TECHNOLOGY EVALUATION AND DEVELOPMENT SUB-PROGRAM

THE FEASIBILITY OF BAND SPRAY APPLICATION IN CONJUNCTION WITH INTER-ROW CULTIVATION IN NO-TILL CORN

FINAL REPORT
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Prepared by:	Jack Rigby R.R. #2, Blenheim, Ontario Project leader and cash crop farmer
	J.E. Shaw Ridgetown College of Agricultural Technology Weed Scientist

contracted by:	Southwestern Ontario Agricultural Research Corporation
Under the direction of:	Ecological Services for Planning Limited Guelph, Ontario - Sub-program Manager to TED
On behalf of:	Agriculture Canada Research Station Harrow, Ontario, N0R 1G0

PROJECT PERSONNEL

Project Manager

Jack Rigby
Cash Crop Farmer

R.R. #2
Blenheim, Ontario

Researcher

J.E. Shaw
Weed Scientist, Horticulture & Biology Section
Ridgetown College of Agricultural Technology
Ridgetown, Ontario

Contracting Agency

Southwestern Ontario Agricultural Research Corporation
Harrow, Ontario

Research Technicians

Bob Stone
Horticulture & Biology Section
Ridgetown College of Agricultural Technology
Ridgetown, Ontario

Dave Bilyea
Horticulture & Biology Section
Ridgetown College of Agricultural Technology
Ridgetown, Ontario

Clerical Assistant

Mrs. Toni Bulckaert
Horticulture & Biology Section
Ridgetown college of Agricultural Technology
Ridgetown, Ontario

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<u>Executive Summary</u>

The goal of this study was to develop an integrated weed management program for use in reduced-tillage corn production utilizing band herbicide application in conjunction with inter-row cultivation. Also it was our intent to further evaluate the efficacy and usefulness of specific preemergent and postemergent herbicide treatments suitable for use within this systems approach to weed management, and finally to test this technology under grower conditions using field scale equipment and large research plots.

The results of this study show that shallow cultivation between crop rows is very effective in providing control of weeds in these areas. Cultivation alone did not have a significant effect on crop yield. When cultivation was used, the low recommended herbicide rate provided equivalent weed control and yield to the higher recommended rate of herbicide, both when the herbicides were broadcast overall and when they were applied in a band over the row. These results show that one inter-row cultivation was satisfactory.

Most preemergent and postemergent herbicide treatments tested performed very well. Of the thirty treatments evaluated, only two treatments failed to provide consistent commercially acceptable weed control. Those two treatments could only be faulted one year out of three years of testing.

The large scale field trial was the ultimate test of the technology. Results show that crop yield was virtually unaffected by cultivation. Weed control was maintained at a high level, well above commercially acceptable standards, and the technology was easily adapted to large scale field operations. Soil disturbance was minimal, crop residue remained on the soil surface and the shallow layer of disturbed soil did not erode.

The farmer involved, and project manager, was quick to point out that the combine at harvest in damp conditions may tend to slide out of the undisturbed row area, particularly on side hills; in stoney conditions the cultivator may roll stones into the row area; and that root pruning could be a problem if the operator allowed the cultivator to penetrate too deeply. Also he noted that herbicide usage was reduced by 60% and weed management costs were reduced by 40% when this technology was applied to his general farming operation.

Growers can apply this concept immediately if they wish. All they need is the appropriate equipment. The herbicide treatments are currently registered for use.

1.0 INTRODUCTION

The Technology Evaluation and Development (TED) sub-programme of the Soil and Water Environmental Enhancement Programme (SWEEP) was established to facilitate the evaluation of new and existing technologies and the adaptation of these for soil conservation purposes in keeping with the overall purpose of SWEEP to reduce phosphorous loading to Lake Erie from crop land runoff, and to improve the agricultural productivity of Southwestern Ontario by reducing soil degradation which contributes to water pollution. One of the main intentions of TED was to encourage evaluation of such technologies at the farm level. It is hoped by this process, results of such research will be directly applicable to the needs of farmers actively engaged in adopting soil conservation practices.

