Strawberry Fertility

Soil, Tissue, and Nematode Sampling

2019 Strawberry Preplant

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Smithfield, NC

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Preparation

- "A man has got to know his limitations" Dirty Harry Callahan

- How do we do that? What is your limitation?

Preparation is Key

Pre-Plant Fertility

Soil Sampling

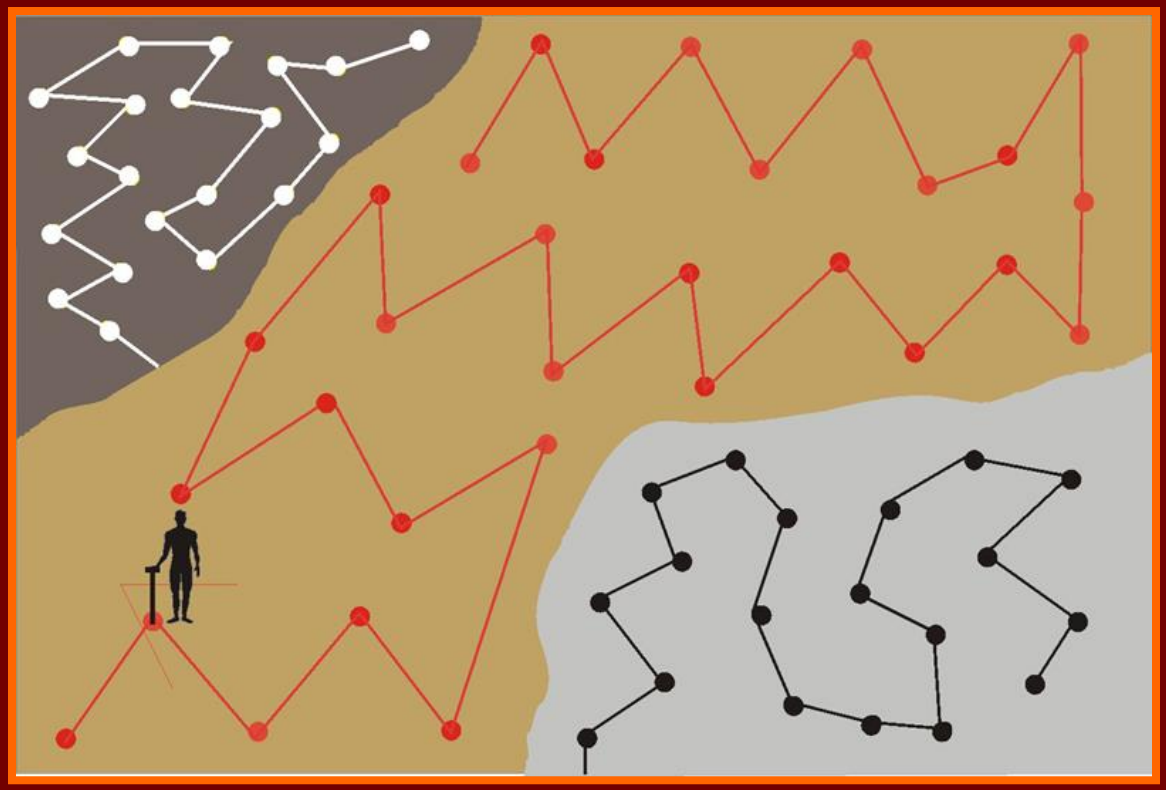
- Low soil pH is the most significant problem identified on soil samples submitted from strawberry fields in NC.
- This problem cannot be corrected in a timely manner if the crop has already been planted.
- Low Ca and Mg also usually come with low pH.
- Correct with dolomitic lime

