Summary of the First Soil Management Meeting in Salinas, California

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Abstract:

The initiative to organize the first soil management meeting was based on several observations. First: the demand among farmers to manage agricultural soils in general and soilborne diseases in particular with precise, efficient and systematic tools like fumigants and the demand among researchers to deliver such systems. Second: the complexity of soil management systems. Third: The extremely knowledgeable local pool of researchers, growers and industry representatives in California. The intention of the meeting was to combine research efforts with the aim to improve future research aspects of systematic soil management. For this reason, we tried to bring together start-up companies and young scientists with experienced researchers and representatives of established companies. With this objective in mind, the main focus of the meeting was a discussion about current problems in integration and research of soilborne pest management. Our goal was to find common interests among groups, initiate collaborations and address possible funding sources. 10 talks summarized current research in soilborne disease management at the Central Coast and South California, including fumigant research, systematic management, pathogen detection, resistance etc. The following discussion covered six main topics: (1) Fumigants; (2) Systematic management; (3) Soil health; (4) Land value; (5) Collaboration; (6) Economy. A major outcome of the discussion was the interest of several industry and federal participants in valuing the quality of agricultural land on a local community level. Monitoring agricultural land would be a major step to more precise and systematic management methods. Possible research collaboration partners were identified in the meeting and potential funding sources and potential project leaders were discussed.
Location, Date and Agenda:

Location:
USDA Research Station, 1636 East Alisal Street, 93905 Salinas CA
Conference Room

Date:
5th February 2016, 8:30 am – 1pm

Agenda:
8:35 – 10:15: Introduction of Participants and Presentations
10:15 – 10:30: Coffee Break
10:30 – 12:30: Round Table Discussion
12:30 – 1:30: Lunch and Continuing Discussion

Organizational Board:
Steven Fennimore, UC Davis (Organization)
Thomas Gordon, UC Davis (Discussion Lead)
Mark Hoffmann, UC Davis (Organization)
John Rachuy, UC Davis (Catering)

Participants:
Husein Ajwa (Extension Specialist, UC Davis, retired)
Abbie Asche (Pest Control Advisor, Tri Cal Inc.)
Mark Bolda (County Director, UC Coop Ext.)
Janet Broome (Plant Health Department Manager, Driscoll’s)
Eric Brennan (Researcher, USDA-ARS, Video-Presentation)
Kelly Cobaugh (Research Assoc., Driscoll’s)
Oleg Daugovish (Farm Advisor, UC Coop Ext.)
Nathan Dorn (Owner, Food Origins)
Steve Fennimore (Extension Specialist, UC Davis)
Thomas Gordon (Professor, UC Davis)
Ian Greene (Field Researcher, Ramco)
Mark Hoffmann (Post-Doctoral Researcher, UC Davis)
Steve Koike (Farm Advisor, UC Coop Ext.)
Frank Martin (Researcher, USDA-ARS)
Mike Mellano (Owner, Mellano Flowers, via Skype)
Joji Muramoto (Assoc. Researcher, UC Santa Cruz)
Poornima Parameswaran (Owner, Trace Genomics)
Alexander Putman (Assistant Extension Specialist, UC Riverside)
Ruijin Qin (Visiting Scientist, USDA-ARS)
John Rachuy (Field Research Assistant, UC Davis)
Manuel Rosas (Vice-President Global Research, Driscoll’s)
Mike Stanghellini (Research Dep. Leader, Tri Cal Inc.)
Greg Vargas (Research and Development Scientist, Tri Cal Inc.)
Diane Wu (Owner, Trace Genomics)
Talks:

