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SHREDDING PRIOR TO DEFOLIATION, PRE-AND POST-FROST, WITH DIFFERENT WEED DENSITIES ON SUGARBEET YIELD, QUALITY, TARE PERCENT AND ECONOMICS

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"Have Gun - Will Travel" was an old western television program in the early 1950's (for those who can remember back that far). A new TV version for 21st century agriculture may be "Bought a Shredder – Have to USE IT". The use of shredders in sugarbeet production should be based on given conditions and not ownership or the complaints of those tilling the soil, defoliating or lifting the crop. Simply put, it costs money to operate a shredder and conditions must exist that will make a return on investment possible. Those conditions in sugarbeet production are (but not limited to) length of stubble if small grain precedes sugarbeets, weeds and frost that make canopy removal by a standard defoliator less than optimum for maximum quality and storeability over the processing season. In a preliminary study on stubble residue length, Giles and Cattanach[1] found no benefit from shredding to reduce stubble length. A preliminary trial was initiated in 2003 at the U of M, NWROC, Crookston, MN to evaluate shredding prior to defoliation, pre- and post-frost, and at different weed densities on yield, quality, tare and economics.

Procedure: Two blocks of land 500 ft by 132 ft (72 rows) was space planted at 5.0 inches to Holly HH-115 sugarbeet seed on May 21, 2003. Cultural, insecticide and fungicide treatments were applied for maximum yield. Three weed populations (heavy, intermediate, none) were established by altering the number of herbicide applications (1x, 2x and 3x with standard micro-rates). Each weed population was replicated four times. On September 30 and October 29, one half of each block was shredded, then defoliated with a standard triple-drum defoliator (all rubber flails, studded front drum) or just defoliated in an alternate pattern. Three subsamples in each replication, within each method and weed population, were lifted with a modified Parma lifter for quality analysis and yield. The cleaning area (grab rolls) on the modified lifter is slightly larger than current 6 or 8 row commercial lifters. The September 30 harvest represented the pre-frost harvest, and the October 29 harvest the post-frost harvest. The dominant broadleaf weed in the heavy and intermediate weed strips was pigweed with the remainder being lambsquarter.

Results and Discussion: The harvest on September 30 (pre-frost) showed no significant differences in yield (within a given weed population), net sucrose %, recoverable sucrose per ton (RST), beet tare or economic return between a single pass with a standard defoliator vs use of a shredder followed by a defoliator (Tables 1,2,3). Yield was significantly reduced between the various weed populations (Table 4). Conditions for both defoliation and harvest were prime.

Ten frost conditions (23EF - 31EF) separated the pre- and post-frost harvests. The October 29 harvest was also preceded by 0.65 inch of rainfall and daytime temperatures of 35EF which made both methods of defoliation as well as harvest more difficult. On the day of defoliation and harvest, the start was delayed to let the beet leaves thaw out. Even with this number of frost periods, and the date of harvest, the canopy was still considered to be in fair condition. The leaf canopies in both weed populations were less affected by the frost conditions than the weed free check.

There was no significant reduction in net sucrose % or RST in the heavy weed density plots between shredding and defoliating vs a single defoliation. A statistically significant increase in both traits occurred with the intermediate weed density and the weed-free treatments when shredding preceded defoliation (Table 1). This resulted in an increase in revenue of $1.35 and $2.79 per ton respectively. This increase may be due to greater frost damage to the canopy of these two treatments as noted earlier. The weed-free plots had larger amounts of petiole material still attached with a single defoliation, than did those beets from the heavy weed treatments.

The amount of beet tare, soil on beets delivered to the quality lab, was significantly higher for the heavy weed infestation, compared to the weed-free treatments post-frost (Table 3). Shredding plus defoliation reduced the beet tare at all weed densities. As noted earlier, harvest conditions were less than ideal, and it is speculated that the increase in canopy material and weeds on the grab rolls most likely reduced the cleaning capacity of the lifter which resulted in the beet tare shown.

The effect of weed population on yield is clearly evident (Table 4). Even though there was 10 frost periods between the two harvest dates, an average increase of five ton/A of yield and 1.06% net sucrose occurred.

Table 1. Effect of shredding ahead of a standard defoliator on net sucrose percent [1] and RST ( ) pre- and post- frost at different weed populations.

	Heavy Weed		Intermediate Weed		No Weed	
Harvest Date	Defoliator	Shred. + Defol	Defoliator	Shred + Defol	Defoliator	Shred + Defol
September 30 (pre-frost)	16.48	16.52	16.55	16.51	16.49	16.51
	(329.6)	(330.4)	(331.0)	(330.2)	(329.8)	(330.2)
October 29 (post-frost)	17.52	17.58	17.44	17.74	17.26	17.88
	(350.4)	(351.6)	(348.8)	(354.8)	(345.2)	(357.6)

1. Net sucrose = % sucrose - % LTM

Table 2. Value [1] increase (decrease) per ton from shredding ahead of a standard defoliator, pre-and post-frost at different weed populations.

Harvest Date	Heavy Weed	Intermediate Weed	No Weed
September 30	$ 0.18	$ (0.18)	$ 0.09
October 29	$ 0.27	$1.35	$ 2.79

1. Assumes a sugar price of $0.225/ lb.

Table 3. Beet tare % from shredding and defoliating vs defoliating only, pre-and post-frost, at different weed populations.

	Heavy Weed		Intermediate Weed		No Weed	
Harvest Date	Defoliator	Shred + Defol	Defoliator	Shred + Defol	Defoliator	Shred + Defol
September 30	2.82	2.93	3.00	2.91	2.72	2.93
October 29	8.01	7.08	7.89	7.28	6.61	6.28

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Table 4. Effect of weed populations on yield (T/A) at different harvest dates.

Harvest Date	Heavy Weed	Intermediate Weed	No Weed
September 30	12.33	16.09	19.42
October 29	17.58	21.16	24.25

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[1] Giles, J. F. and N. R. Cattanach. 2002. Effect of Grain Stubble Length on Sugarbeet Production. 2002 Minnesota - North Dakota Sugarbeet Research Extension Reports. 33: 128-129.