Soil Disinfestation with Allyl Isothiocyanate (AITC) and Steam in California Strawberries

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SUMMARY

There are many reasons to pursue alternative soil disinfestation methods. Township caps, a growing organic sector and political/public concerns about safety and environment are among the most common arguments for alternative soil-disinfestation methods. Allyl Isothiocyanate (AITC) is registered in many US States. Steam is well known to generally reduce weed and pathogen pressure without fumigants. Here we evaluate the pest and weed control efficacy of an AITC product (**Dominus®**) and Steam in strawberry. Future investigations evaluate AITC and enhanced steam as part of integrated pest management systems for both conventional and organic strawberry production in California.

OBJECTIVE

Evaluation of weed and pathogen control of Dominus® for conventional and Steam for organic strawberry production in the Salinas/Watsonville area.

MATERIALS AND METHODS

Dominus (AITC): current season (2014/15):

- Field trials were conducted at USDA field station at Spence Rd., Salinas, CA.
- K-Pam, Dominus and Pic-Clor 60 were applied through drip tape.
- Treatments were applied between Ocober 11th and October 15, 2014.
- To evaluate pest control efficacy, bags containing citrus nematodes, *Pythium* and *Verticillium* inoculum were placed at 9" and 18" depth and recovered 14 days after fumigation for analysis.
- To evaluate the effect on weed control, weed densities were assessed.

Treatments							
Dom @ 20 gal/a	Dom @ 40 gal/a	K-Pam 31 fb Dom 20	K-Pam @ 31 gal/a	K-Pam @ 62 gal/a	Pic20 fb Dom 20	Pic 20 fb K-Pam 31	Non treated control

Steam: season 2012/13:

- Field trials were conducted at TCR (Dricroll's), Watsonville, CA.
- Steam applications were conducted on 6th and 7th September 2012.
- MSM was applied at 3000lbs/a.
- Weed density, disease progress related to *Macrophomina phaseolina* (charcoal rot) and yield data were recorded.

Treatments		
Steam	Steam + MSM	Non-treated Control

ACKNOWLEDGMENTS

California Strawberry Commission

USDA MB Transition Grant

AITC

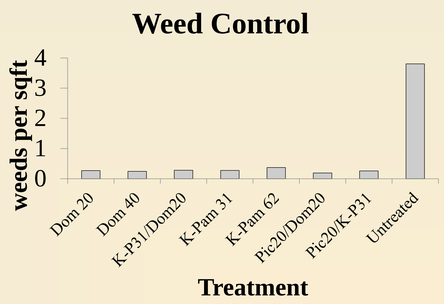

Figure 1: Weed control with combinations of Dominus, K-Pam and PicClor. January – May 2015.

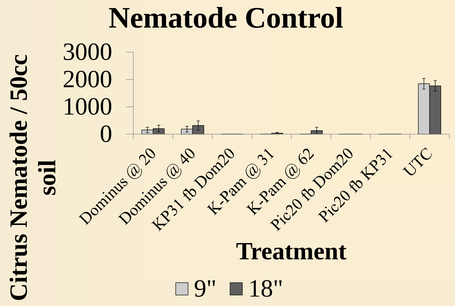

Figure 2: Citrus Nematode survival with combinations of Dominus, K-Pam and PicClor in two different depths.

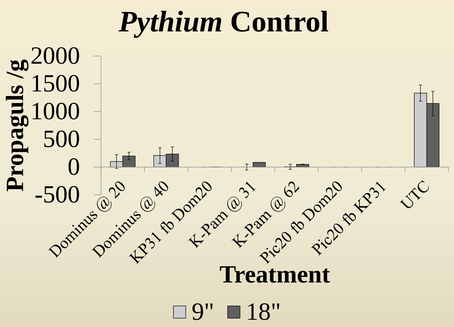

Figure 3: *Pythium ultimum* survival after treatment with combinations of Dominus, K-Pam and PicClor in two different depths.

STEAM

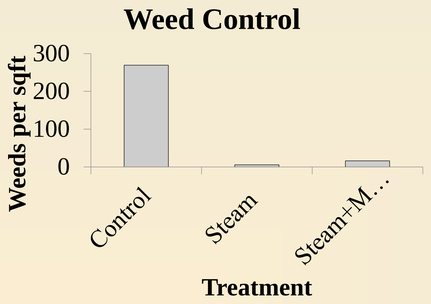

Figure 4: Weed control by steam. Shown are cumulative weed data for 2012/13 (weeds per sqft). Steam controls all weeds significantly (Fennimore et al. 2014)

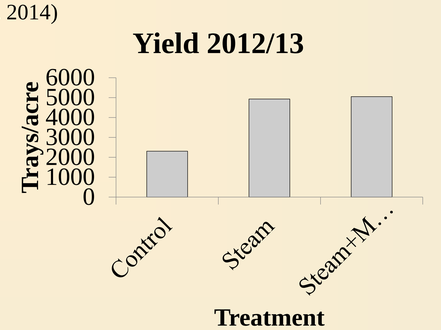

Figure 5: Impact of steam on yield. Steam increases the yield significantly (Fennimore et al. 2014)

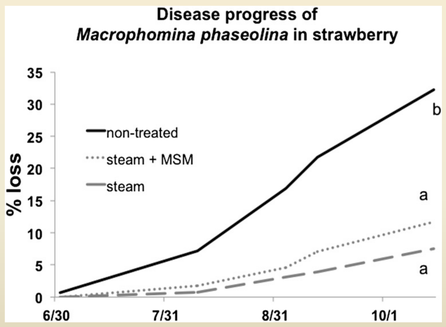

Figure 6: Impact of steam (dotted lines) on diseases progress, caused by *Macrophomina phaseolina*. Steam reduces the progress of diseases signifcantly (Fennimore et al. 2014)

- Tractor towed steam soil disinfection machine. Proto Type, owned by Reiter Inc.. Able to disinfect shaped beds.

RESULTS

Dominus (AITC):

- All treatments had sufficient weed control (Figure 1).
- Nematode (Figure 2) and *Pythium ultimum* (Figure 3) control was efficient in combinations with K-Pam® and Dominus®.
- The same trend was found for control of *Verticillium dahliae* (e.g. 13 microsclerotia/g @ Dominus 40g/a vs. 1.3 microsclerotia/g @ K-Pam fb. Dom).

Steam:

- Weed control was efficient in steamed treatments. Steam + MSM slightly increased weed growth (Figure 4).
- Steam and Steam + MSM increased yield (Figure 5) and reduced charcoal rot dieback (Figure 6) significantly. (Fennimore et al. 2014: *HortScience* 49(12)1542-1549.)

CONCLUSIONS

Together with tools such as ASD, C-Fertilization, cover cropping and conventional fumigation, Steam and AITC should be considered as important parts of integrated soilborne pest management systems for strawberry. Combinations of K-Pam and Dominus or combined application of Steam and MSM appear to be promising future IPM tools for both, conventional and organic strawberry production in California.

CURRENT & FUTURE RESEARCH

We are currently (season 2014/15) investigating the efficacy of steam in organic strawberry production at three locations in the Salinas/Watsonville area. We observe yield increases up to more than 20% in steamed treatments for April/May period so far.

In cooperation with TriCal Inc., we currently build a direct-fired fuel efficient flat field steam machine. Investigations using cover crops systems, Dominus/MSM and steam will be conducted during the next seasons in conventional and organic strawberry production.