Grant Overview

One of our goals at Rainshadow Organics is to always be working toward a more sustainable farm system. We have a variety of philosophies, methods, and practices that move us towards that goal. One of those philosophies is the idea of closed-loop nutrient cycling. How can we keep as many of the nutrients as possible on the farm, and how can we return those nutrients back to our soil? This grant project is an extension of that idea. Can we produce our own fertilizer on farm? Can we do this economically using only inputs we grow or are abundant locally? That was the initial motivation of this project. After several years of using and experimenting with Comfrey Fermented Plant Juice (CFPJ), compost teas, and the like, we applied for this grant to accomplish several things:

- Determine if CFPJ is safe and effective.
- Find out if it is feasible for a farmer to produce CFPJ systematically and economically.
- Create a framework for the production of CFPJ and share that with the community and fellow farmers.
- Share our findings with our community and cultivate conversation surrounding our food systems and sustainable agriculture.

What is Comfrey Fermented Plant Juice?

FPJ is a preparation made from plant matter and water (traditionally also brown sugar) that was pioneered as a sustainable farming practice by Master Han Kyu Cho of the Janong Natural Farming Institute in South Korea. A practice called Korean Natural Farming (KNF) [see “Natural Farming: Fermented Plant Juice” published by the College of Tropical Agriculture and Human Resources, University of Hawai’i for a concise summary of the KNF FPJ method]. We arrived at FPJ by following the practices of biodynamics. Preparations and ferments are reasonably well known for a variety of uses amongst the adherents of biodynamic farming. This, along with some initial research and field testing, led us to a simplified version of FPJ where we simply harvest the plant matter and ferment it in water with no other additives. We feel this is the best approach to meet our goals of farm sustainability.

Why comfrey?

- Extremely fast growing and an excellent producer of biomass.
    - About 30 comfrey plants on the farm regenerate around 150 lbs of plant matter every 2 weeks, though this varies with the season. On average, we were able to produce 150 gallons every 2 weeks.
    - Comfrey grows vigorously in a wide variety of climates, from the tropics to the high desert. It can be propagated via seed or by taking shoots from a mother plant.

- A Dynamic Accumulator
    - A term used in permaculture and organic farming literature for plants that gather certain minerals or nutrients from the soil and store them as a highly concentrated and bioavailable form in their tissues.

Experimental Design

Layout

- Two hoop house beds approximately 75 long
- Each has three drip lines with emitters on 18 in spacing
- Beds are separated into 5 zones
    - All zones receive equal compost and gypsum
        - 40 lbs compost per bed
        - 0.4 lbs Gypsum per bed
    - Three FPJ test zones 3oz, 6oz, 9oz
        - Applied at date of transplant and every 2 weeks subsequently.
    - One zone using Perfect Blend (PB) and Kelp Help
        - 0.5 Gal PB
        - 2 oz Kelp Help diluted into 1 gallon of water at time of transplant
    - One zone as control receives nothing additional beyond the standard compost/gypsum
    - Zones laid out randomly
- 26 individual plants per zone
- Zones separated by flowers as applicable

Application

- FPJ zones received comfrey treatment every two weeks at respective rate of application in one gallon of water starting at date of transplant.
- Perfect Blend zones received Perfect Blend during bed preparation and a 6oz dose of Kelp Help at transplant. Nothing further throughout the experiment
- Control receives nothing.

Comfrey FPJ production

- Produced on a 2 week cycle.

- Produced as much as possible depending on variable comfrey growth.
- One batch each week was properly weighed and measured for use in the experiment.
- All other batches were injected on to the big field.

Initial Findings

Observations

- Heavy ant damage in Iko Iko bed especially 3E-5. Three most northern plants were stunted and never recovered.
- Sprayed safer soap to control aphids for the first few months until aphids were under control. All test beds were sprayed equally.
- Somewhat significant Blossom End Rot (BER) in 3E. This is noted but does not seem to be a specific indicator because it is being seen fairly consistently in all Iko Iko test zones. We also know that our calcium is fairly low which is a main cause of BER. This is backed up by our soil tests. Additionally other beds in the house (not just the test bed) are experiencing above average BER. The implication is that the FPJ does not cause BER but it also does not supply enough calcium to prevent it.
- Plants that received any amount of comfrey or kelp at transplant had more success long term than those that did not. The control beds had highly variable stress at transplant, some resolved over time others are still apparent.
- Approximately 30 comfrey plants around the farm produced and average of 150lbs of leaf material every 2 weeks. High numbers in early spring were close to 300 lbs every 2 weeks. Low numbers in the fall have been closer to 100 lbs every two weeks.