The adoption by farmers of conservation tillage practices such as no-till is an important step towards achieving sustainable crop production (Swanton & Weise 1991) and accomplishing the primary goals of SWEEP. The objective of no-till is to limit mechanical disturbance of the soil to that required for seed placement (Sprague 1986). The no-till production system limits soil disturbance and increases amounts of crop residue on the soil surface resulting in less wind and water erosion, lower labour and fuel inputs, and increased water use efficiency by the crop (Hairston et. al. 1984, Brown et. al. 1989, Griffith et. al. 1986)

No-till farming is on the increase in both the United States (Klassen 1991) and in Southwestern Ontario (Robinson[T]). Weed control is but one component of the total production package but it is an extremely important one particularly to the no-till farmer. In fact many authors have identified the lack of reliable economical weed management systems as one of the major factors limiting acceptance of no-till crop production systems (Buhler 1988, Nowak 1983, Williams and Wicks 1978). In fact some researchers (Koskinen and McWhorter 1986) cite findings from a farmer survey which claim the main reasons for farmer reluctance to adopt conservation tillage systems were unsatisfactory weed control methods and high herbicide cost.

It has long been feared that when tillage was reduced or eliminated that the changes in the micro-environment would result in a drastic change in weed population dynamics and that build up of crop residues would interfere with herbicide performance (Bands and Robinson 1982, Wrucke and Arnold 1985) resulting in a build-up of perennial weeds and exotic weed species.

Many thought the reduction in tillage would make farmers more reliant on chemical weed control and thus growers would require more variety and greater quantities of herbicide (Brock 1982, Johnson et. al. 1989, Kells and Meggitt 1985, Koskinen and McWhorter 1986 and Witt 1984).

[T] Personal communications Soil and Water Conservation Information Bureau, Dept. Land Resource Science, University of Guelph, Guelph, Ontario, N1G 2W1.

No-till crop production in Southwestern Ontario is still in its infancy, but these fears have not materialized to date (Frick et. al. 1989, Shaw et. al 1991, Chandler and Swanton 1990). We recognize that weed control problems faced by farmers in the process of implementing no-till systems differ from those faced by conventional-tillage farmers. The need for specific weed management programs no doubt has been an impediment to rapid wide spread adoption of conservation technologies. We are aware that some of the weed management needs of conservation tillage production systems are being addressed by researchers in Ontario (Shaw and Swanton 1991).

In the ridge-till crop production system mechanical weed control is an integral part of the system making band herbicide application practical and appealing both from an economical and environmental view. The amount of herbicide used is reduced as much as 65% by banding instead of broadcasting herbicide treatments. The success of this method of weed management is dependent on timely removal of weeds from between crop rows with heavy duty cultivators designed to function well in heavy crop residue and firm soil conditions. The improvement in cultivation equipment designed for ridge-till has led to the suggestion that this same equipment could be adopted for a similar use in no-till seeded crops on flat soil surfaces rather than on ridges.

This technology is common to ridge-till and conventional tillage production systems. Controlling weeds with shallow cultivation while keeping high levels of crop residue on the soil surface has potential (Fawcett 1983, Gebhardt and Fornstrom 1985). The idea was first applied to no-till production in Ontario by Mr. Allen Eadie, a graduate student at the University of Guelph (Eadie et. al. 1992). The focus of the research reported here was to further develop this technology, investigate the feasibility of this integrated weed management approach using inter-row cultivation and reduced levels of herbicides.

Also it was our intention to test the efficacy of various preemergence and postemergence herbicide treatments in this system. Most importantly it was our intention to test the system in the field, under the same conditions a farmer works with on a day to day basis, in order to assess its practicality and usefulness to no-till farmers.

