

Organic Weed Management in Perennial Fruits

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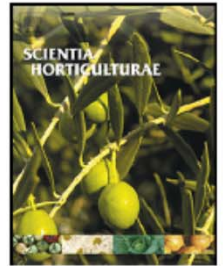




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Organic weed management in perennial fruits



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ABSTRACT

Weed management is key component of establishing and sustaining a profitable organic orchard. Good site preparation is a critical part of an orchard establishment plan. Pre-plant weed control coupled with addressing soil fertility issues before planting can dramatically increase the options available to producer for weed management, while reducing the time to commercially viable levels of fruiting and harvest. Tillage may be the best option on sites with perennial rhizomatous weeds and low soil fertility, or where there is high risk of rodent damage to the crop. Dead organic mulches are best suited to sites with low presence of perennial rhizomatous weeds and sites where at least moderate levels of soil fertility are present. While living mulches tend to provide a desirable habitat in the orchard understory, they are competitive with the crop for water and nutrients, regardless of whether they are mowed or not. They should only be used on sites with good background soil fertility, with frequent mowing, and where climate or irrigation minimize risk of moisture stress. Most manufactured mulches can provide effective weed control for a longer period of time but reduce soil fertility management options. The use of biodegradable mulches under dead organic mulches poses interesting possibilities and should be studied further. Organic herbicides are presently not effective enough or too costly to be used as the primary means of weed control but would be a useful tool for spot and edge control of weeds in mulches.

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There is no single best practice!

- Many weed management options!
- Every farm/site is different
 - Site condition: slope, erodibility, texture, stoniness
 - Irrigation plan
 - Labour availability
 - Budget
 - Capital available
 - Materials available
 - Weed profile
 - Soil fertility status and management plan

Weed Profile

- **Perennial rhizomatous weeds**

- Most sites where the land is being broken from pasture or hay field
- Recently cleared bush with thinner stands
- Can grow into mulches of dead organic matter
- More resistant to flaming and contact herbicide

- **Annual non-spreading weeds**

- Likely cultivated in recent years
- Seed bank in the soil
- Cannot grow through a good mulch of dead organic matter
- More susceptible to flaming and contact herbicide



Soil Amendment Considerations

- Most soil fertility amendments are more effective when incorporated
- Most amendments will not be effective if applied on top of a dead organic mulch
- Mulches (dead organic or manufactured) reduce options for adding soil amendments
- Some dead organic mulches may tie up nutrients (e.g. wood, straw)
- Important:
 - Consider soil fertility status when selecting orchard site
 - Build soil fertility before planting
 - Match soil fertility management plan with weed management plan

Fertility Management - Incorporation?

Solid
Amendment



Mulch of Alleyway
Vegetation



Fertigation



Image: www.fgsagri.co.uk

Unweeded Field

Weeds can significantly impair growth and yield of fruit.

(Weibel and Haseli, 2007; Gut et al. 1996; Tahir et al., 2015)



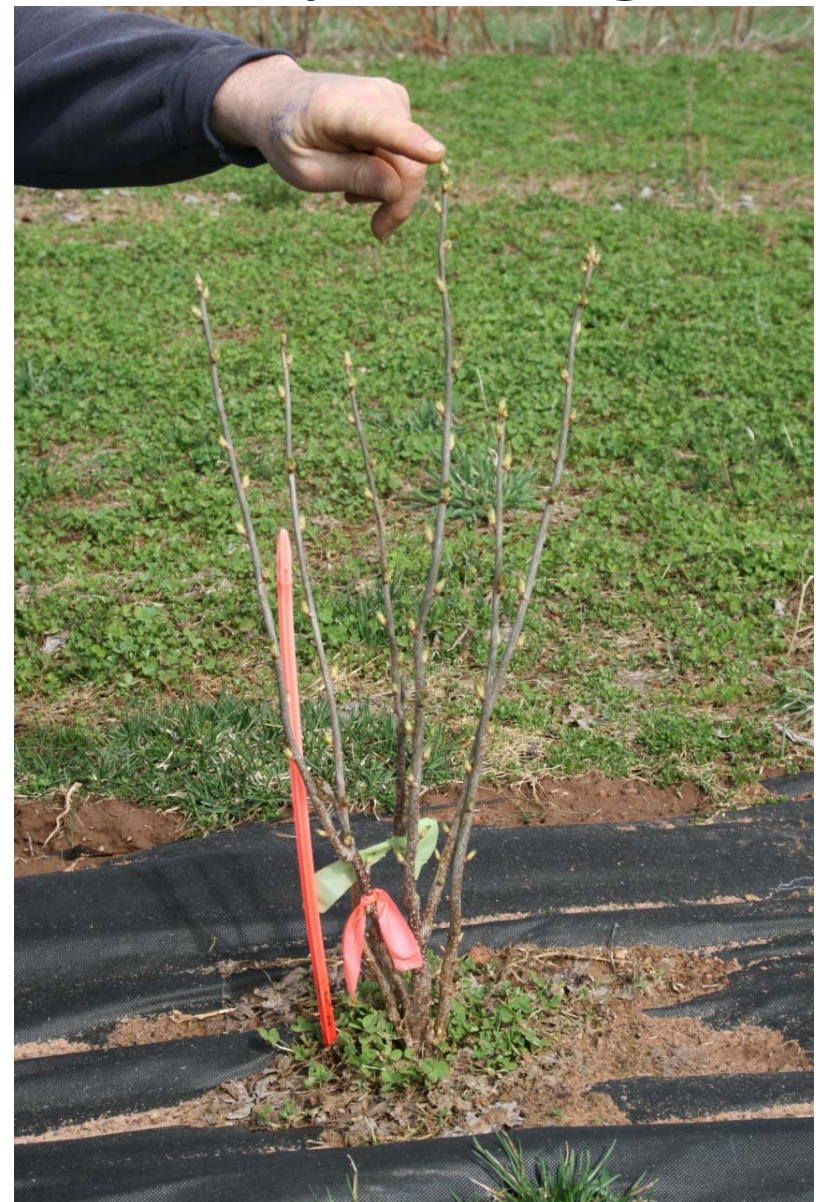
Mowed Living Mulch (Live Cover)