Yields

The yields between the two cultivars varied. The Jimmy Nardello behaved fairly uniformly. The yields went as follows, from least to most: Control, 3oz, 6oz, 9oz, PB. The difference between total yields of the 6oz and 9oz vs the PB was about 8.5 pounds. This does not sound like much but considering a single pepper weighs about 0.1 pounds this is somewhat significant.

FPJ Composition

	FPJ Biology Test Results	
	Result	Recommended Range
pH	6.5	5.5 - 9

Electrical Conductivity	3490	<3000
Areobic Fungi	0	>2
Total Fungi	6.7	>10
Aerobic Bacteria	46.08	>10
Total Bacteria	4480.01	<10000

How to make FPJ?

Our method:

1. Harvest comfrey
    a. I use a machete and cut the plant essentially down to the ground and load into a large wheelbarrow. This varies with the season.
2. Load comfrey into a large permeable bag, leaf stems and all.
    a. We get coffee chaff for our chickens and it comes in large plastic sacks, these work quite well.
3. Weigh your comfrey.
    a. *optional: For the FPJ used in this experiment the comfrey was weighed 1lb to 1 gallon of water. However, we use 100s of gallons more than what is needed for the experiment. An estimate will get you close enough. Note that a higher comfrey to water ratio will result in a more potent FPJ than the 1 to 1 mixture.
4. Add comfrey to water
    a. We use 55 gal food safe barrels with the tops cut off.
    b. 50 lbs of comfrey and 50 gallons of water fit almost perfectly.
5. Let it sit for about two weeks
    a. This is dependent on temperature. During the summer when it is consistently hot two weeks will be enough. This season in the spring the temps were down in the 40s for our first batch and we decided it needed and extra week to properly ferment.
    b. Note: The FPJ usually will not grow mold but it can. General rule of thumb is that all mold is good except black mold.
6. *Optional: Aerate
    a. prior to application aerate the finished FPJ.
    b. This boosts the microbial activity in the solution so that it really feeds those soil microbes when it is applied.
7. Apply
    a. Application rates vary
    b. We use most of our large batches injected directly in to our wheel lines on our 25 acre field. This is so diluted over such a large area that we are not at all concerned with burning our plants
    c. For smaller hand applications we will measure an appropriate amount to be applied
8. *Optional: Store
    a. At the beginning of this season it was too cold to make a proper FPJ but fortunately we had stored away a 5 gallon bucket of last fall's FPJ for just this case. It smelled almost as ripe as the fresh stuff and really did the trick while we were waiting for temps to go up.

Western Region Sustainable Agriculture Research & Education Program Outreach Survey

Name (optional): _____ **Date of Event:** _____

Everyone	**Please circle one**		
Improved my awareness of the topics covered	Yes	No	NA
Provided new knowledge	Yes	No	NA
Provided new skills	Yes	No	NA
Modified my opinions and/or attitudes	Yes	No	NA

How many people do you estimate you will share some aspect of this project within the next 12 months?

_____

Producers – In the next year I am likely to use some aspect of this project to

Adopt one or more of the practices shown	Yes	No	NA
Increase the operation's diversifications	Yes	No	NA
Reduce my use of purchased off-farm inputs	Yes	No	NA
Increase my networking with other producers	Yes	No	NA
Incorporate value-added into some aspect of my operation	Yes	No	NA

Professionals – In the next year I am likely to use some aspect of this project

In an education program that I plan or participate in	Yes	No	NA
As a resource I will make available to producers	Yes	No	NA
As a professional development tool for my peers	Yes	No	NA
To improve advice/counsel I give to producers	Yes	No	NA

Professionals – Please describe how you are likely to use some aspect of this project for an educational purpose?

USDA United States Department of Agriculture National Institute of Food and Agriculture