Soil Sampling

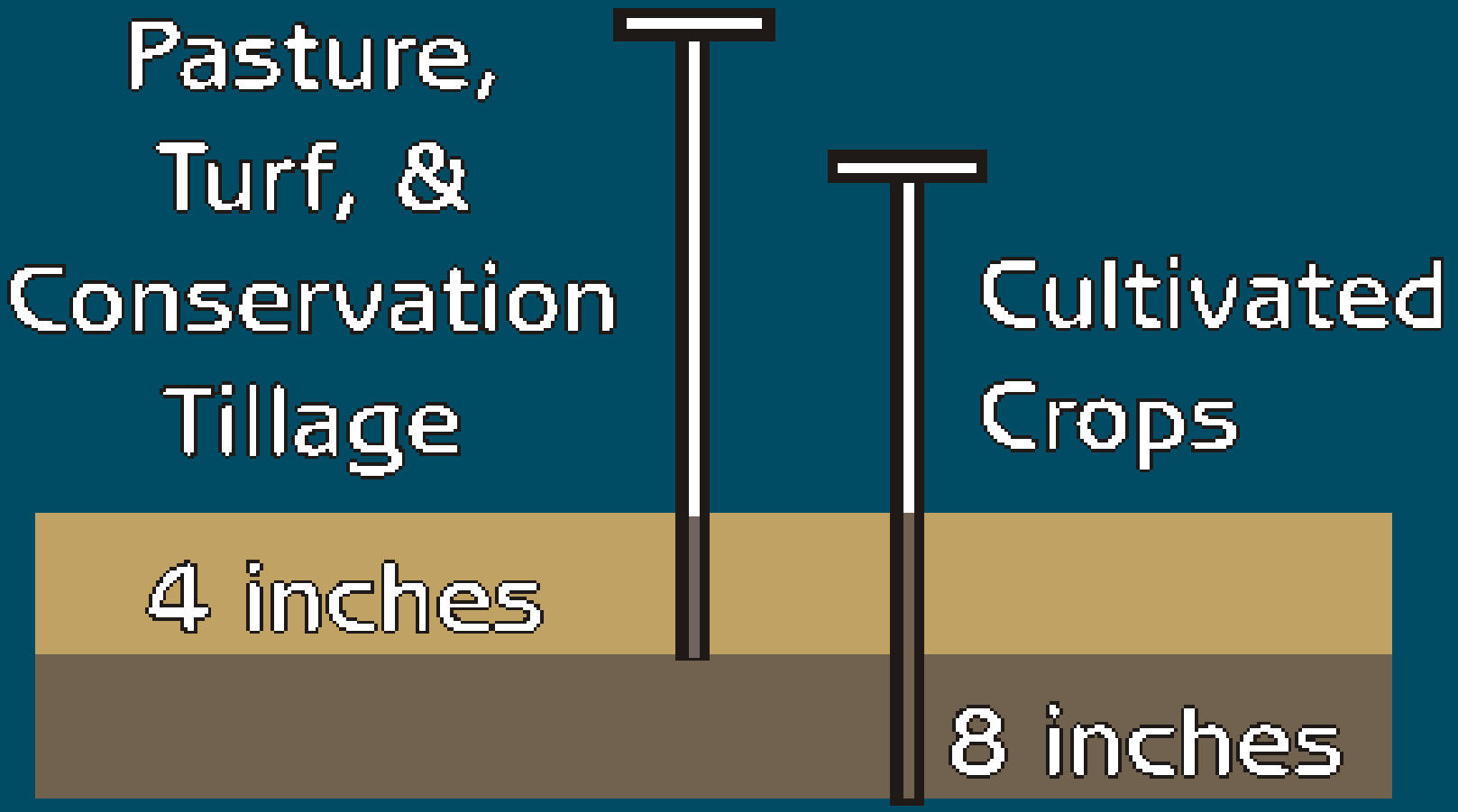
- Soil pH should be adjusted 3 to 4 months before bed forming and fumigation.
- Optimum pH is 6.0 - 6.2 for mineral soil.
- Guessing leads to pH issues

Collecting Soil Samples

- **Collect a separate sample for each soil type.**



Sampling Depth



Planting and Establishment

- Importance of Planting well
- Watering plants at establishment
- Neglecting these can make everything else you do be in vain.

