The Frozen Ground Conference was a two-day meeting held in August 2014 at Fairlee Vermont, of 35 farmers along with Extension/research and seed businesses who are engaged in winter vegetable production. The meeting focused on 'what we know' and 'what we need to know' with lively discussions over two days.

Research needs that came up in discussion were noted, and also as part of the wrap-up, farmers identified their top priority topics for further research.

Topics that came up in discussion:

Interaction of covers inside the tunnel with soil temperature, soil moisture. Does removing cover during the day INCREASE soil T or reduce it, on sunny days (or cloudy days)? What is impact on growth and quality of leaving cover on vs off daily? Does temperature fluctuation increase hardening off and make the crop more hardy? It is useful to measure plant T w/ a thermocouple as well as measuring soil T and moisture.

Freezing and thawing physiology in relation to environment and management. Eg: When you measure heat loss in heated GH, radiant heat not considered important; however in unheated GH radiant heat is an important factor. If plant is uncovered and it cools below freezing, frost will form on plant. If plant is covered then frost will form on the cover first. The plant needs light to accumulate sugar and carbohydrates to tolerate cold. There's also factor of age and maturity at time of increasing cold. Younger plants often go through winter better.

Interior Covers: Plastic vs fabric/covertan type. Is the plastic keeping the heat in better compared to heavy row cover? What about moisture? Research by John Biernbaum found that in 10 ft high tunnels inside a larger high tunnel, T was higher under plastic compared to Remay.

Light incidence; diffuse vs direct light. Does light incidence change w hooped inner cover compared to flat cover over the crop? Does north light make a difference?

Potential for selecting for greater hardiness

Steam for weeds: Steamer to reduce weeds and pathogens vs heat sterilization (shut house down in summer or early fall, use clear plastic)

C02 levels. Dynamics relative to day/night; soil characteristics. Does high organic matter in soil release enough CO2 even when it's a 45 degrees during the winter? Impact of unvented heaters that release C02; what is the interaction of these heaters and of CO2 with light and temperature, photosynthesis and respiration of the plants.

Irrigation and salts. Tools for deciding, what level is needed, how does plastic on surface influence it. Salts: what levels are problematic for winter crops, what thresholds to use (in what test), how to manage it. Let rise to top and scrape off? The amount of water needed to leach is large and has other impacts on soil.

Pest (biological) issues:

Weeds: chickweed

Disease:

- Crown rot in lettuce; 2
- Downy mildew lettuce 4 (31 races)
- Spinach dm (14 races)
- Cladisporium on spinach
- Pythium (fight with maple bark on surface)

leaf mold in tomatoes (not an issue in cold-hardy crops, but may be affected by rotations, winter practices)
Downy mildew on arugula
Cercospora leaf spot on chard, spinach, beets

Insects:

Cyclamen mites in spinach; crown spinach mites
Aphids on spinach, Asian greens, chard, lettuce
Beet armyworm
thrips (in year-round tomatoes, in overwintered onions)

Other critters

Slugs and snails
Voles and moles
Symphylans

Physiological

White spots on spinach (trichomes?)
Physiological disorders related to winter growing (eg tip burn on spinach)

NAME YOUR ONE TOP PRIORITY TOPIC – around the room final discussion.

Spinach leaf diseases – 2 – (management, resistant varieties; including Fusarium, Cladysporium)

A definitive book on spinach - 1

Chickweed control – 2 (note: everyone seems to struggle with this weed)

Stabilizing movable tunnels -1

Inner layers –2 (automating/managing low inner curtains)

Different covers-1

C02 – 2

Impact of temperatures on yields, range of temps, heat source – 3

Cold hardiness, hardier varieties - 2

Planting dates that we could count on -1

Nutrients - 1 (– too much of some things not of others, not clear whether a problem is caused by a nutrient issue and which issue.)

Fertilizer recommendation for winter production -- 2

Benchmarking – how and what to measure so that we can compare results with other people - 1