Using Mulch to Reduce Dependence on Preemergence Herbicides and Improve Weed Control in Nurseries
(Preliminary Report)

November 9, 2022

Chris Marble and Ping Yu
UF/IFAS Mid-Florida Research and Education Center, Apopka, FL

Project Overview and Objectives:
Preemergence herbicides provide many benefits to growers but can result in crop injury. Recent data suggest that new branded cultivars of loropetalum, ligustrum, nandina, and many others are much more sensitive to herbicides compared with older varieties. Mulch materials have shown promise for weed control, but more information is needed to optimize their use for nursery growers. Two mulch materials (rice hulls and pine bark nuggets) will be evaluated at different depths, use patterns, and in combination with preemergence herbicides to determine weed control efficacy, release rates from fertilizers, and improvements in crop safety to increase growers' profitibility. The specific objectives of this project are to answer questions pertaining to the use of mulch as a weed management tool for container nursery growers. Experiments are currently being conducted to answer the following questions:

1) Can mulch reduce injury from preemergence herbicides?
2) Will a mulch application reduce the release rate of a controlled release fertilizer (CRF)?
3) Can mulch be applied in lieu of hand-removal to reduce spread and survival of small weeds or liverwort?
4) If mulches and herbicides are combined, should mulch be applied before or after PRE application?

Progress to date:

Objective 1: Experiments are scheduled to be conducted beginning in early Spring 2023 and will be completed and results provided to NHF in the final report.

Objective 2: One experimental run was completed and another ongoing to determine if the use of ricehulls or pinebark negatively affect the growth of pentas (Pentas laceolata) when fertilizer is applied via topdressing, subdressing, or incorporated. In this study, a standard pinebark substrate was used as the potting mix and then fertilizer was applied via one of the three methods but the same rate and type of fertilizer was used in all cases (Osmocote 17-5-11 at a rate of 36 grams per pot). For pentas, the plants were potted, fertilized, and then the mulch was applied at a 1 inch depth. Weed control was assessed in separate pots by sowing 25 seeds of bittercress (Cardamine flexuosa). All pots were kept inside a greenhouse and irrigated once daily for 15 minutes supplying 0.25 inches of water.
The data collected on pentas included growth index (plant height + width + perpendicular width) every two weeks and shoot dry weight was determined at the conclusion of the trial by clipping plants at the soil line and drying shoots in a forced air oven. Soil pH and EC were also measured every two weeks using a Hanna pH/EC meter with the Virginia Tech pour through method. For bittercress, coverage was rated in each pot on a 0 to 100 scale where 0 = 0% of the pot was covered with bittercress and 100 = 100% of the pot was covered with bittercress every two weeks and shoot dry weights were collected in the same manner as described above.
The experiment was designed as a completely randomized 3 (mulch) × 3 factorial (fertilizer placement) factorial with 8 single pot replications per treatment. Data were subjected to ANOVA and means were separated using Tukey's Honest Significance Difference test at $p = 0.05$.
For the first experimental run, the difference in pentas shoot dry weights indicated that all plants grew similarly regardless of fertilizer placement or mulch type

(Table 1). For bittercress, there were significant differences in the growth attributed to the interaction between the mulch type and fertilizer placement (Table 2). Bittercress with topdressed fertilizer placements had lower coverage and dry weights as compared to subdressed or incorporated. However by week 12, mulch was the only significant factor (Table 2). Both rice hulls and pinebark suppressed growth of the bittercress with rice hulls providing 100% growth reduction, and pine bark providing a 78% reduction in growth (Table 2). Electrical conductivity data showed that while EC values were at times higher in the subdressed treatment, there was no significant effect on plant growth. Results to date indicate that fertilizer placement nor mulch type have an affect on pentas growth. This allows growers to use the fertilizer placement and mulch that is most convenient for them in their operations while still obtaining optimal weed control with mulch. Regardless of fertilizer placement, use of mulch may reduce bittercress growth by 78% to 100%, but a greater reduction in bittercress growth may be achieved with pinebark if the fertilizer is topdressed. This study is currently being repeated to validate the results and to allow for better analysis of additional data.

Table 1. Growth of pentas over 12 weeks as affected by mulch type and fertilizer placement.