Pre-Plant Nitrogen

- 60 lbs N in the Fall
- Too much N will likely produce excess vegetative growth and set fewer fruit.
- Consider applying sulfur if sulfur index is below 30 on sandy soils.
- 20 to 30 lbs/A sulfur

Pre-Plant P and K

- Pre-plant phosphorus, potassium, magnesium and micronutrients should be applied based on soil test results.
- Fall fertilization should meet the nutritional needs of the crop until growth begins in the spring.
- As a general rule a tobacco blend of fertilizer ex. 6-3-18, 10-5-23 etc. work well for our soil needs and have low levels of Cl.

Post-plant Fertility Spring

Spring Nitrogen

- General N recommendation is 5.25 lb/acre/week
- Fine tune N management by tissue sampling
- Specific N rate recommendations provided on plant analysis report
  - 5.25 lb N/acre/week or
  - 7 lb N/acre/week
- Can help identify hidden hunger
- Crop needs increase rapidly as spring growth increases – weekly tissue sampling is recommended

Spring K (potassium)

- Very important for taste and quality
- Double N rate for K rate
- Through drip
- Monitor with tissue sampling

Boron

- Deficiency resembles pollination problem
- Upper end of sufficiency scale
- Be careful with decimal points

Boron Continued…

- ¼ lb of actual Boron/acre during 2nd full week of fertilization, repeat every 2 to 3 weeks.
- 20 Mule team Borax- 18 to 19 oz/acre
- Solubor- 12 to 14oz oz/acre
- 10% liquid boron- 1 qt/acre

Strawberry Tissue Sampling

What is tissue analysis?

- Measure of essential plant nutrient concentrations
  - Leaf blade analysis:
    - N, P, K, Ca, Mg, S, Na (%)
    - Fe, Mn, Zn, Cu, B (ppm)
  - Petiole analysis:
    - NO_3-N (nitrate nitrogen)
- Also includes
  - Interpretation indexes
  - Nutrient ratios (ie. N:S)
  - Nutrient rate recommendations (N, K, Mg, S, Mn, Fe)
  - Agronomist comments

Routine tissue sampling

- Is very important in high-value crops like strawberries
  - Evaluate the fertility program and nutritional status to *prevent* problems

Once a nutrient deficiency has occurred, yield is already lost.

A nutrient deficiency is easier to correct and results in less yield loss the sooner it is detected and corrected.

How to tissue sample

- For monitoring (predictive)
  - Collect biweekly samples from early bloom through harvest (start about March 1st)
  - This is the bloom (B) and fruit (F) growth stages
- For diagnosing
  - Collect samples as soon as abnormal plant growth or color is noted

How to tissue sample

- Collect the most recently mature trifoliate leaves (MRML)
  - Has three leaflets and a petiole
  - Is full-sized and dark green
  - Is healthy--no diseases, insects or harsh environmental conditions (predictive)

How to tissue sample

- Detach the petioles
  - Snap leaves off at the stem then separate the blades from the petioles

Measure NO3-N on petioles

A great predictor of soil N availability

Plant sample information form

- Properly identify the growth stage and week
  - Bloom/fruit (B/F) has 12 consecutive weeks
  - Week 1 of B/F is characterized by the presence of 5–10 open blossoms on at least 50% of the plants
    - Or to state it another way – it means strawberries will be ready to pick in 4½ to 5 weeks
  - Week 5 of B/F growth stage coincides with first harvest