While living mulches may compete with weeds (Bordelon and Weller, 1997), provide cover and promote biodiversity, they can also:

- harbour pests (Webel and Haseli, 2003),
- reduce nutrient availability (TerArvest et al., 2010; Merwin and Stiles, 1994),
- and compete for water (Bordelon and Weller, 1997)



Currants: Mowed living mulch vs. fabric 11 months after planting



Living mulch with coir mat at base of plant



Rototiller

<https://www.youtube.com/watch?v=GDzXixytPs>



Tillage



www.Princeton.edu

Weed badger

<https://www.youtube.com/watch?v=wJeGOYzK4sl>



Rinieri weeder

<https://www.youtube.com/watch?v=GDzXixytPs>



Hydra weeder

http://willsie.com/index.php?main_page=product_info&cPath=1_7&products_id=23



Tillage

- Effectiveness of tillage may vary depending on weed population (Baumgartner et al., 2007),
- Tillage treatments outperformed living mulches and no weed control, but had lower yields than mulch treatments (Larsson, 1997; Makus, 2007)
- Tillage can be detrimental to soil quality (Neilsen et al., 2009; Wander, 1946)
- Tillage may damage tree trunks (Neilsen et al. 2009); and reduces root abundance in the tillage zone (van Huysteen and Weber, 1980)



Organic herbicide?

- Few organic options
- Efficacy varies among studies (Brainard et al., 2013); but often not favourable (Granatstein et al., 2014; Ingels et al. 2013) and costly with moderate efficacy (Shrestha et al., 2012, 2013)
- More effective on annual broadleaf weeds than grasses and perennials unless treated frequently (Brainard et al. 2013)



Image: agrimek.co.za

Flaming (and steaming)

- Most effective on erect, broadleaf weeds and less effective on prostrate and grassy weeds (Shrestha et al., 2012); reapplication every 2-3 weeks is required
- Requires use of shields and good control of flame to avoid damaging tree or bush, and irrigation lines (Stefanelli et al. 2009)
- Comparable in cost to tillage (Granatstein et al., 2014)