		Growth Index and Dry Weight[a]		
Mulch	**Fertilizer placement**[b]	**4 WAT**	**8 WAT**	**D.W. (g)**[c]
Rice hull	Incorporated	31.3	51.0 a	31.1
	Subdressed	33.3	53.7 a	38.4
	Topdressed	29.9	48.6 a	33.6
	Mean	31.5	51.1 AB	34.4
Pinebark	Incorporated	32.7	51.8 a	36.7
	Subdressed	30.8	45.8 ab	33.4
	Topdressed	27.7	30.0 b	37.9
	Mean	30.4	42.5 B	36.0
No mulch	Incorporated	31.5	56.3 a	44.8
	Subdressed	33.1	52.4 a	38.9
	Topdressed	32.2	54.0 a	40.5
	Mean	32.3	54.2 A	41.4
ANOVA[d]				
Mulch		0.5756	**0.0134**	0.2545
Placement		0.3786	**0.0723**	0.9892
Mulch x Placement		0.7280	0.1905	0.7500

[a]Growth index was taken at 4 and 8 weeks after treatment (WAT) by averaging plant height and two width measurements.

[b]36 g of controlled release fertilizer was applied to each pot.

[c]Dry weight was taken at 12 weeks after potting.

[d]ANOVA shows the results of analysis of variance. Means within a column followed the same lower case letter within each mulch type are not significantly different based on Tukey's Test (0.05). Means followed by same uppercase letter are not significantly different based on the same statistical test.

Objective 3: An experiment is currently underway (initiated in October, 2022) to evaluate the use of mulch to control weeds following emergence. In this trial, trade gallon (3.0L) pots were seeded with either bittercress (Cardamine flexuosa) or Oxalis (Oxalis stricta) seedlings. Following emergence, pots were thinned to 5 weeds per pot. Weeds were then allowed to grow to one of two growth stages, 1) cotyledon to 1 leaf (reached approximately 14 days after sowing) or 2) 2 to 4 leaf growth stage (reached approximately 21 days after sowing). When the targeted growth stages were reached, pots were mulched rice hulls at either 0, 0.25, 0.5, or at a 1 inch depth. Counts were then conducted at 4 weeks and then are scheduled to be conducted again at 10 weeks to determine how many seedlings survived and emerged through the mulch in each treatment. To date, almost all weeds for both species in both growth stages have emerged through the mulch layer when applied at 0.25 or 0.5 inches. However, weed counts are still at an average level of 0 when mulch was applied at 1 inch, indicating that neither species can emerge through a 1 inch layer of rice hulls. This indicates that for growers who have weeds that are already emerged and plan to topdress with ricehulls, handweeding may not be necessary if mulch is applied at a level of at least 1 inch. The trial is still ongoing and final results will be shared in our final report, as well as with additional data on liverwort.

Table 2. Growth of bittercress over 12 weeks as affected by mulch type and fertilizer placement.				
		Percent Cover and Dry Weight[a]		
Mulch	Fertilizer placement[b]	4 WAT	8 WAT	D.W. (g)[c]
Rice hull	Incorporated	0.0 b	0.0 a	0.0 a
	Subdressed	0.3 a	0.0 a	0.0 a
	Topdressed	0.0 b	0.0 a	0.0 a
	Mean	0.1 B	0.0 C	0.0 B
Pinebark	Incorporated	0.8 a	22.5 a	1.7 a
	Subdressed	0.8 a	21.0 a	1.8 a
	Topdressed	0.0 b	0.0 b	0.0 b
	Mean	0.5 B	14.5 B	1.2 B
No mulch	Incorporated	12.5 a	100.0 a	8.0 a
	Subdressed	12.0 a	95.0 a	5.9 a
	Topdressed	0.3 b	31.8 b	2.7 b
	Mean	8.3 A	75.6 A	5.5 A
ANOVA[d]				
Mulch		**0.0001**	**0.0001**	**0.0010**
Placement		**0.0040**	**0.0006**	0.0515
Mulch x Placement		**0.0022**	**0.0071**	0.1679

[a]Percent cover was based on 0 to 100% scale where 100% = 100% of the pot surface covered with bittercress.

[b]36 g of controlled release fertilizer was applied to each pot.

[c]Dry weight was taken at 12 weeks after potting.