Growth Stage and Week

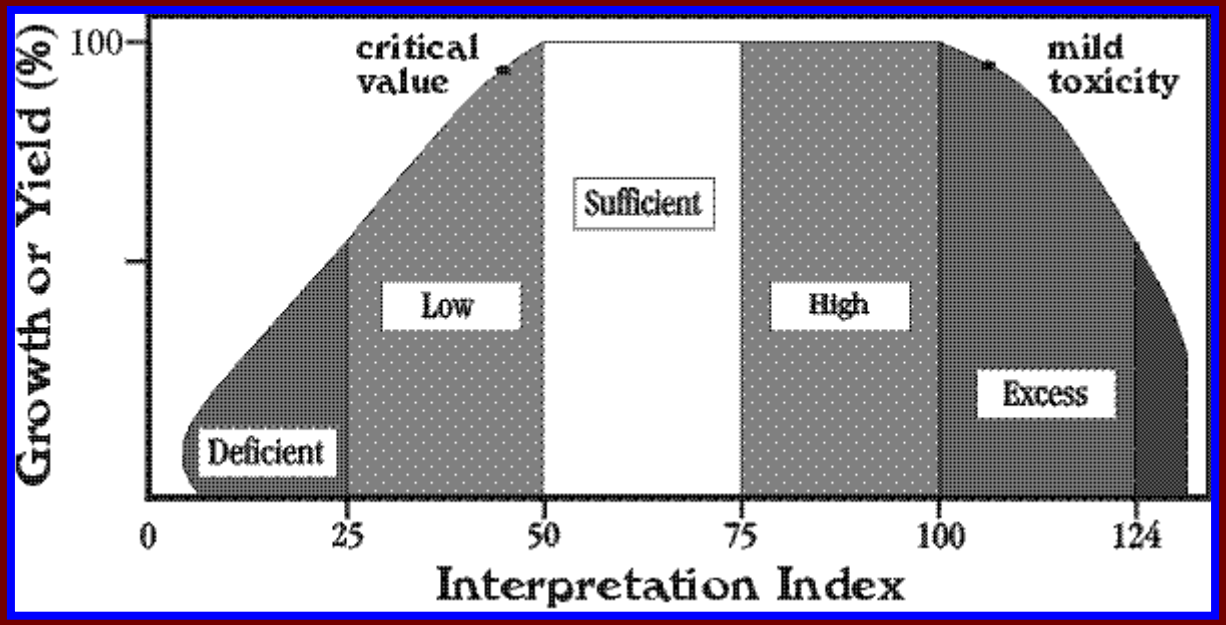
Growth Stage	Week	NO_3-N Sufficient Range (ppm)*	Nitrogen recommendation when petiole NO_3-N		
			Below-	Within-	Above-
			the sufficient range		
B/F	1	600-1500	7 lb N/a/wk	5.25 lb N/a/wk	None
	2-3	4000-6000			
	4	3500-6000			
	5-8	3000-5000			
	9	2000-4500			
	10	2000-4000			
	11	1500-3000			
	12	1000-2000			

Understanding the Plant Report

- Interpretation Indexes
  - Scale: 0 to 124
  - Ranges: deficient, low, sufficient, high, excessive
- Nutrient Ratios
  - N:S, N:K, Fe:Mn
- Nutrient recommendations
  - N, K, Mg, S, Mn, Fe
- Agronomist Comments