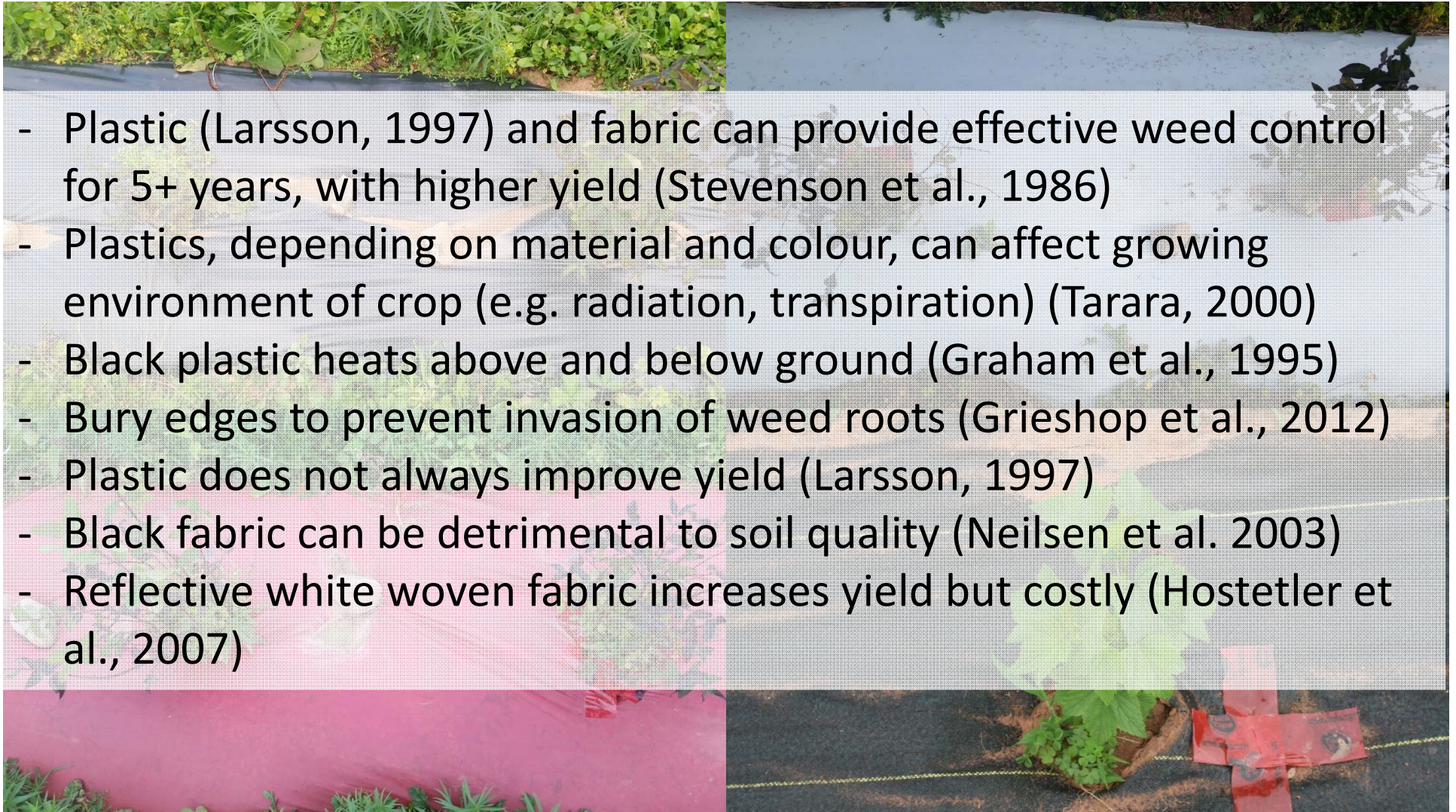


Image from Red Dragon Torches and Equipment:
<http://flameengineering.com/products/red-dragon-vineyard-orchard-flamers>

Manufactured Mulches

Black plastic

White plastic



- Plastic (Larsson, 1997) and fabric can provide effective weed control for 5+ years, with higher yield (Stevenson et al., 1986)
- Plastics, depending on material and colour, can affect growing environment of crop (e.g. radiation, transpiration) (Tarara, 2000)
- Black plastic heats above and below ground (Graham et al., 1995)
- Bury edges to prevent invasion of weed roots (Grieshop et al., 2012)
- Plastic does not always improve yield (Larsson, 1997)
- Black fabric can be detrimental to soil quality (Nielsen et al. 2003)
- Reflective white woven fabric increases yield but costly (Hostetler et al., 2007)

Red plastic

Black fabric

Dead Organic Mulches

- Needs to be at least 10 cm thick to be effective (Lanini et al., 2011); susceptible to encroachment of rhizomatous weeds from edges (Weibel and Haseli, 2003)
- Wood mulch can be effective in weed control (Granatstein and Mullinix, 2008), but:
 - is costly and loses efficacy over time (Larsson, 1997)
 - generally not outperforming treatments with tillage or manufactured mulch (Larsson, 1997; Sanderson and Fillmore, 2012), possibly due to high C:N ratio (Weibel and Haseli, 2003)
- Compost is not an effective weed control (Tworkowski, 2004)
- Straw can provide good weed control (Sanderson and Fillmore, 2012; Merwin et al. 1994) but needs to be replenished



