

## PFI Flame Cultivation Research in Corn – Effectiveness and Cost

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### Summary

- Flame cultivation can be effective in killing weeds, including those growing in the crop row.
- Any positive effect on crop yields is through reduction of weed competition only.
- The cost per acre of flame cultivation is two-to-three times greater than rotary hoeing, as is the time involved.
- In wet conditions, when the hoe and harrow are relatively ineffective, flame cultivation is probably the best non-chemical weed control option for corn.

### Background

The wet spring of 2008 has made mechanical weed control more difficult. The rotary hoe and harrow are effective tools to eliminate small weeds in new crops, but only if conditions are dry enough to desiccate the weeds disturbed by the equipment. Lacking those conditions, some farmers have recalled another weed control tool, flame cultivation. Flame cultivation does not require drying conditions to be effective, so in a wet year it can be the one nonchemical method that will clean up the young crop.

For at least ten years, Practical Farmers of Iowa members have researched flame cultivation. These trials have typically been done in corn. The growing point of corn remains below the ground until about the fifth-leaf stage, so the young crop will recover from any flaming damage. Soybeans are much more sensitive to flaming, although some PFI members have flamed emerging beans in which the first true leaf is not yet visible. Vegetable growers **Gary and Nancy Guthrie** (Nevada) also flame ahead of carrot emergence.

### On-Farm Research

The following table summarizes PFI flame cultivation trials in corn. **Joe Fitzgerald** at the New Melleray

Abbey (Peosta) was among the first enthusiasts of this practice. His 1998 trial lacked weed counts and was replicated only three times, but the flame cultivation at least seemed to have no negative effect on corn yields. In fact at the time Joe was of the mind that flame cultivation might actually stimulate the crop to yield more. He repeated the trial in 1999 and found that flaming reduced broadleaved weeds by over 60% and – yes – significantly increased corn yield. In the same year, **Dennis and Eve Abbas** (Hampton) carried out a similar trial and reduced weeds over 40%. However there was no statistically significant effect on corn yield. However, Dennis and Eve carried out another trial in 2000, comparing one flame cultivation to two, and they experienced a significant *reduction* in corn yield. In this trial weed pressure was light, so there was no crop benefit in terms of reduced competition. In recent years several other cooperators have, intentionally or unintentionally, evaluated flame cultivation in conditions of low weed pressure. In 2004, **Doug Alert and Margaret Smith** (Hampton) found that flaming did not affect corn yield. In 2006 and 2007, **Ron and Dottie Dunphy** (Creston) also found that flaming did not affect corn yields when weeds were light or mechanical cultivation had already taken care of the problem.



Flame cultivation at the New Melleray Abbey farm.

## Flame Cultivation Weed Management Trials

COOPERATOR	TREATMENT "A"					TREATMENT "B"
	DESCRIPTION	TREATMENT COST	YIELD	BROADLEAF WEEDS/ACRE	OTHER WEED INFORMATION	DESCRIPTION
NEW MELLERAY (1998)	FLAME WEEDER + 2 CULTIVATIONS	\$19.29	155.4	—		2 CULTIVATIONS
ABBAS (1999)	ROW CULTIVATION ONLY	\$0.00	139.1	2,656	WEEDS COUNTED ON 8/3	FLAME CULTIVATED + MECHANICAL
NEW MELLERAY (1999)	ROW CULTIVATION ONLY	\$12.00	135.5	20,300	GRASS RATING SIGN. GREATER	FLAME CULTIVATION
ABBAS (2000)	FLAMED ONLY BEFORE 1 <sup>ST</sup> CULTIVATION	\$4.85	131.3			FLAMED BEFORE 1 <sup>ST</sup> AND 2 <sup>ND</sup> CULTIVATION
MUGGE (2002, rye cover & flaming factorial)	FLAME CULTIVATION +MECHANICAL	\$31.29	—	53.8		MECHANICAL ONLY
ALERT (2004)	MECHANICAL ONLY	\$12.03	190.1			FLAMED +MECHANICAL
DUNPHY (2006)	2X ROTARY HOE	\$4.70	156.8			1 HOEING, 1 FLAMING
DUNPHY (2007)	2X HOE ONLY	\$5.41	169.8	540	VERY FEW GRASSES	FLAME & 2 X HOE

These PFI trials demonstrate that flame cultivation can be effective on weeds. They also strongly suggest that any positive effect on corn yields is simply from reducing weed competition.

The table shows that in these trials, cooperators seldom relied on flaming alone for weed control. Flame cultivation was likely to be accompanied by rotary hoeing and mechanical row cultivation. This means the weed counts do not reflect the full potential of flame cultivation to kill weeds. It also suggests that these farmers were cautious

about relying completely on flaming.

In the eight trials shown in the table, the cost of one pass of flame cultivation varied from \$4.11 per acre to \$11.42, with an average of \$7.14. This included liquid propane in the range of 4-6 gallons per acre. Using current ISU estimated equipment costs and a labor rate of \$10 per hour, a single pass with a 31-foot rotary hoe would cost about \$2.63 per acre. The hoe would also accomplish that pass in one-half to one-quarter the time required by a 4- or 6-row flame cultivator. So clearly mechanical weed removal is the preference when it can be effective. However, when the spring stays

## Flame Cultivation Weed Management Trials

TREATMENT "B"				TREATMENT DIFFERENCES					COMMENTS
TREATMENT COST	YIELD	BROADLEAF WEEDS/ACRE	OTHER WEED INFORMATION	YIELD DIFF.	YLD. SIG.	YLD. LSD	BRDL. WEED SIG.	TRT "A" \$ BENEFIT	
\$9.04	146.5	—		8.9	N.S.	22.7		-\$10.25	3 REPS ONLY. BOTH TRTS 1X HOED & 2X CULTIVATED
\$5.05	136.6	1,557		2.5	N.S.	12.3	*	(\$5.05)	FLAMED JULY 1. REDUCTION IN CANADA THISTLE AND QUACK
\$17.41	143.8	7,700	BROADLEAF RATING SIGN. LESS	-8.3	*	7.4	*	(\$19.15)	FLAMED JUNE 20
\$9.70	127.0			4.3	*	3.4		\$4.85	SECOND FLAMING SIGNIF. REDUCED GRASS & BROADLEAFS, BUT LOW OVERALL WEED PRESSURE
\$27.18	—	117.0		—			*		BOTH TRTS ALSO HOED 3X, CULTIVATED 3X
\$21.53	189.4			0.7	N.S.	10.9		\$9.50	BOTH TREATMENTS HOED & CULTIVATED 2X
\$8.85	158.5			-1.7	N.S.	4.2		\$4.15	NO LARGE OR CONSISTENT DIFFERENCE IN WEEDS
\$16.83	173.9	266	VERY FEW GRASSES	-4.1	N.S.	7.0	N.S.	\$11.42	BROADLEAF DIFFERENCE SIGNIF. AT 94%

wet, rotary hoeing or harrowing may not be effective at all. In conditions like that, flame cultivation may be the only practical way to achieve in-row weed control, which is critical to success.

### References

For tips on equipment, settings, timing, and other aspects of flame cultivation, contact Rick Exner or the PFI cooperators contributing to this flame cultivation research:

Dennis and Eve Abbas, 1038 180<sup>th</sup> St., Hampton, IA 50441 641-579-6421

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