Understanding the Plant Report

Interpretation Index



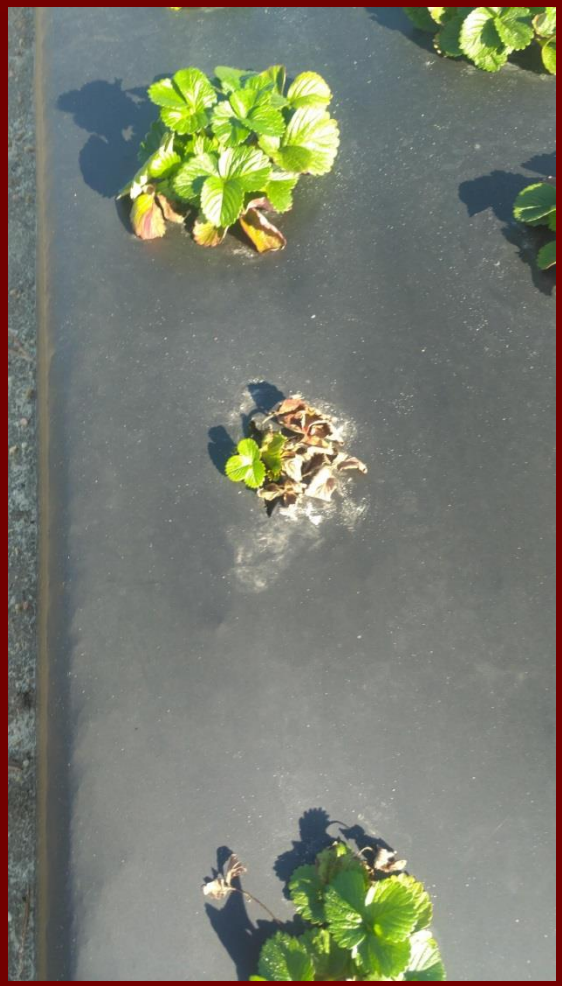
Concluding remarks

- Plant tissue analysis is a tool – use it properly
  - Consider everything else you know about the field
    - Environment
      - Temperature and rain
      - Soil pH and fertility
      - Disease/insect pressure
    - Production practices
      - Fertilization
      - Irrigation

2018/2019

- Lessons learned from 2019
- Weather is UNPREDICTABLE!
- Instead of a rough spring, we had a rough fall with hurricane and wet conditions.
- Rushed fumigation and late planting were many growers concerns.

Root Rot and Crown Rot



Frost Protection

- Row covers
  - Limitations- wind, labor, temperature etc.
  - Weight- 1.25 oz good, 1.5 oz better
  - Timing
- Irrigation
  - Limitations- wind, water source/volume
  - Timing

Damaged bloom

Bloom and fruit Damage

Control what you can

- pH and fertility
- *Laying the plastic (good beds/tight plastic)*
- *Planting (on time and correct depth)*
- Protection (row covers/frost protection)
- Irrigation/fertigation
- Picking
- Weeds, disease and insects

Irrigation (managing)

- You can not be over observant of soil moisture under plastic- Do Not Get Behind!
- Hot Weather (May 2019) is rough on plants, especially fruiting plants.
- When increasing water, increase number of times during day not duration. Soil can only hold so much water, roughly 2 hrs is long enough. Once soil capacity is surpassed, fertilizer is leached.

Questions/Comments

Questions?

- Contact:
  - E-mail: don.nicholson@ncagr.gov
  - Phone: 919-499-8708
  - Website: www.ncagr.gov/agronomi/
  - Address: NCDA&CS Agronomic Division
    1040 Mail Service Center
    Raleigh, NC 27699-1040

got to be NC AGRICULTURE

Questions?

- Contact info
- Email-bkparker@ncsu.edu
- Phone-office-919-989-5380/cell-919-464-6054

NC STATE EXTENSION

Respirator

- Fit Test!
- Medical Exam
- Make sure it forms a seal

- Store at dry and cool place (not in garage/shop)
- Clean regularly
- Change cartridge regularly

- Never use a cartridge AFTER expiration date

Fumigants

Equipment	Cost
Full Face Respirator	$ 150 – 200
Cartridge	$ 30 – 50 (frequent costs)
Chemical resistant gloves	$ 20 – 40 / pair (frequent costs)
Rubber Boots	$ 20 – 60 / pair
TiVac	$ 20 – 30 / piece (frequent costs)
TOTAL	**$ 170 – 230 one time**
	$ 70 – 120 frequent

Fumigants: look at label!!!!