Couch grass encroachment



Mulch on biodegradable plastic after 1 season

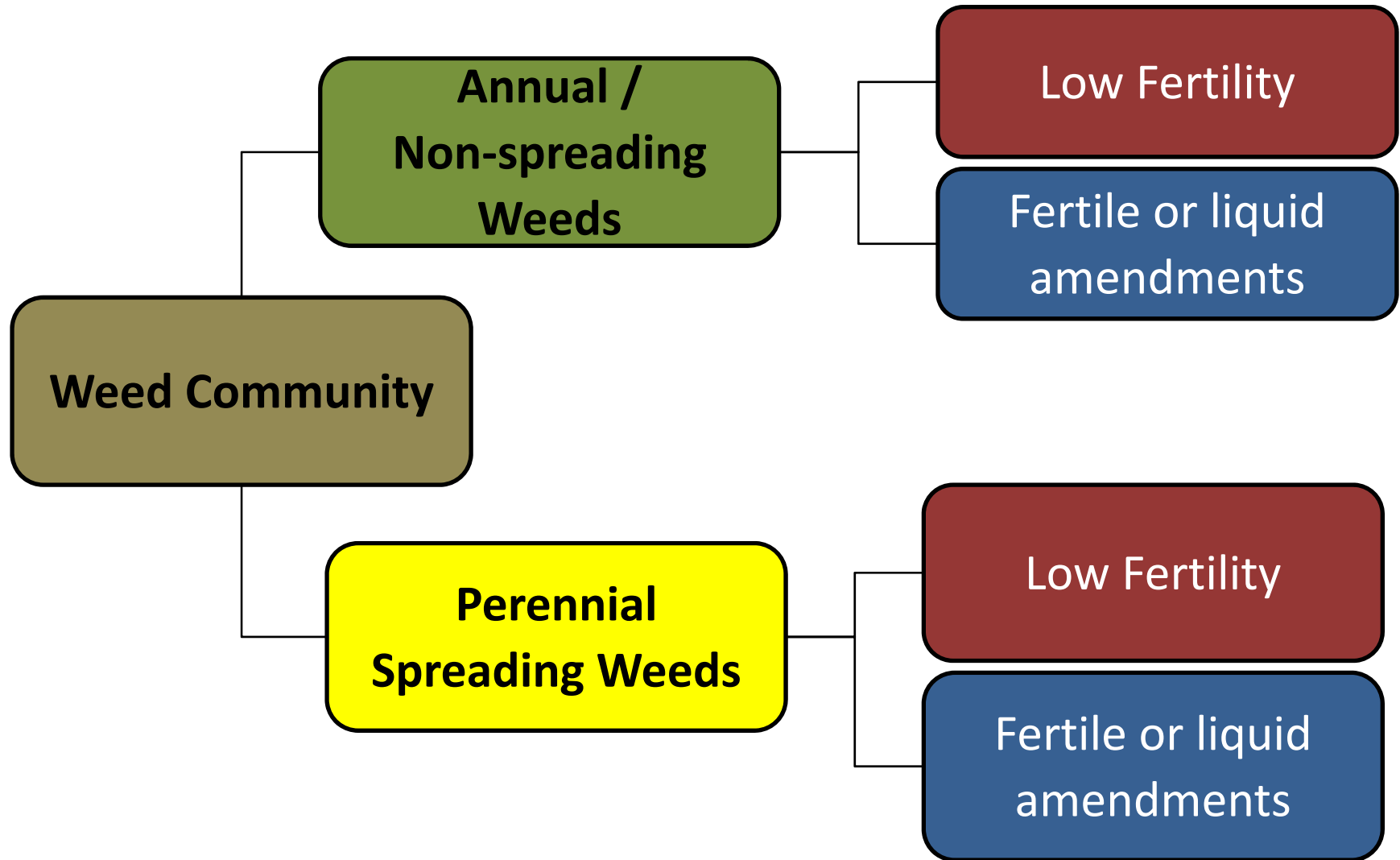


Dead organic mulches – fertility management plan?



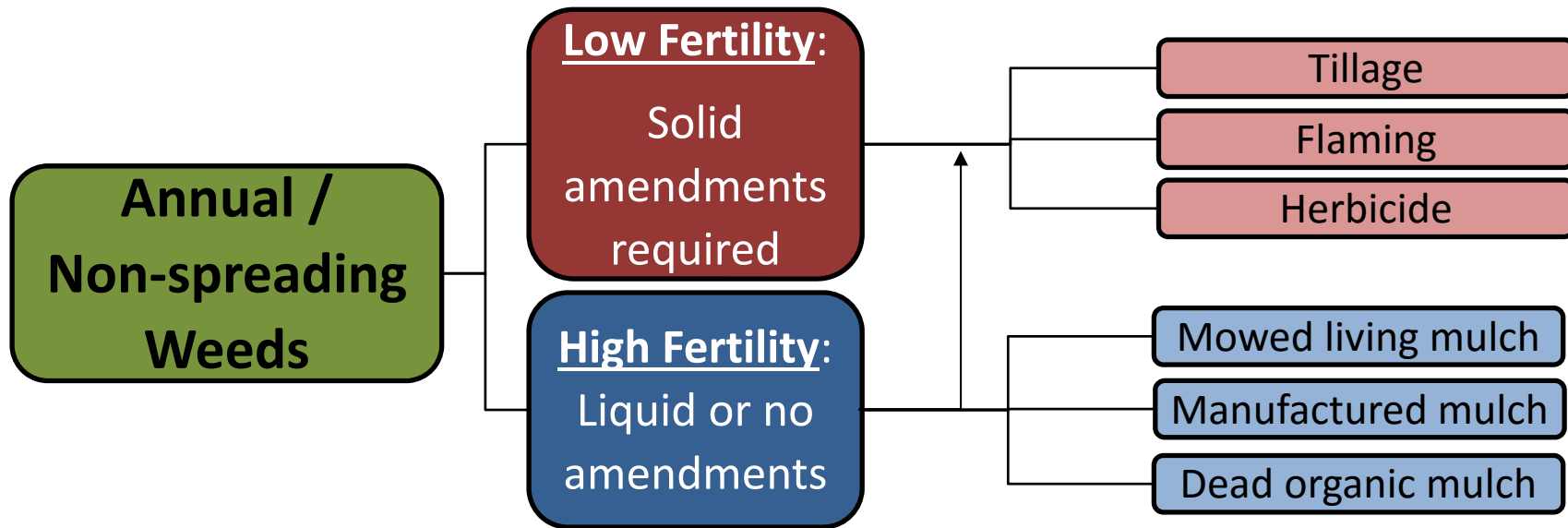
Figure 1. Decision aid for organic weed management

