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Utilizing Cover Crops in Vegetable Production Systems

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Vegetable growers can improve farm productivity and profitability by using cover crops. Cover crops normally are not intended to be harvested for cash sale; rather, their purpose is to naturally enhance crop and soil output. An intense vegetable cropping system removes large amounts of nutrients from the soil. Long-term fallow periods to naturally restore soil nutrients are not cost effective. Therefore, a crop rotation is needed that can utilize the maximum amount of vegetable production while allowing cover crops to help improve soil quality.

Benefits of Cover Crops

- Reduce weed pressure. Reducing initial weed pressure improves subsequent weed control strategies like herbicide applications and cultivation.
- Protect the environment from nitrate leaching by trapping residual nutrients left in the soil after harvest of the cash crop and then recycling these nutrients to the following crop.
- Cover the soil to prevent erosion, reduce soil compaction, add organic matter, and increase water infiltration.
- Improve biodiversity, increase the population of beneficial soil micro-organisms, attract beneficial insects, and suppress nematodes thereby building a more resilient system for long-term productivity.

- Create a new source of nutrients in the soil. By planting a legume cover crop, nitrogen can be added to the soil, allowing a reduction in purchased commercial nitrogen for the cash crop.

Types of Cover Crops

There are many options for vegetable growers when selecting the type of cover crop to plant. These options can be separated into two major categories: legume and non-legume. Growers need to determine the primary purpose of the cover crop being planted. Is it to add nutrients, recycle nutrients, improve soil structure, or deter pest problems? Also, cover crop seed can be blended to combine several purposes into one planting. This shotgun approach may solve several problems at the same time. Seed cost and availability need to be considered when making a selection.

A legume is a plant that fixes atmospheric nitrogen and creates a source of this essential nutrient in the soil for subsequent crops. The amount and availability of nitrogen following a legume cover crop can be quite variable. As an organic form, this nitrogen may be present in the soil as ammonium or nitrate. Plants can only absorb nitrate nitrogen, which also is very mobile in the soil. Therefore, rainfall can cause nitrate to move deeper into the soil profile beyond crop roots. Relying on nitrate nitrogen produced by

legumes in the fall of the year will be subject to leaching during winter months and may lose significant amounts by the following spring when crops need it. Maximizing the nitrogen available to the crop can be done by allowing legumes to overwinter and continue growth in the spring, at which point, a cash crop can be planted.

Examples of legume cover crops include clover (red, mammoth, sweet, crimson), hairy vetch, winter pea, cowpea, alfalfa, and soybean.

A non-legume is a plant that does not fix its own nitrogen. These types of cover crops are excellent at absorbing excess nutrients in the soil, creating plant biomass, and improving soil tilth. Care must be used when a grass type of cash crop (such as sweet corn) follows a grass type cover crop (such as cereal rye). Pests such as armyworm may infest the sweet corn as the rye is destroyed. A two week break between crops will allow pests to seek alternate hosts and will help minimize this problem.

Examples of non-legume cover crops include cereal rye, annual ryegrass, oats, wheat, sudangrass, buckwheat, mustards, and oilseed radish.

Managing Cover Crop Growth

The last thing a vegetable grower needs is to introduce a new weed to his/her farm. Care must be used when selecting and managing cover crops so as not to allow viable seed to be produced from a crop that may become a weed in the future.

Planting date for cover crops is directly related to the plant's ability to set seed. Even summer-planted cover crops may flower and produce seed if cool weather is delayed in the fall. Especially fast maturing species of cover crops include buckwheat and mustards. Tillage or herbicides may be used to prevent seed set.

If spring growth is undesirable in a cover crop, select species that naturally winterkill. However, be aware that snow cover, winter temperatures, and the amount of fall growth on a cover crop may influence its hardiness. Hairy vetch is an example of a cover crop that may or may not winterkill.

If herbicides are the preferred method of killing a cover crop, make sure that the label of the product used is read to determine any risk of carryover damage to subsequent vegetable crops. Annual ryegrass may

require several herbicide applications to control spring growth. A cover crop that is not killed before planting the cash crop may not have an herbicide option that would not also damage the vegetables.

Biofumigation

Cover crops that release natural insecticidal chemicals from their residues are called biofumigants. As the cell walls in these plants rupture, isothiocyanate escapes into the soil. This chemical, which is used in Vapam, has shown activity on many plant pests, especially nematodes. The brassica species of cover crops are recognized as the best source of biofumigation. This includes oilseed radish, oriental mustard, yellow mustard, brown mustard, turnip, and rape. Allow the cover crop to grow up to flowering stage, but do not let it set seed. Then flail chop and incorporate the residue for maximum biofumigation output. As a result, harmful soil nematode populations may be reduced.

Rotation Examples

As a vegetable grower plants cash crops through the rotation, there are many opportunities for cover crops to be included. With sufficient soil moisture and growing degree days, a cover crop can take advantage of open time when a cash crop is not being grown. Also, underseeding will establish a cover crop at the same time a cash crop is growing without interfering in its production. The following are examples of including cover crops in a grain and vegetable farming system.

Year 1	Spring	soybeans	
	Summer	soybeans	
	Fall	wheat	
	Winter	wheat	
Year 2	Spring	wheat	clover underseed
	Summer	wheat	clover
	Fall	clover	
	Winter	clover	
Year 3	Spring	tomato	
	Summer	tomato	
	Fall	cereal rye	
	Winter	cereal rye	
Year 4	Spring	pumpkins	

Year 1	Spring	soybeans
	Summer	soybeans
	Fall	wheat
	Winter	wheat
Year 2	Spring	wheat
	Summer	wheat
	Fall	winter pea
	Winter	winter pea
Year 3	Spring	tomato
	Summer	tomato
	Fall	oats/winter pea
	Winter	oats/winter pea
Year 4	Spring	sweet corn

Year 1	Spring	snap beans	
	Summer	snap beans	
	Fall	oilseed radish	
	Winter	oilseed radish	
Year 2	Spring	pepper	
	Summer	pepper	
	Fall	wheat	
	Winter	wheat	
Year 3	Spring	wheat	clover underseed
	Summer	wheat	clover
	Fall	clover	
	Winter	clover	
Year 4	Spring	tomato	

Seed Source

Finding an affordable and reliable source of cover crop seed may be a challenge to some vegetable growers. Clover, oats, and cereal rye are examples of cover crop seed that can be grown locally. Ohio's humid growing season may deter good quality, disease-free seed from being produced locally. Western states have dry climates with irrigated seed production, which is disease-free. Shipping time and cost need to be considered when planning to use seed from these regions. Local seed dealers may be able to find cover crop seed, or they can contact a wholesale supplier such as CISCO at 800-888-2986.

Detailed Information

There is a wealth of information available about cover crops. Time of planting, seeding rate, characteristics, nutrient action, pest control, and growth type are examples of published comparisons between cover crop species. Midwest Cover Crop Council (<http://mccc.msu.edu>) is a new web site that contains research and Extension publications from the Midwest area, and the Sustainable Agriculture Research & Education program has an excellent book (*Managing Cover Crops Profitably*), which can be found on the Internet at <http://sare.org/publications/covercrops.htm>.

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