2.0 Table I

1989 WEATHER DATA
RAINFALL IN MM
RCAT, Ridgetown, Ontario

Date	April	May	June	July	August	September	October
1			7.1			3.6	1.8
2	15.0						
3	5.6		11.0	12.5			
4	0.8	5.1			2.0		
5	0.3	2.8					
6		1.3				6.6	
7					0.5	0.5	
8	0.5					3.8	
9	0.3		0.3	0.5		4.6	7.6
10	0.3	2.5		2.5	2.8		4.1
11		5.3			0.3		
12	4.6	8.6	6.6				
13		0.8				0.8	
14	4.3		0.8			12.5	
15		1.5	1.6		4.6		
16						13.2	1.0
17	12.4		17.6			0.3	5.1
18							0.3
19		8.1	26.4	8.2			34.1
20	1.0	1.1	0.8	3.3	0.8		5.6
21			4.5		0.3	2.8	
22			0.3		52.6	0.5	
23		13.7					
24		7.2					
25	0.5	40.4					
26			11.7		0.3		
27			0.3	7.9			
28					22.9		
29		2.0					
30		18.5					
31		13.7			3.0		3.6
Total	45.6	132.6	89.0	35.0	90.1	49.2	63.2
30 yr. Av.	85.1	73.2	82.3	83.5	91.1	76.6	55.1
Temp. °C 1989							
Mean Max	11.5	18.0	22.0	28.5	27.0	22.0	17.0
Mean Min	1.0	8.0	15.0	16.0	14.5	11.0	5.5
Mean	6.5	13.0	18.5	22.2	20.7	16.5	11.5

Table 2

1990 WEATHER DATA
RAINFALL IN MM
RCAT, Ridgetown, Ontario

Date	April	May	June	July	August	September	October
1							
2			7.8				
3			7.8				
4	1.3	19.8	0.2		10.4		17.6
5	6.0	0.4			0.2		
6	0.6				3.0	33.6	
7	0.6					26.8	0.2
8			21.6				1.6
9	1.0			7.6		5.0	15.6
10	17.8	0.4				0.2	10.8
11	0.2			0.6		0.2	2.0
12		3.4			33.2		4.2
13		21.2			20.4		0.2
14	4.0		0.4	14.2		26.2	
15		2.4					
16	0.4	12.6		3.2		7.6	
17	1.2	7.4		0.8			
18		0.2		16.4	5.8		7.6
19		2.0		8.6	12.6	7.8	
20	11.0	0.8	0.2	5.4	0.8		
21		0.2		0.2		11.8	1.0
22			3.8	6.0		0.2	3.0
23			5.2	1.0			
24		0.2					
25							
26							
27							
28					58.8	0.2	0.2
29						1.8	
30				29.0		2.0	
31							
Total	44.1	71.0	47.0	93.0	145.2	123.4	64.0
30 yr. Av.	81.3	73.3	81.4	85.1	98.9	84.6	57.9
Temp. °C 1990							
Mean Max	15.5	18.7	24.9	27.0	26.3	22.3	16.1
Mean Min	3.7	6.6	13.8	15.6	14.7	10.5	5.4
Mean	9.6	12.7	19.4	21.3	20.5	16.3	10.8

Table 3

1991 WEATHER DATA
RAINFALL IN MM
RCAT, Ridgetown, Ontario

Date	April	May	June	July	August	September	October
1	2.8	4.8	0.8				
2				3.8			
3					3.3	7.9	1.3
4	1.3					2.5	35.0
5	0.5	6.3					0.3
6	0.3	9.6					1.0
7				11.9			
8	8.6				7.1		
9	11.2	2.8			1.0	0.3	
10			4.1				5.6
11			6.1				0.3
12		10.2	0.3				0.5
13		0.8		20.8			
14	5.1	0.3					7.9
15	4.3		17.5		2.5		
16		0.8	0.5				
17		8.4			31.8		
18					0.3		2.8
19	58.0				2.5		6.6
20				1.5	11.9		0.3
21				10.2	1.3		
22				9.1	3.8		
23	10.2				0.3	1.5	
24	5.1	4.6				8.6	30.7
25		8.1				4.1	32.8
26		46.7				1.0	11.2
27	3.0						13.2
28	1.0						
29	4.5			8.6			
30	0.3	6.6		18.8	4.8		
31		19.5					
Total	116.2	129.5	29.3	84.7	70.6	25.9	149.5
30 yr. Av.	81.2	73.3	81.4	85.1	98.9	84.6	57.9
Temp. °C							
Mean Max	14.5	24.1	27.7	28.8	28.1	23.5	16.5
Mean Min	4.9	11.9	14.1	14.9	14.4	9.0	6.7
Mean	9.7	18.0	20.9	21.85	21.25	16.25	11.6

3.0 Experiment I - Integrated Weed Control in Reduced-Tillage Corn

Objective:

This study was undertaken to determine whether the use of aggressive heavy duty cultivators have a beneficial effect on reduced-tillage corn production; and also whether the use of such cultivation in conjunction with banded herbicide application can compare favourably with or surpass the level of weed control currently being obtained with control strategy that relies almost entirely on herbicides.