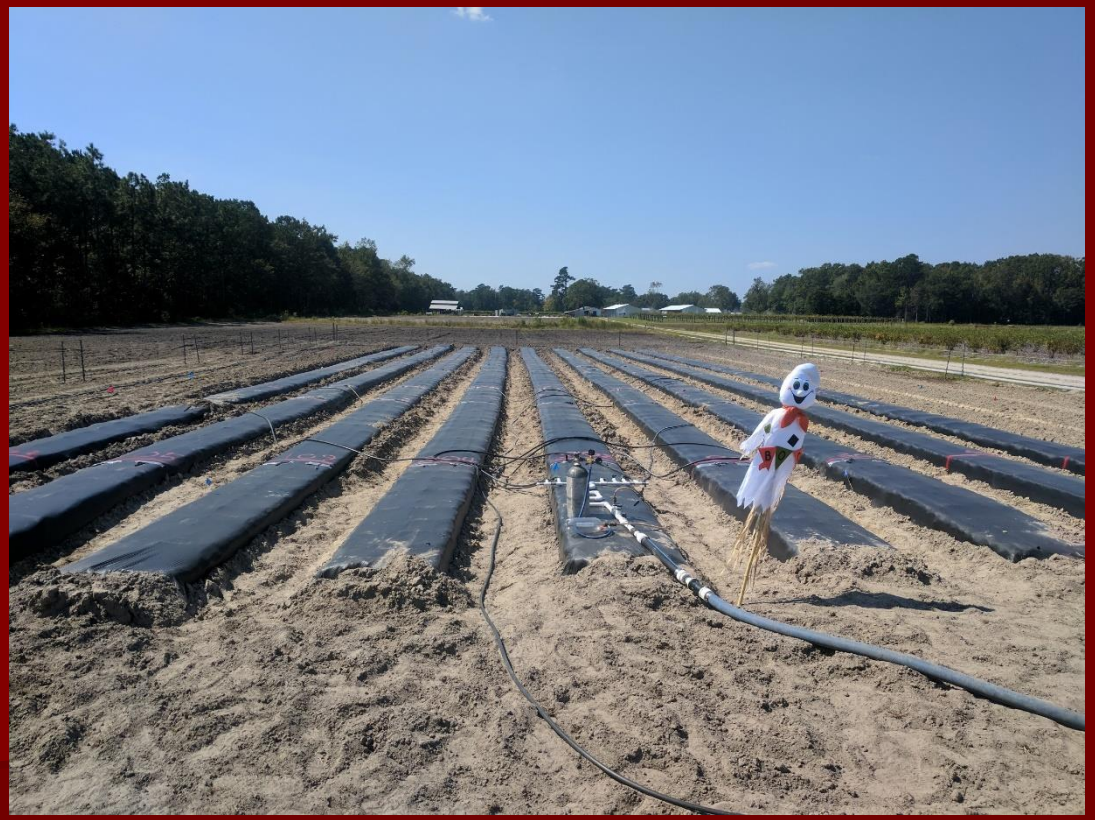
Fumigant	Short-Term Exposure	Long-Term Exposure
Chloropicrin	Sever irritation of skin, eyes, respiratory tract	Long-lasting Nausea, vomiting, diarrhea
	Difficulty breathing, Headache, Nausea	Affects respiratory tract
1,3 Dichloropropene	Chest Pain, breathing difficulties	Nasal tract, respiratory tract, Urinal bladder
		Maybe carcinogen

Calculation

Step 1: Calculate the rate of fumigant per 'row acre'

'row acre' =

43,560 sqft / row spacing



Calculation

Step 1 – Calculate the rate of fumigant per 'row acre'

Example: Row-Spacing is 5 feet

43,560 sqft / 5 = 8,712 linear ft of rows = 1 acre!!!

100 rows x 200ft = 20,000 linear ft

Row acres = 20,000 / 8,712 = 2.29 acres

Row acres = 100 rows are equivalent to 2.29 acres

Calculation

Step 2 – Calculate Broadcast equivalent rate

Total amount of fumigant applied to the treated area (ROWS) divided by the TOTAL LAND

- Total area within the perimeter of the fumigated part of the field
- Pounds/gallons of product per treated acre (rate of product applied in the bed)
- Total treated area: Bed with (bottom), row spacing

Calculation

Step 2 – Calculate Broadcast equivalent rate

Example:

Size of beds and furrows (without ditches)
= 5 acres – 0.25 acres = 4.75 acre

Divide the bed width at the bottom by the row spacing
= 32 Inches / 60 Inches = 0.53

Determine the **proportion** of the application block to be treated
= 4.75 acres / 5 acres = 0.95

0.53 * 0.95 * 350 lbs/A = 176.22 lbs (Broadcast equivalent rate)

Calculation

Step 2 Calculate Broadcast equivalent rate

Example:

- Bed with at bottom: 32 inches
- Row spacing: 60 Inches
- Product applied per treated area: 350 lbs
- Application block size: 5 acres
- Ditch size 0.25 acres

Size of beds and furrows (without ditches)
= 5 acres – 0.25 acres = 4.75 acre

Calibration

Flow Meter

- Usually calibrated for water!
- Higher density = slower movement!!!