1) Introduction – Mark Hoffmann, Post-Doctoral Researcher, UC Davis
2) Use of biological fungicides in strawberry – Mark Bolda, Farm Advisor, UC Coop. Ext.
3) Use of mustard seed meal (MSM) with MB Alternative fumigations to maintain plant performance – Mark Bolda, Farm Advisor, UC Coop. Ext.
4) Soil fumigation with multiple drip tapes in low permeability film covered raised bed systems – Ruijin Qin, Visiting Scientist, USDA-ARS
5) ASD 2.0 – Joji Muramoto, Project Scientist, UC Santa Cruz
6) Steam for soil disinfestation – Steven Fennimore, Extension Specialist, UC Davis
7) Cover Crop and Soil Management – Eric Brennan (video presentation), Researcher USDA-ARS
8) South California Perspective on Soil Management – Oleg Daugovish, Farm Advisor, UC Coop. Ext.
9) Diagnostics and Quantification Assays – Frank Martin, Researcher USDA-ARS
10) Strawberry Production with fumigants – Husein Ajwa, UC Davis, retired
11) Managing Soilborne Pathogens – Thomas Gordon, Professor UC Davis

The talks summarized current research and problems in soilborne pest management methods in California. Fumigants (especially Pic-Clor) are in agricultural practice currently the most important, economical feasible soil disease control agents. Current fumigant research focuses on the pest control efficacy of stand-alone and combinations of possible alternatives (e.g. Dominus, TRX-58 with Pic-Clor), by using different films and/or a variety of drip application techniques. In highly pathogen infested fields, drip application of fumigants is not sufficient enough to reduce pathogen levels in the perimeters of the raised beds (Ajwa, Qin, Gordon).

A consensus was agreed upon by most participants to focus on research in integrated approaches to soilborne pest management and move away from uniform stand-alone fumigant applications. Research should focus on (a) improvement and combination of management tools; (b) Improvement of soilborne disease detection and prediction tools. Besides fumigants and chemical alternatives, main management tools under investigation are currently MSM, ASD and steam. All these tools are used more or less on a commercial scale, mostly in organic production. ASD and steam are currently under heavy investigation to improve economic and environmental aspects of the treatments. Integrated approaches, combining some of those treatments with fumigants and/or cover crops are also currently under investigation (Bolda, Muramoto, Brennan, Fennimore). Other approaches include the investigation of biological fungicides and bio control agents (e.g. Trichoderma harzianum) (Bolda, Gordon). Including disease resistant/tolerant crop varieties was suggested as important tool to integrate into soilborne disease management systems (Daugovish, Gordon). Molecular PCR based field tools to detect pathogens (several Verticillium species, Macrophomina phaseolina clades, Fusarium oxysporum, Rhizoctonia solani) in plant tissues are in the end-phase of testing and might be
available for research soon. Remote sensing techniques are being developed to detect and predict growth depression in several crops (Martin).

Oleg Daugovish gave a review of the economic situation in Southern California. Land leases are high and usually time limited. This leads to a short-term, high production business and makes it extremely hard to install long-term soil management methods. Reports of land-owning farmers who go out of business are increasing as well. Drop outs are mostly due to increased production costs, but similar or even lower productivity of land. Daugovish further suggested site-specific selection tools for soilborne disease management as a potentially important short-term/mid-term aim to buffer drop outs and to provide better support for management of soil pests.

Discussion:

Main topics of the discussion were: (1) Systematic approaches to soilborne pathogen management in CA. (2) Pathogen detection methods and epidemiology. (3) Site-Specific databases and services.

In the beginning of the discussion, two new start-up companies were introduced by their owners: Trace Genomics (Wu and Parameswaran) and Food Origins (Dorn). Both provide unique services to research and agricultural companies and focus on molecular community assessments and prediction models (Trace Genomics) or remote sensing and food tracking (Food Origins). More information is available on their websites (see appendix).

The following summarizes the main discussion points as well as the outcome of the meeting:

(1) Fumigants: Pic-Clor 60 is widely used to disinfest soils in CA and is one of three fumigants which are registered. Broad consensus among participants was given to preserve Pic-Clor as the currently most important, economical and effective soil disinfestation method. Suggestions were made to use Dominus for crop termination in Strawberry to reduce pathogen levels in rotational crops (Ajwa).

(2) Systematic Approaches: More systematic approaches were discussed: combinations of ASD, MSM plus chemical fumigant alternatives and effects of MSM on crop growth were point of discussion. In conclusion, more experiments are needed to separate effects of MSM on crop growth and yield. Fumigant combinations with Dominus and TRX-58 (non-disclosed experimental chemical) were mentioned. Work which combines steam with Dominus also was briefly mentioned.