Introduction:

Conservation tillage in Ontario has taken three main directions; 1) Minimum-tillage; 2) Ridge-tillage and 3) No-tillage. Weed control in minimum-tillage systems is very similar to weed control in conventional-tillage systems. The grower using minimum-till still does some tillage prior to planting, has the option of using the rotary hoe or weeder harrows, has the option of inter-row cultivation and still has the option of using preplant incorporated, preemergent and/or postemergent herbicides, all of which contribute significantly to the total weed control program.

Growers using the ridge-till system forfeit the option of using preplant incorporated treatments, but retain the optional use of preemergent and postemergent herbicides, as well as tillage supplied by seeding equipment and heavy duty inter-row cultivators designed specifically to function in tough undisturbed soil and heavy crop residue conditions. Because of the aggressive cultivation component and the seeding method, band applications of preemergent and/or postemergent herbicides is a very practical and cost efficient approach to weed control.

The traditional no-till grower usually applies a non-residual burndown herbicide, seeds the crop, and applies either preemergent and/or postemergent herbicides to control the weeds that emerge after the burndown application. In this scenario, weed control is entirely dependent on selecting the most appropriate herbicide for the crop and weed spectrum, applying it correctly and timing the application well. In the interest of economy and efficiency, the no-till farmer also wants to make the most use possible of each trip across the field. Our intent in this study is to; 1) test the feasibility of using a heavy duty cultivator (designed for use in ridge-till); 2) determine if shallow cultivation has an effect on crop yield; 3) determine if banded herbicide application in conjunction with shallow inter-row cultivation can compare favourably with overall broadcast herbicide application.

3.1 Methods & Materials

Procedure:

Field experiments were conducted in 1990 and 1991 at Ridgetown, Ontario. In 1990 the soil type was a Miami clay loam and in 1991 the soil type was Brookston clay loam. Precipitation data from both years is presented in tables 2 and 3. In 1990 the previous crop was corn and in 1991 the previous crop was oats. The 1991 site had been ploughed immediately after oat harvest levelled and left until the following spring.

Prior to seeding the crop each year the sites were treated with a burndown application of glyphosate at 0.9 kg ai/ha plus Agral 90 at 0.1% v/v and Ammonium sulfate at 2 kg ai/ha on May 1. Burndown treatments were applied with field sprayers in both years.

In 1990 the corn variety Golden Harvest 2410 was seeded on May 3 with a Kinze double framed no-till planter at a rate of 70,000 seeds/ha in 76 cm. row. In 1991 the variety Asgrow RX409 was seeded on May 11 with the same planter at a rate of 62,000 seeds/ha in 76 cm. rows. The crop was fertilized both years according to soil test recommendation by broadcasting dry forms on the soil surface.

Each plot consisted of four rows (3m width) by 12m long in 1990 and 8m long in 1991. Each treatment was replicated 4 times in a randomized block design.

Herbicide treatments were applied in both years with an Oxford Precision sprayer calibrated to deliver 200L/ha of spray solution at 240 kpa. Band applications were applied in a 30 cm. band both years. In 1990 herbicide applications were made on May 23 and in 1991 on May 16. The two dose levels of metolachlor and cyanazine represent the high and low dose levels recommended in Ontario Publication #75, Guide to Weed Control.

Inter-row cultivations were performed using a Buffalo heavy duty 4-row cultivator with the sweeps and hiller-disc set to run 4 to 6 cm. deep. In 1990 the first cultivation was done when the corn was in the 5-6 leaf stage on June 26. The second cultivation was completed when corn was in the 10-11 leaf stage on July 10. In 1991 the first cultivation was done on May 30 when the corn was in the 5 leaf stage and on June 21 when the corn was in the 8-10 leaf stage.

Observations

Weed control ratings are expressed as percent control relative to the weedy check. The whole plot was considered for weed control ratings. Weed biomass (above ground) or fresh weed weight data were obtained by removing the shoots from a m^2 area and separating weeds into broadleaf weeds and grass groupings and recording the fresh weights. Weed count data was obtained by further separating the weeds into groups by species and recording the number of each species. Weed counts and biomass data are from the area inside a m^2 frame randomly placed in the vicinity of the centre of each plot over one row. Weed control data was recorded in 1990 on July 24 and in 1991 on July 7.