(Adapted from (Hammermeister, 2016))



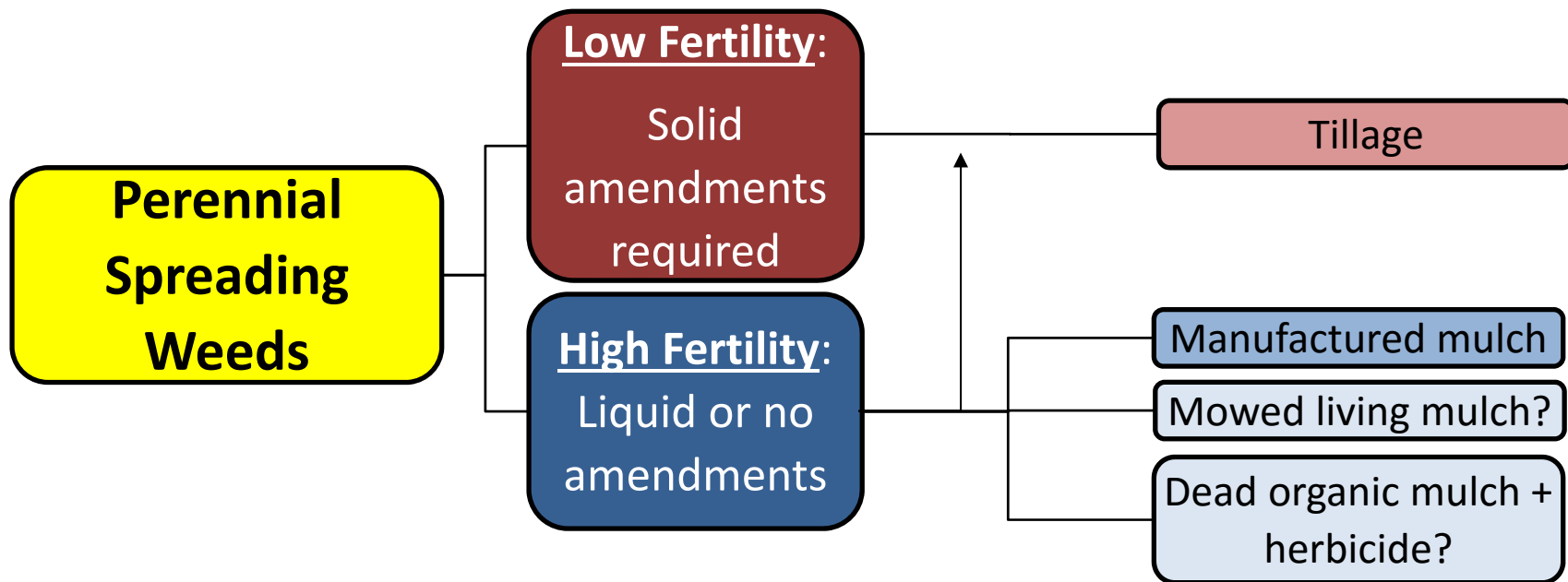
Decision aid for management of sites with annual weeds

(Adapted from Hammermeister, 2016)



