased yield in oat-forage radish and oat-peas plots compared to 100 kg N ha<sup>-1</sup> (Data not shown). Oat-Forage radish mixture was more efficient in providing nutrients for the following potatoes when no N fertilizer was applied (Data not shown).



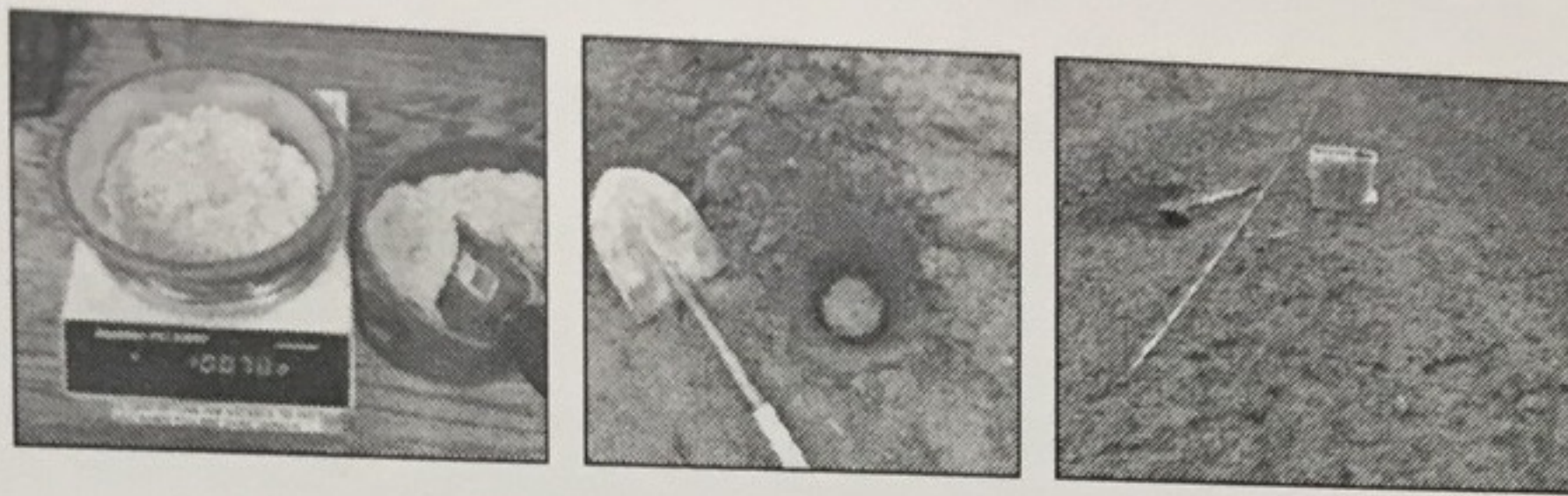


Figure 1. Nitrate absorbent resin units buried before planting cover crops in August