Yield data was obtained by hand husking one of the inner rows of the plot in 1990. The ear corn was then shelled later back at the Ridgetown College. In 1991 two centre rows of each plot were harvested with a plot combine. In each year the corn was moisture tested and is expressed as tonne/ha @ 15.5% moisture.

Statistical analysis consists of Analysis of Variance.

3.2 Results and Discussion

In 1990 the spring was cool and moist (Table 2). The crop emerged slowly and unevenly resulting in considerable variability in maturity. There were only a few treatments that were significantly higher in yield than the uncultivated weedy check. The uncultivated weedy check, however, was the lowest yielding treatment in the test (Table 4).

One cultivation alone improved weed control by 73% for broadleaf weeds and 75% for annual grasses over the weedy check. Two cultivations alone provided 85% control of broadleaf weeds and 98% control of the annual grasses. Two cultivations without herbicide provided commercially acceptable weed† control under the conditions in this test. Broadcast applications at the higher rate did not benefit from inter-row cultivation. Broadcast treatments at the low rate appeared to benefit from each cultivation but the differences were not statistically significant. In both broadcast and banded treatments one cultivation was sufficient to remove weeds between the rows and in conjunction with broadcast or banded, high rate or low rate herbicide applications, provided commercially acceptable control. Velvetleaf and lamb's quarters were the predominant weeds in the plot. Also a few cocklebur and giant foxtail were present. As in many no-till fields the annual weed population was light and quite variable in the plot area. This site was last tilled in 1986. If weed pressures had been higher on this site perhaps there would have been greater differences in yields.

In 1991 the spring was warm and moist. The burndown with glyphosate was effective on most weeds present and there were many annual weeds emerged. Shepherd's purse was very slow to die following burndown; perhaps because of its advanced growth at application time. The corn crop emerged quickly and grew well during May. Conditions throughout the remainder of the growing season were excessively dry resulting in reduced yield across the plot. Early season competition from the escaped shepherd's purse may have been magnified by the following drought. Conditions after burndown were not favourable for weed germination, consequently, weed pressure was low and sporadic across the plot area.

The uncultivated weedy check, and the uncultivated banded herbicide treatments were the lowest yielding treatments in the test, although many treatments were not significantly higher in yield (Table 4).

One cultivation alone provided 78 and 76% control respectively of broadleaf and grass weeds. The second cultivation brought the control level up to the 95% range. All other treatments provided excellent weed control.

In Summary: Cultivation in either year did not affect yield in the weeded plots. The cultivator was operated at a shallow depth and no benefits from tillage are evident. In general cultivation alone provided about 75% control of broadleaf weeds and grasses with one pass. When cultivation was done twice weed control improved to about 90 to 95% of annual weeds.

† Commercially acceptable weed control is a minimum level of weed control that growers will accept as being satisfactory, usually in the 80 to 85% control range.

Generally low rate application provided similar levels of weed control to the higher rate application either as a broadcast treatment or a band treatment. Banded herbicide application followed by inter-row cultivation once or twice, provided weed control comparable to overall broadcast herbicide application. There was no statistically significant advantage to using higher rates of herbicides compared to the low rates. A trend of slightly better weed control with higher rates may be present in non-cultivated plots but vanishes when the plots are cultivated.

These data generally suggest that banded herbicide treatments did not require cultivation to provide a level of control normally considered commercially acceptable. Usually weed growth between herbicide bands offers heavy interference with the crop. Low weed pressure and drought may account for this anomaly. In a similar vane cultivation in normal conditions usually would not provide 90 to 95% control of weeds.

The cultivator performed well. Once adjusted to penetrate the hard clay loam soils to a 4 to 6 cm. depth the cultivator maintained that depth reasonably well. The soil surface was left reasonably level and the crop residue remained on the soil surface to fulfil its erosion control function. The following spring the soil surface was level enough so that proper seeding of the next crop was not jeopardized. There were no signs of soil movement over winter due to soil loosening by cultivation. The test area was relatively flat and level.

