

Cover Crops: Growing Potatoes with Less Nitrogen Fertilizer

Nitrogen is one of the most important key nutrients for growth and developments of potato plants. An adequate early- season nitrogen supply is important to support vegetative growth of plants and high yielding potatoes. However, over application of nitrogen in potato fields along with high risk of nitrate leaching by rainfall or irrigation increases costs of production and contamination of water resources. Nitrogen management practices such as tailoring nitrogen fertilizer rates and integrating appropriate cover crops into potato production can reduce nitrate leaching and enhance profitability by cutting fertilization costs. Cover crops can provide several benefits to cropping systems. In the Northeast, cover crops are usually used to protect the soil against winter erosion, or to add nitrogen to the succeeding crops. However, there are several other benefits associated with cover crops; they can increase soil organic matter, alleviate subsoil compaction, suppress weeds and other pests, and increase soil microbial activity and diversity. Rye is the most common cover crop used by growers in Massachusetts to prevent soil erosion during the winter. Despite the fact that cereal cover crops are more efficient in nitrate leaching prevention than legumes, rye may not be a reliable source of nitrogen for the succeeding crops, especially for those early-planted in the spring. This is mainly because of early termination of rye, which leaves low biomass residues and therefore less nitrogen will be available for the following crops. In our experiment, we assumed that mixtures of cereals with legume or brassica plants can improve the synchrony of released nitrogen from cover crop residues with potato nitrogen demands. Below is a list of cover crop species that we used as mixtures in rotation with potato:

Rye

Rye is the hardiest of cereals and outperforms all other cover crops on infertile, sandy, or on poorly prepared land. It is adapted widely, but grows best in cool, temperate zones. Compared to other cover crop seeds, rye is inexpensive and easy to establish. Rye is one of the best cool-season cover crops for outcompeting weeds, especially small-seeded annuals such as lambsquarters, redroot pigweed, velvetleaf, chickweed, and foxtail. Rye also suppresses many weeds allelopathically (as a

natural herbicide). Because of its root system, rye protects the soil against erosion, especially in sloping fields, contributes to soil health, and improves soil drainage. Rye can be managed as a cover crop or be harvested as silage. In our experiment, the seeding rate for rye was 90 lbs/A as monoculture, and in mixture with winter pea and forage radish (rye + forage radish; rye + pea), seeding rates were 45 and 60 lbs/A, respectively. Depending on the termination time, you can either kill rye using a burn down herbicide or by thoroughly flattening and crimping the rye stems with a rolling stalk chopper or roller crimper. You need to be cautious not to kill rye late because it can deplete soil moisture and could produce more residue than your tillage systems can handle.

Oat

Oat is a very useful cover crop in the Northeast, as well as Massachusetts. This is a low cost and reliable cover crop that winterkills in Massachusetts. Oat will grow very vigorously and straight up when seeded early in the fall. Similar to rye, oat scavenges excess nutrients in the soil and because of quick growth and high biomass production, it can suppress weeds. It provides good cover during the winter and because of fibrous root system, oat contributes to holding soil particles and improving soil health. Since oat is winter killed in Massachusetts, the need for burndown herbicide or crimping is eliminated and only a light disk is enough to incorporate residues with the soil. We used 100 pounds of oat seeds per acre (using a grain drill) for monoculture and in the mixture with winter pea or forage radish (oat + winter pea; oat + forage radish), seeding rates were 50 and 60 lbs/A, respectively.

Forage radish

Forage radish is relatively newcomer cover crop in the Northeast and is known for its rapid fall growth, great biomass production, and nutrient scavenging ability. Forage radish is used increasingly as winter or rotational cover crops in vegetable production. It has a large taproot that can break through plow pans better than the fibrous roots of cereal cover crops. Also, taproots can scavenge nutrients in deeper soil. Forage radish winter kills in Massachusetts and decomposing roots and leaves release their nutrients quickly. Also, forage radish releases chemical compounds that may be toxic to soil borne pathogens and pests, such as nematodes, fungi and some weeds. Please note that forage radish is more sensitive to late planting compared to rye or oats and late planting results in weak biomass production, and consequently lower availability of nitrogen to the following crop. According to our experience, planting should occur no later than August 25 to September 1 in Massachusetts, if you want to get the most out of forage radish as a cover crop. In spite of more

expensive seeds compared with cereals, seeding rate is low and 6 to 8 lbs/A is enough to have an acceptable cover and biomass. In our experiment, the seeding rate for forage radish in mixture with pea, rye, and oat were 2.5, 3, and 3 lbs/A.

Winter pea

Including legume green manure crops such as winter pea can increase nitrogen availability to subsequent potato crops. Austrian winter pea is a low-growing, vining annual legume. It is sometimes called black pea or field pea. Austrian winter pea produces abundant vining forage and as nitrogen fixing plants, are considered as one of the top nitrogen producers that can yield from 50 to 190 lb N/A. Winter pea can withstand temperatures as low as 10 F with minor injury but will ultimately be winter killed in Massachusetts. Their succulent stems break down easily and are a quick source of available nitrogen if the cash crop is planted early in the spring. If you plan to use winter pea as a cover crop in Massachusetts, try to select the most winter-hardy cultivars such as Granger, Melrose, or Common Winter. Please note that to get good results; winter pea should be inoculated with bacteria just prior to planting. The most common inoculant for winter pea is *Rhizobium leguminosarum* R. Leg. The seeding rate for winter pea in mixture with forage radish, oat, and rye was 70, 50, and 50 lbs/A, in our field trials.

A key to successful use of cover crops is to choose the appropriate species to fit the specific goals of your intended use in the cropping system. As such, a grower should first identify a primary goal or use for the cover crop, characterize the conditions under which it will be grown, and then use this information to describe the ideal species before matching the description with the best available cover crop species.

Adapted by Emad Jahanzad from:

- *Managing Cover Crops Profitably, 3rd Edition.*
- *SARE learning center:*
[http://www.sare.org/product_search/results/\(crop_production\)/Cover%20Crops](http://www.sare.org/product_search/results/(crop_production)/Cover%20Crops)
- *UMass Extension vegetable program:*
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