Decision aid for management of sites with perennial weeds

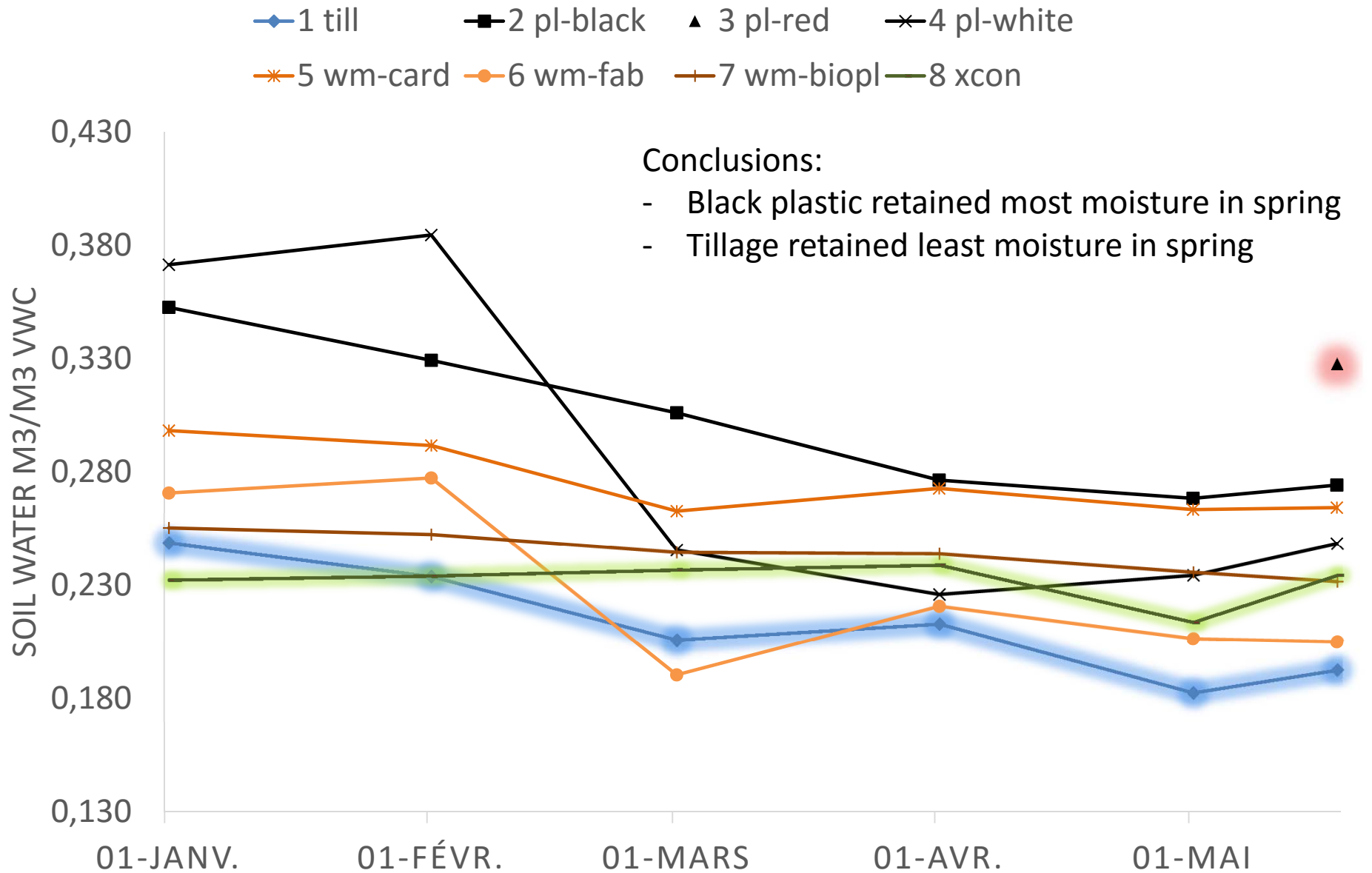
(Adapted from Hammermeister, 2016)