Table 4. **No-till corn yields as affected by cultivation alone, cultivation plus high rate or low rate, broadcast or banded herbicides in 1990 and 1991.**

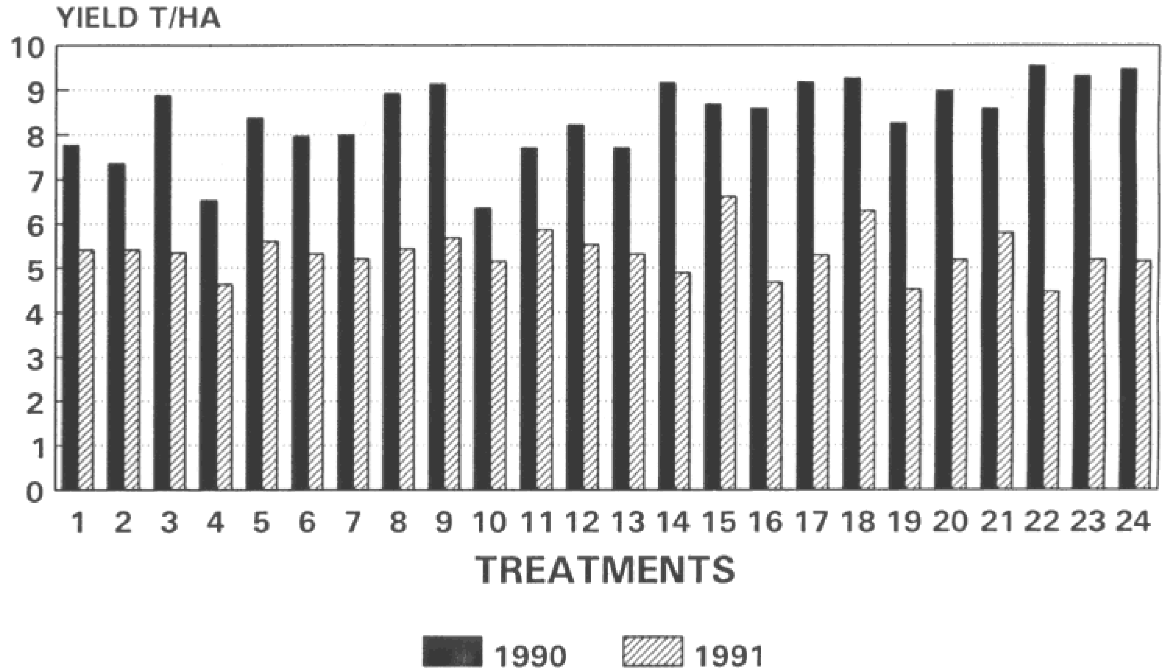
Treatment	Rate kg ai/ha	Applied	Yield T/ha 1990	Yield T/ha 1991	Ave. Yield T/ha
1. Check, 0 cult. weeded			7.76	5.41	6.58
2. Check, 1 cult. weeded			7.35	5.41	6.38
3. Check, 2 cult. weeded			8.87	5.35	7.11
4. Check, 0 cult. weedy			6.52	4.63	5.57
5. Check, 1 cult. weedy			8.37	5.61	6.99
6. Check, 2 cult. weedy			7.96	5.32	6.64
7. Metolachlor + Cyanazine 0	2.64 + 2.25	pre[1/]	7.99	5.21	6.60
8. Metolachlor + Cyanazine 1	2.64 + 2.25	pre[1/]	8.91	5.43	7.17
9. Metolachlor + Cyanazine 2	2.64 + 2.25	pre[1/]	9.13	5.69	7.41
10. Metolachlor + Cyanazine 0	1.68 + 1.75	pre[1/]	8.35	5.15	6.75
11. Metolachlor + Cyanazine 1	1.68 + 1.75	pre[1/]	7.70	5.86	6.78
12. Metolachlor + Cyanazine 2	1.68 + 1.75	pre[1/]	8.21	5.52	6.86
13. Cyanazine 0	1.75	pre[1/]	7.69	5.31	6.50
14. Cyanazine 1	1.75	pre[1/]	9.15	4.89	7.02
15. Cyanazine 2	1.75	pre[1/]	8.68	6.61	7.64
16. Metolachlor + Cyanazine 0	2.64 + 2.25	pre[2/]	6.58	4.68	6.63
17. Metolachlor + Cyanazine 1	2.64 + 2.25	pre[2/]	9.16	5.29	7.22
18. Metolachlor + Cyanazine 2	2.64 + 2.25	pre[2/]	9.25	6.30	7.77
19. Metolachlor + Cyanazine 0	1.68 + 1.75	pre[2/]	8.25	4.53	6.39
20. Metolachlor + Cyanazine 1	1.68 + 1.75	pre[2/]	8.98	5.19	7.08
21. Metolachlor + Cyanazine 2	1.68 + 1.75	pre[2/]	8.58	5.80	7.19
22. Cyanazine 0	1.75	pre[2/]	9.54	4.48	7.01
23. Cyanazine 1	1.75	pre[2/]	9.31	5.20	7.25
24. Cyanazine 2	1.75	pre[2/]	9.48	5.16	7.32
L.S.D. 5%			2.21	0.86	