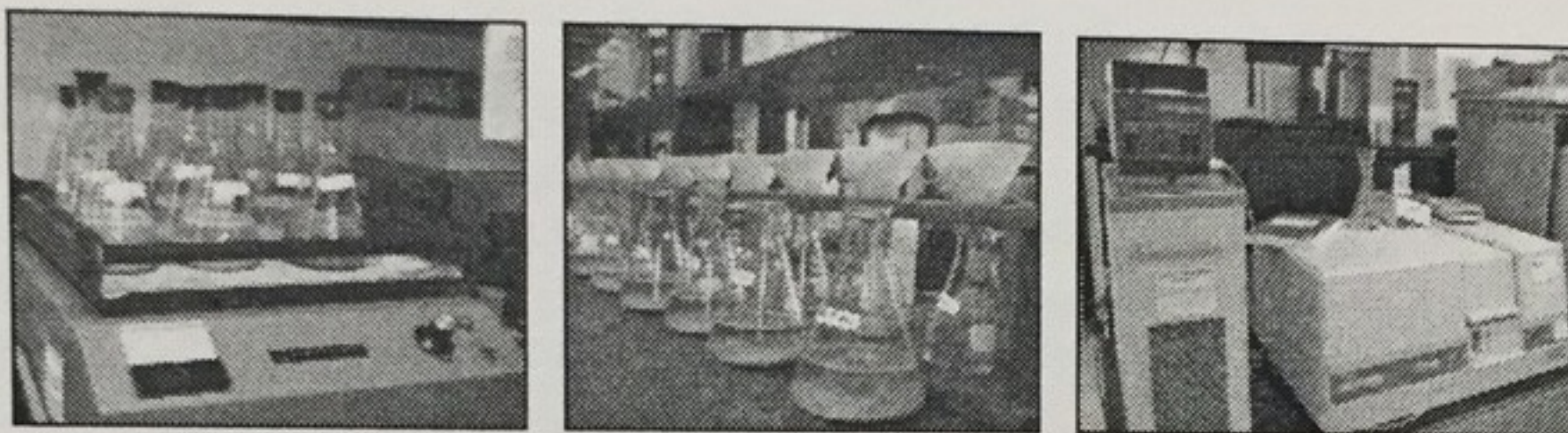


Figure 2. Extracting nitrate from resins and nitrate determination in the lab

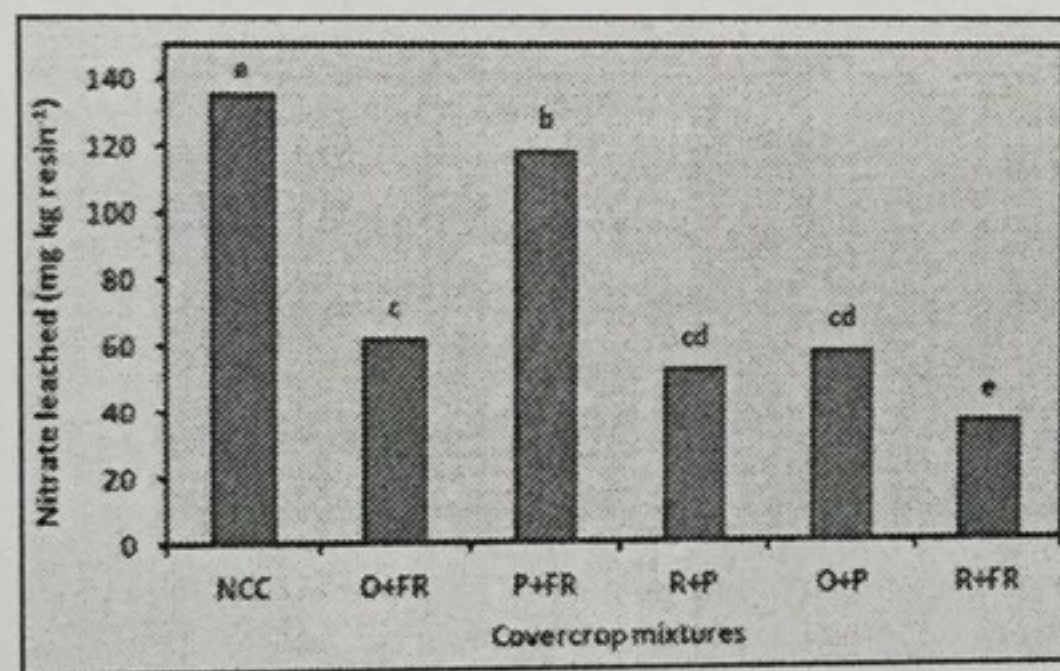
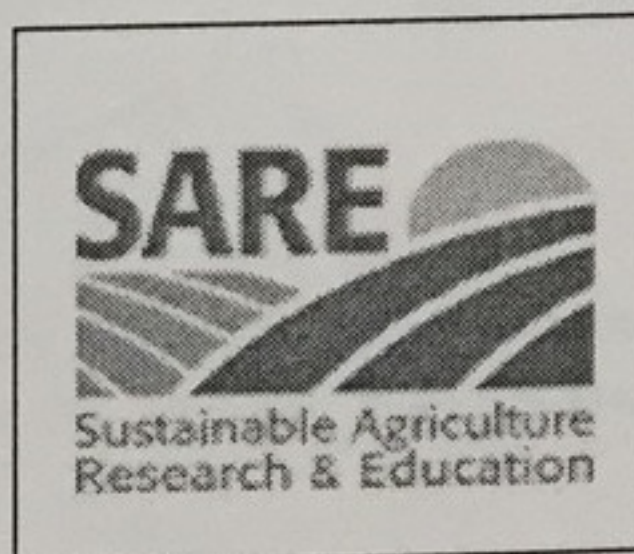


Figure 3. Nitrate leaching as affected by cover crop mixtures

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