

PROJECT TITLE: Combination Herbicide Study

YEAR/PROJECT: 1989/754

PROJECT PERSONNEL: Leader - Vern R. Stewart, Todd K. Keener - Research Specialist, NWARC, Kalispell, MT  
Chemical Cooperators

OBJECTIVE: To determine the effectiveness of broadleaf and wild oat herbicides in combination for broad spectrum weed control.

SUMMARY: In high populations of broadleaf and wild oats several broadleaf herbicide treatments combined with Hoelon, Puma, Tiller and Assert provided excellent broad spectrum weed control.

RESEARCH METHODS:

Herbicides were applied at the 1-3 leaf and 3-5 leaf stage of wild oats using a research-type tractor mounted sprayer. Plots were 10' X 12' with treatments being replicated four times in a randomized complete block design. A volume of 24.85 gpa was used with 8002 nozzles at 32 psi.

Planting data: Newana spring wheat was planted 4/21/89 at 60 lbs per acre using a International press-type drill with 7" spacing. Seed depth was 1 1/2" in a seedbed that had been first fall plowed, spring disced, cultivated and then packed. Previous crop was spring barley. A surfactant at .25% V/V was used with sulfonyl ureas except where combined with Hoelon.

Application data:	1-3 leaf stage	3-5 leaf stage
Date:	5/15/89	5/22/89
Air temp:	71 F	68 F
Soil temp:	66 F	66 F
Rel humid:	10%	11%
Wind (mph)	0-2 sw	0-3 ssw
Cloud cover:	clear	prtly cldy
Soil moisture:	top/good sub/v.good	top/fair sub/v.good

Weed stages:	1-3 leaf stage	3-5 leaf stage
Wild oats	2 1/2 lf	4-5 leaf
Henbit	4-6 lvs	4-8 lvs
Fanweed	6-8 lvs	10-12 lvs
N. F. Catchfly	4 lvs	4-10 lvs
W. buckwheat	2 true lvs	2-4 lvs
Lambsquarter	4-6 lvs	4-10 lvs
Chickweed	seedling	6-10 lvs

RESULTS:

Broadleaf herbicide treatments alone were in most cases over run with wild oats resulting in very low yields. Sulfonylureas combined with Hoelon and Assert gave wild oat control below 90% and was less than 45% in the Hoelon plus Harmony Extra combination. All Puma and Tiller combinations gave excellent wild oat and broadleaf control. Puma and Tiller alone did not give as good wild oat control when combined with broad leaf herbicides suggesting a synergistic reaction. Broadleaf control was very good for most broadleaf herbicides tested and was even seen in wild oat treatments where plant competition thinned out broadleaf weeds. Yields varied from 102 bushel to 36.9 bushel/A and was related to, in most cases, the degree of wild oat control.

FUTURE PLANS:

Finding an economic level for weed control in small grains with the combination herbicides has been an ongoing project and will, no doubt, be continued at least another two years.

Table 1. Agronomic data from the Combination Herbicide Study. Percent weed control. Northwestern Agri. Res. Center, Kalispell, MT 1989. R-9 Date planted: April 21, 1989 Harvested: Sept. 12, 1989

#	Treatment	Rate ( oz ai/A ) unless marked #	% Wild Oat Control 7-11	% Stand 7-24	% Stand Wheat
1.	Harmony Extra	.225	.0000	.0000	95.50
2.	Harmony Extra	.45	.0000	.0000	95.25
3.	Express + 2,4-D	.06 + 4.0	.0000	.0000	94.25
4.	Express + 2,4-D	.125 + 4.0	.0000	.0000	95.25
5.	Harmony Extra + 2,4-D	.225 + 4.0	.0000	.0000	92.75
6.	Harmony Extra + 2,4-D	.45 + 4.0	.0000	.0000	93.75
7.	Hoelon	1.0 #	96.75	90.75	95.75
8.	Hoelon + C.O.C.	.75 # + 1 pt	89.50	85.00	94.25
9.	Puma	.20 #	97.00	92.00	91.25
10.	Tiller	.66 #	92.25	82.50	95.25
11.	Assert + surf (.25% )	.45 #	99.50	90.50	94.25
12.	Harmony Extra + Hoelon	.225 + .75 #	83.00	44.50	95.00
13.	Harmony Extra + Hoelon	.45 # + .75 #	70.50	31.25	94.25
14.	Harmony Extra + Puma	.225 + .66 #	99.25	98.50	95.50
15.	Harmony Extra + Puma	.45 + .66 #	98.25	98.25	95.75
16.	Express + 2,4-D + Puma	.06 + 4.0 + .66#	100.0	100.0	96.25
17.	Express + 2,4-D + Puma	.125 + 4.0 + .66#	98.00	96.75	96.75
18.	Harmony Extra+2,4-D+Puma	.225 + 4.0 + .66#	99.75	99.00	96.50
19.	Tiller + Bromoxynil	.66 # + .25 #	98.25	96.00	96.00
20.	Tiller + Harmony Extra	.66 # + .225	99.00	97.00	95.50
21.	Tiller + Tordon	.66 # + .023 #	97.50	96.00	95.75
22.	Tiller + Clopyralid	.66 # + .09 #	97.75	93.75	96.00
23.	Avenge + Surf(.25%)	.75 # + .25%	81.25	27.50	93.25
24.	Hoe 6001	.074 #	100.0	99.75	95.25
25.	Bromoxynil	.25 #	.0000	.0000	93.00
26.	Tordon	.023 #	.0000	.0000	95.25
27.	Clopyralid	.09 #	.0000	.0000	92.75
28.	Express	.125	.0000	.0000	94.00
29.	2,4-D	4.0	.0000	.0000	94.75
30.	Check	---	.0000	.0000	93.75