Fumigant	Boiling point (°F)	Specific gravity*	Vapor pressure (mm Hg at 20°C)**
1,3-Dichloropropene	219	1.21	34
Chloropicrin	234	1.65	18
MITC (dazomet, metam potassium, metam sodium)	246	1.06	13
Methyl bromide	38	1.73	1420
Dimethyl disulfide	229	1.05	17

*Specific gravity = the molecular weight of a fumigant divided by the molecular weight of water.
**mm Hg = millimeters of mercury.

Calibration

Flow Meter

Must be corrected!

Example:

- Swath width of the rig is 6 feet

Determine the time to treat an acre:

- 100 foot rig test: 22 sec. for 600 sqft (6 * 100)
- 22 sec. / 600 sqft = 0.036 sec./sqft
- 0.036 sec./sqft x 43,560 sqft/ac = 1568 sec./acre = **26.1 m**

Calibration

Flow Meter

Must be corrected!

Example:

- Time to treat an acre = 26.1 min
- 100 % flow rate (Water) = 2gpa
- Telone EC (93.6 % 1,3D) = 2 x **0.913 =** 1.83 gal/min
- 20 gal/a

Determine the flow meter setting

- Total gal/acre = 26.1 min * 1.83 gal/a = 47.7 gal (100%)
- FlowMeter (water): (20/47.7) * 100 = **41.9%**

Plastic

Joe Noling, UF, 2013
http://edis.ifas.ufl.edu/in403

Plastic

Table 1. Effect of plastic mulch color on soil temperature, as compared to unmulched soil.

	Relative temperature of mulched soil	
Mulch color	Nighttime	Daytime
Clear	warmer	warmer
Black	warmer	warmer
White	warmer	cooler
Reflective	warmer	cooler

Plastic

Joe Noling, UF, 2013

http://edis.ifas.ufl.edu/in403

Plastic

Plastic	Costs	Fumigant efficacy	Control efficacy
PE Films	Cheap	Not good	
Metalized Films	More costly	better	Controls Thrips
VIF	Costly	better	
TIF	Costly	good	

Plastic

❖ **TIF Pro**

- Increase fumigant efficacy
- Leads to less problems later on
- Increased yields due to more efficient fumigation

❖ **TIF Con:**

- May increase plant back date
- Higher $$$

Fumigants

- **Dominus**
  Allyl Isothiocyanate (AITC, synthetic; 200-350 lbs/a)

- **Mustard**
  Allyl Isothiocyanate (AITC, natural)

- **Mustard Seed Meal and Pelleted Mustard**
  Allyl Isothiocyanate (AITC, natural)

Fumigants

Fumigant and activity

Fumigant	Nematode	Disease	Nutsedge	Other weeds
Telone C 35 + VIF/TIF	+++++	+++++	+++	+++
Telone C 35	+++++	+++++	+	+
In-Line	+++++	+++++	+	+++
Metam Sodium	++	+++	++	+++++
Dominus	++	+++	++	+++
Pic-Clor 60	+++++	+++++	+	+++
Chloropicrin	+	+++++	-	-

Fumigants

Fumigants

- **Pic-Clor 60/80 (300-350 lbs/a, 14-21 days)**

Chloropicrin (60/80%) + 1,3D (40/20%)

- **Telone C-35 (30-40 gal/a, 21 days)**

Chloropicrin (35%) + 1,3-D (65%)

- **Paladin (14 days)**

Chloropicrin (21%) + Di-Methyl Disulfide (79%)

- **Vapam/Kpam/Sectagon and others**

Metam Sodium/Potassium

Info online:

Fertility:
http://www.ncagr.gov/agronomi/documents/StrawberryFertility-Feb2015.pdf
Google: 'Strawberry Fertility Management NCDA'

IPM: www.smallfruits.org

Strawberry: https://strawberries.ces.ncsu.edu/

Homepage: https://smallfruits.cals.ncsu.edu/