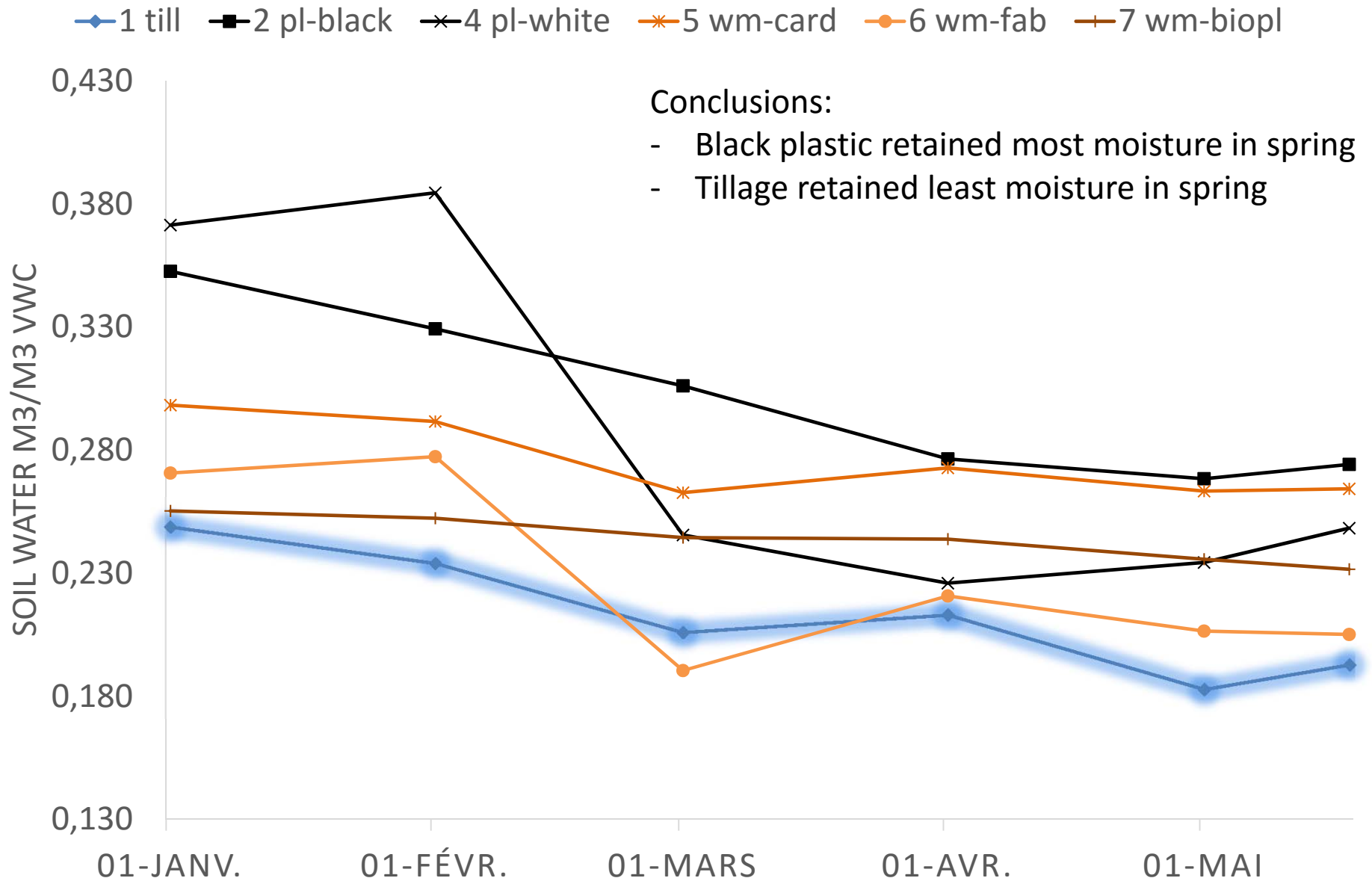
Soil Moisture and Temperature

- Some crops prefer cool soils, how do weed management treatments affect soil temperature?
- Do some weed management practices delay soil warming in spring?
- How do weed management practices affect growing season moisture availability?