OVERALL MEAN =		56.58	50.63	94.76
P-VALUE TRTS =		.0000	.0000	.1507
CV (SE/MEAN) =		5.719	11.55	1.169
LSD(0.05 by t)=		9.096	16.44	3.114

HOE 6001 .57 lb ai/gal Harmony Extra 75% DF Express 75% DF  
 2,4-D 3.8 lb ai/gal Hoelon 3 lb ai/gal Puma(HOE7113) .63 # ai/g  
 Assert 2.5 lb ai/gal Avenge 2 lb ai/gal Tordon 2 lb ai/gal  
 Clopyralid 3 lb ai/gal Bromoxynil 4 lb ai/gal  
 Tiller (HOE7125) 3.08 lb ai/A (.75# fenoxaprop, .58# 2,4-D, and 1.75# MCPA )  
 No surfactant added ( label requirements ) when Harmony is mixed with Hoelon.

Table 2. Agronomic data from the Combination Herbicide Study. Percent weed control. Northwestern Agri. Res. Center, Kalispell, MT 1989. R-9  
Date planted: April 21, 1989 Harvested: Sept. 12, 1989

#	Treatment	Rate ( oz ai/A ) unless marked #	Percent Broadleaf Control				7-6-1989	
			FNWD	NFC	CKWD	BUCK	LMQTR	HNBT
1.	Harmony Extra	.225	100.0	100.0	100.0	95.00	100.0	99.25
2.	Harmony Extra	.45	100.0	100.0	100.0	94.00	98.75	100.0
3.	Express + 2,4-D	.06 + 4.0	100.0	99.50	100.0	67.50	100.0	96.75
4.	Express + 2,4-D	.125 + 4.0	100.0	98.50	100.0	98.75	99.75	95.00
5.	Harmony Extra + 2,4-D	.225 + 4.0	100.0	99.50	100.0	94.25	100.0	74.75
6.	Harmony Extra + 2,4-D	.45 + 4.0	100.0	100.0	100.0	99.25	100.0	100.0
7.	Hoelon	1.0 #	.0000	25.00	50.00	37.50	.0000	50.00
8.	Hoelon + C.O.C.	.75 # + 1 pt	12.50	43.75	50.00	25.00	15.00	67.50
9.	Puma	.20 #	.0000	25.00	62.50	52.50	25.00	50.00
10.	Tiller	.66 #	75.00	60.00	25.00	65.00	75.00	100.0
11.	Assert + surf (.25%)	.45 #	100.0	25.00	25.00	99.75	63.75	92.50
12.	Harmony Extra + Hoelon	.225 + .75 #	100.0	98.75	100.0	97.00	98.75	97.50
13.	Harmony Extra + Hoelon	.45 # + .75 #	100.0	100.0	100.0	100.0	100.0	100.0
14.	Harmony Extra + Puma	.225 + .66 #	100.0	100.0	100.0	75.00	100.0	93.25
15.	Harmony Extra + Puma	.45 + .66 #	100.0	100.0	100.0	100.0	100.0	98.25
16.	Express + 2,4-D + Puma	.06 + 4.0 + .66#	100.0	77.50	98.75	68.25	75.00	82.50
17.	Express + 2,4-D + Puma	.125 + 4.0 + .66#	100.0	94.50	100.0	93.00	100.0	92.00
18.	Harmony Extra+2,4-D+Puma	.225 + 4.0 + .66#	100.0	100.0	100.0	96.50	100.0	96.00
19.	Tiller + Bromoxynil	.66 # + .25 #	100.0	95.75	47.50	100.0	100.0	45.00
20.	Tiller + Harmony Extra	.66 # + .225	100.0	98.50	100.0	93.25	100.0	98.75
21.	Tiller + Tordon	.66 # + .023 #	100.0	90.50	41.25	99.00	100.0	73.25
22.	Tiller + Clopyralid	.66 # + .09 #	100.0	85.00	36.25	100.0	100.0	58.75
23.	Avenge + Surf(.25%)	.75 # + .25%	.0000	.0000	50.00	25.00	25.00	25.00
24.	Hoe 6001	.074 #	.0000	18.75	25.00	37.50	37.50	45.00
25.	Bromoxynil	.25 #	92.50	76.25	75.00	95.75	98.75	97.50
26.	Tordon	.023 #	25.00	46.25	47.50	70.00	50.00	55.00
27.	Clopyralid	.09 #	37.50	57.50	75.00	100.0	25.00	75.00
28.	Express	.125	100.0	100.0	100.0	99.00	100.0	99.50
29.	2,4-D	4.0	65.00	60.00	32.50	37.50	87.50	37.50
30.	Check	---	.0000	.0000	.0000	.0000	.0000	.0000