0 = 0 cultivation, 1 = 1 cultivation, 2 = 2 cultivations

[1/] pre broadcast

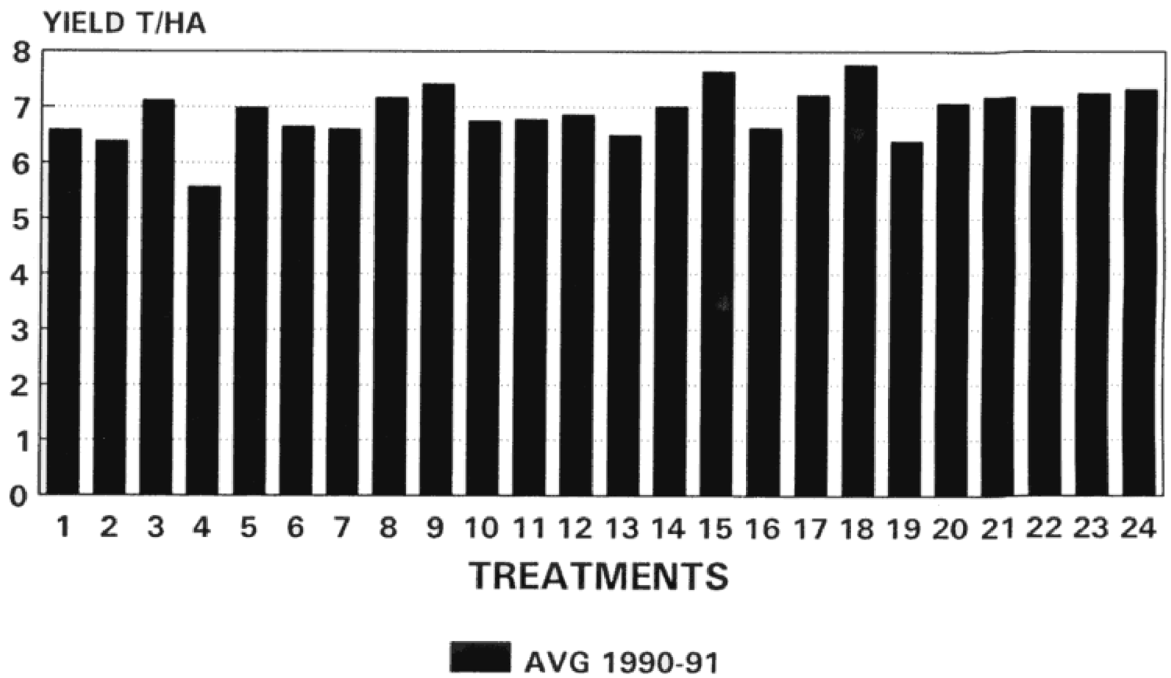
[2/] pre banded

(FIGURE 1) NO-TILL CORN YIELDS INTEGRATED WEED CONTROL COMPARISONS



TREATMENT NUMBERS CORRESPOND
TO THE TREATMENT LIST IN TABLE 4

(FIGURE 2) NO-TILL CORN YIELDS INTEGRATED WEED CONTROL COMPARISONS



TREATMENT NUMBERS CORRESPOND TO THE TREATMENT LIST IN TABLE 4

Table 5. Annual weed control ratings as affected by cultivation alone, cultivation plus high rate or low rate, broadcast or banded herbicides applied preemergently to no-till corn 1990 and 1991.