AVERAGE SOIL MOISTURE OF HASKAP 1-JAN TO 18-MAY, 2016 AT BELMONT, NS

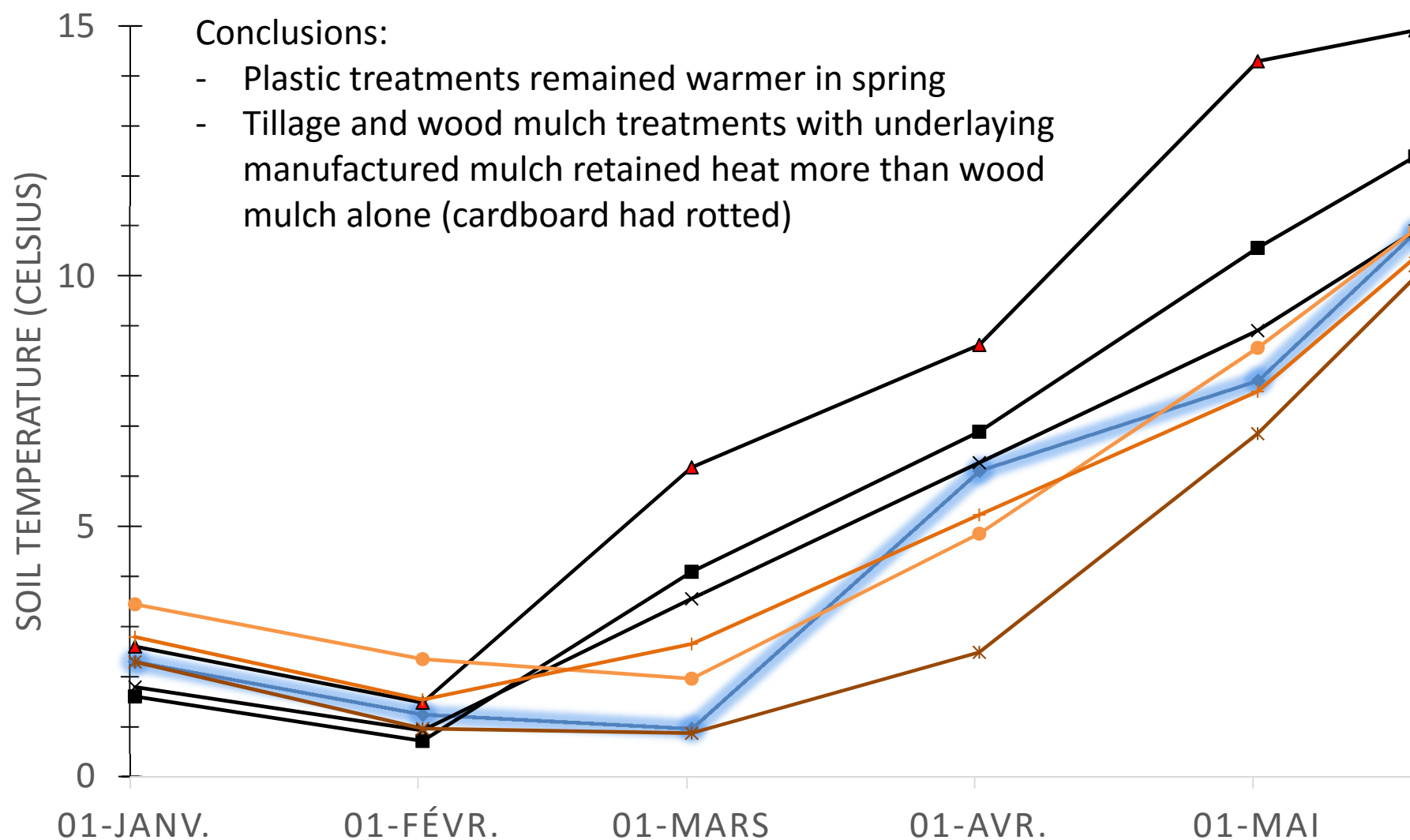


AVERAGE SOIL MOISTURE OF HASKAP 1-JAN TO 18-MAY, 2016 AT BELMONT, NS



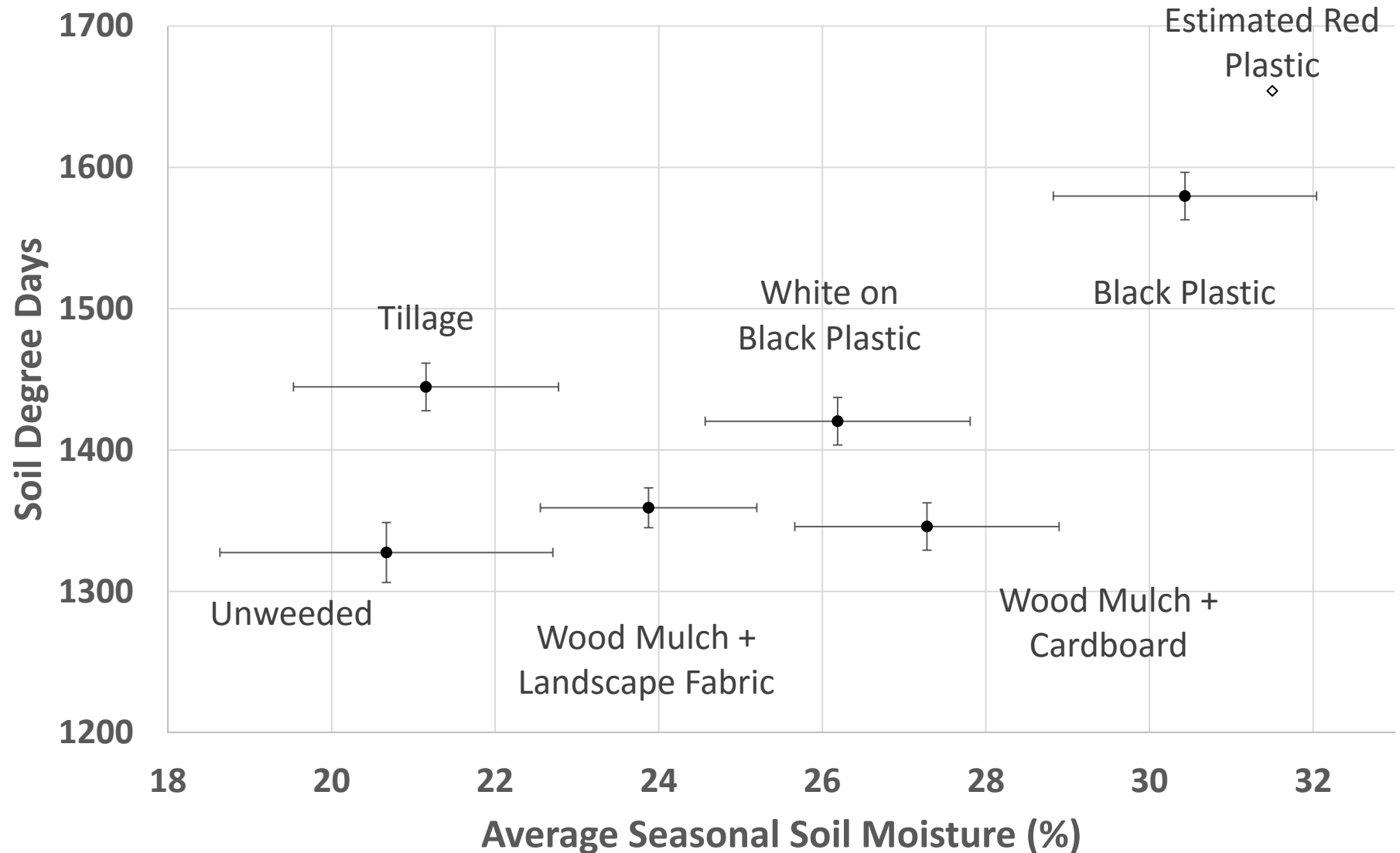
AVERAGE DAILY SOIL TEMPERATURE (10 CM) OF HASKAP 1-JAN TO 18-MAY, 2016 AT BELMONT

—◆— 1 till —■— 2 pl-black —▲— 3 pl-red —×— 4 pl-white
—*— 5 wm-card —●— 6 wm-fab —+— 7 wm-biopl



Soil temperature vs. average soil moisture from June-early September 2015 in haskap weed management trial plots.

Red plastic treatment was estimated due to missing data.



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The crew!