(3) Collaborations: Trace Genomics, Food Origin and Driscoll’s were open for collaborations with state and federal scientists, considering the development of integrated soil management solutions. Driscoll’s also showed interest especially in investigations of methods involving cover crops.

(4) Economy: Economic, political and biological reasons for development of short- and long-term solutions in soilborne disease management were brought up by several participants, including Jenny Broome, Mike Mellano, Oleg Daugovish, Frank Martin and
Husein Ajwa. Land-ownership and short leases are main reasons for short-term soil management and a major problem to support long-term solutions, according to the majority of participants.

(5) *Soil Health:* The conversation and restoration of soil health were major concerns of representatives of several companies. Especially Driscoll’s Jenny Broome was pointing out the dimension of the problem and a potential future scenario of significant losses to CA economy. In the light of the projected situations, she encouraged public researchers to collaborate with industry.

(6) *Value of land:* Discussions about spatial assessments of pathogen distribution induced questions and ideas of valuing agricultural ground. Oleg Daugovish pointed out that a better knowledge of site history would be a good start for a better decision making system for soil management. Participants broadly were concerned about acceptance among land-owners for a land-value system, including pathogen and soil health data. But most participants also agreed on the potential importance of such a system. Especially Mark Bolda, Alexander Putman, Diane Wu and Poornima Parameswaran from Trace Genomics and Nathan Dorn from Food Origin were highly interested in an idea of introducing values to agricultural land on a local community level, based on remote sensing, pathogen data, soil health indicators (e.g. microbiome), pathogen data etc.. CDPR was mentioned as a potential funding source, Alexander Putman as potential person to write a proposal.
Personal Remarks:

(1) On the dogma of Methyl-Bromide: A dogma-like status of Methyl Bromide can be still sensed in today’s discussions about soilborne disease management. It seems that Methyl Bromide has the status of a ‘lost redeemer’, with the argument that there cannot be any treatment as good as Methyl Bromide, considering efficacy, application and costs. Methyl-Bromide ‘alternative’ in this way rather means ‘replacement’. In my opinion, the term ‘alternative’ itself is a poor choice as it keeps Methyl Bromide in the equation. It implies to search for a single stand-alone soil disinfestation method, with Methyl Bromide similar economical and efficacy characteristics. Thoughts (or ‘beliefs’) that Methyl Bromide was only a temporary fix to a rather complex problem are still not well accepted and both people and opinions are often diminished by pushing them into the naive and/or idealistic corner. But by focusing on stand-alone Methyl Bromide replacements, the spotlight is taken from the actual problem: finding systematic ways to manage agricultural soils for today and future economies. Nobody doubts that Methyl Bromide was an efficient and cost-effective treatment. But besides those undoubted positive effects, the era of Methyl Bromide also came with a lot of environmental (and probably also economical) downsides. I strongly speak out for letting the dogma-like status of Methyl-Bromide go and face problems with a fresh mind, so that we can look into the future and not into the past!

(2) On the land owner situation: Land-owner ship and short-term leases are often used as a thought-terminating cliché in discussions about long-term solutions in soil management. But to my knowledge there is no hard evidence as to whether or not land owners, land owning growers or land leasing growers might accept the evaluation of agricultural land and long-term studies to improve soil health. Arguments are largely made based on personal experience. Not denying that personal experience is extremely valuable, I still believe other methods of assessment would be needed for a more precise description of a complex situation such as the will of land-owners to participate in long-term soil health programs and land evaluation across communities. I believe it would be urgently necessary to assess the current situation on a broader scale by using reliable scientific evaluation methods.
Appendix:

**Industry participants:**

Food Origin (https://www.f6s.com/foodorigins)
Trace Genomics (http://tracegenomics.com)
Driscoll's (http://www.driscolls.com)
Ramco (http://www.ramcoenterpriseslp.com)
TriCal (http://www.trical.com)
Mellano & Company (http://www.mellano.com)

**State and federal participants:**

University of California, Davis (https://www.ucdavis.edu)
University of California, Santa Cruz (http://www.ucsc.edu)
University of California, Riverside (http://www.ucr.edu)
University of California Cooperative Extension (http://ucanr.edu)