OVERALL MEAN =	73.58	72.52	71.38	77.18	75.82	76.52
P-VALUE TRTS =	.0000	.0000	.0000	.0000	.0000	.0000
CV (SE/MEAN) =	12.60	18.28	23.14	17.26	16.89	20.58
LSD(0.05 by t)=	26.06	37.27	46.43	37.45	35.99	44.26

Weed species: Wild oat ( *Avena fatua* ) from previous table.

- HNBT = Henbit ( *Lamium amplexicauli* ),
- FNWD = Fanweed ( *Thlaspi arvense* ),
- NFC = Night flowering catchfly ( *Silene noctiflora* ),
- BUCK = Wild buckwheat ( *Polygonum convolvulus* ),
- LMQTR = Lambsquarter ( *Chenopodium album* ),
- CKWD = Chickweed ( *Stellaria media* )

Table 3. Yield data from the Combination Herbicide Study. Northwestern Agri. Res. Center, Kalispell, MT 1989. R-9  
Date planted: April 21, 1989 Harvested: Sept. 12, 1989

#	Treatment	Rate ( oz ai/A ) unless marked #	Yield Bu/A	Test Wt Lbs/Bu	Height Inches
1.	Harmony Extra	.225	63.6	58.6	34.2
2.	Harmony Extra	.45	65.6a	58.4	32.7
3.	Express + 2,4-D	.06 + 4.0	53.3	57.3	32.7
4.	Express + 2,4-D	.125 + 4.0	52.9	57.4	33.4
5.	Harmony Extra + 2,4-D	.225 + 4.0	46.5	57.8	33.6
6.	Harmony Extra + 2,4-D	.45 + 4.0	57.9	58.7	33.1
7.	Hoelon	1.0 #	81.0a	57.8	34.3
8.	Hoelon + C.O.C.	.75 # + 1 pt	74.4a	58.1	34.4
9.	Puma	.20 #	67.7a	58.2	34.6
10.	Tiller	.66 #	77.7a	59.0	34.0
11.	Assert + surf (.25%)	.45 #	88.4a	58.9	34.4
12.	Harmony Extra + Hoelon	.225 + .75 #	72.9a	59.3	34.7
13.	Harmony Extra + Hoelon	.45 # + .75 #	70.0a	56.9	34.3
14.	Harmony Extra + Puma	.225 + .66 #	90.6a	59.3	33.6
15.	Harmony Extra + Puma	.45 + .66 #	95.8a	59.5	34.1
16.	Express + 2,4-D + Puma	.06 + 4.0 + .66#	89.7a	59.9	34.0
17.	Express + 2,4-D + Puma	.125 + 4.0 + .66#	90.7a	59.4	34.8
18.	Harmony Extra+2,4-D+Puma	.225 + 4.0 + .66#	102.6a	59.6	34.6
19.	Tiller + Bromoxynil	.66 # + .25 #	91.6a	59.7	34.6
20.	Tiller + Harmony Extra	.66 # + .225	93.9a	59.7	34.6
21.	Tiller + Tordon	.66 # + .023 #	89.5a	59.4	33.9
22.	Tiller + Clopyralid	.66 # + .09 #	91.0a	59.7	33.7
23.	Avenge + Surf(.25%)	.75 # + .25%	73.7a	57.3	34.7
24.	Hoe 6001	.074 #	81.6a	59.3	34.6
25.	Bromoxynil	.25 #	65.3a	59.4	34.5
26.	Tordon	.023 #	71.1a	59.4	34.7
27.	Clopyralid	.09 #	51.6	58.0	33.8
28.	Express	.125	45.8	57.3	33.6
29.	2,4-D	4.0	65.4a	58.6	34.4
30.	Check	---	36.9	57.8	33.7

OVERALL MEAN =	73.3	58.63	34.03
P-VALUE TRTS =	.000	.0579	.9072
CV (SE/MEAN) =	13.48	1.237	2.141
LSD(0.05 by t)=	27.77	2.039	2.050

a/ Values significantly greater than the check at the .01 level of probability.