[d]ANOVA shows the results of analysis of variance. Means within a column followed the same lower case letter within each mulch type are not significantly different based on Tukey's Test (0.05). Means followed by same uppercase letter are not significantly different based on the same statistical test.

Objective 4: Experiments were completed evaluating the use of herbicides in combination with mulch, and evaluating the timing of herbicide applications in relation to mulch application timing. In this experiment, pots were mulched with either no mulch, rice hulls, or pinebark, and then treated with either isoxaben (Gallery), prodiamine (Barricade), or left not treated. Herbicides were applied both before and after mulch application to determine if timing had any effect on herbicide performance.

Results showed that rice hulls outperformed pinebark, providing 94% control of bittercress compared to 62% control when pinebark was used. The use of herbicides increased the efficacy of pinebark mulch, increasing control to over 90% but no added benefit was obtained with ricehulls as rice hulls alone (with no herbicide) provided 94% control, at least through a 10 week period. In regards to timing, applying the herbicide before or after mulch was applied made no significant difference (Figure 1). Over 90% control was achieved in all cases. Results overall indicate that mulch tends to outperform the use of a single preemergence herbicide application, but when combining the two methods, herbicides could be used either before or after the mulch is applied and growers should still see excellent weed control. Further studies are planned with additional herbicides and weed species to see if results are consistent across a wide weed spectrum.

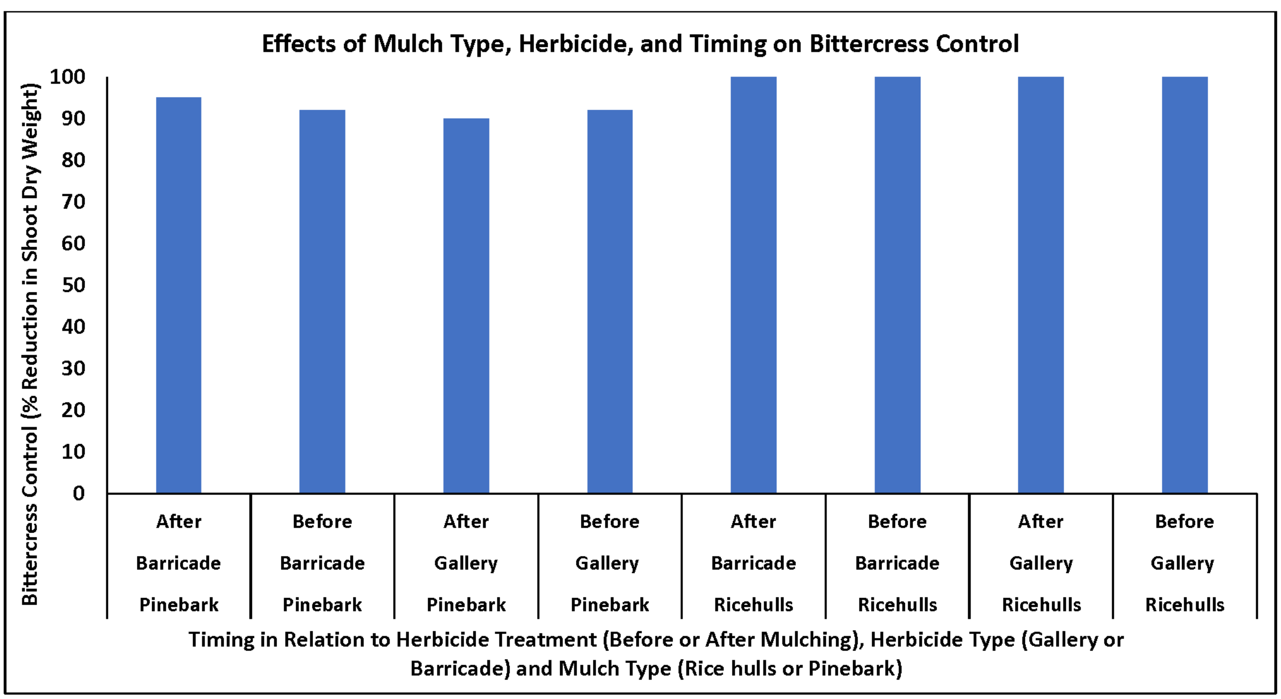

Figure 1. Results from experiments addressing Objective 4.