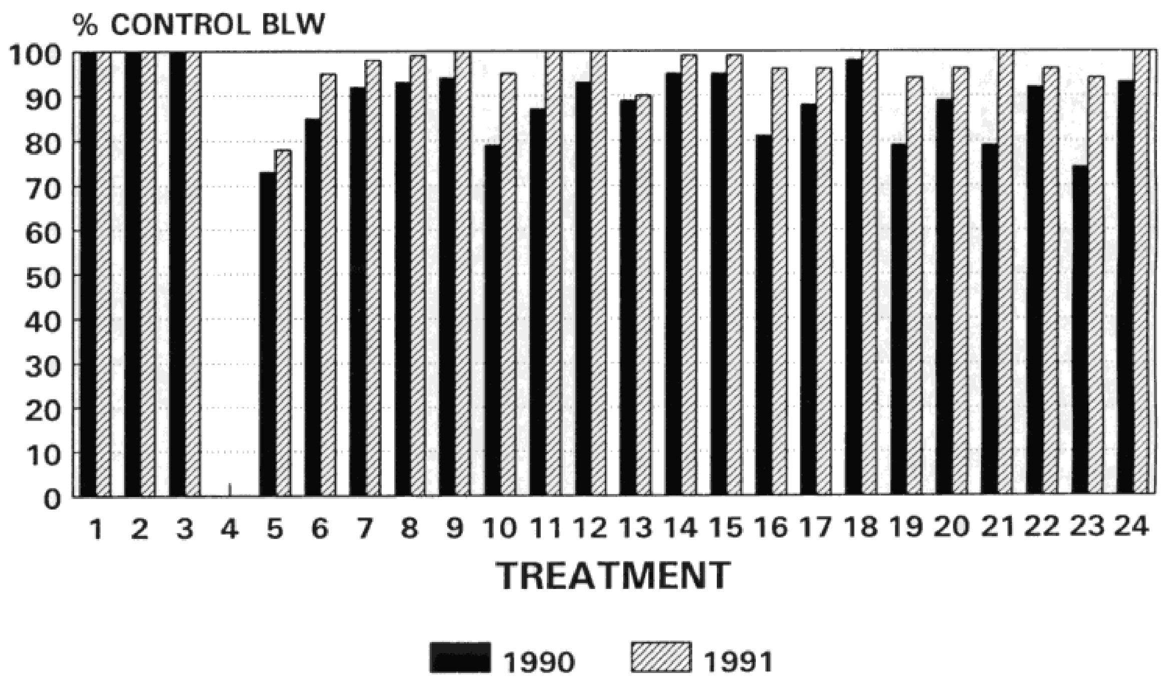
Treatment	Rate kg ai/ha	Applied	% Weed Control BLW 1990	1991	% Weed Control Grass 1990	1991
1. Check, 0 cult. weeded			100	100	100	100
2. Check, 1 cult. weeded			100	100	100	100
3. Check, 2 cult. weeded			100	100	100	100
4. Check, 0 cult. weedy			0	0	0	0
5. Check, 1 cult. weedy			73	78	74	76
6. Check, 2 cult. weedy			85	95	98	94
7. Metolachlor + Cyanazine 0	2.64 + 2.25	pre[1/]	92	98	99	99
8. Metolachlor + Cyanazine 1	2.64 + 2.25	pre[1/]	93	99	99	100
9. Metolachlor + Cyanazine 2	2.64 + 2.25	pre[1/]	94	100	99	100
10. Metolachlor + Cyanazine 0	1.68 + 1.75	pre[1/]	79	95	99	98
11. Metolachlor + Cyanazine 1	1.68 + 1.75	pre[1/]	87	100	99	100
12. Metolachlor + Cyanazine 2	1.68 + 1.75	pre[1/]	93	100	99	100
13. Cyanazine 0	1.75	pre[1/]	89	90	99	80
14. Cyanazine 1	1.75	pre[1/]	95	99	99	99
15. Cyanazine 2	1.75	pre[1/]	95	99	99	100
16. Metolachlor + Cyanazine 0	2.64 + 2.25	pre[2/]	81	96	99	99
17. Metolachlor + Cyanazine 1	2.64 + 2.25	pre[2/]	88	96	98	100
18. Metolachlor + Cyanazine 2	2.64 + 2.25	pre[2/]	98	100	99	100
19. Metolachlor + Cyanazine 0	1.68 + 1.75	pre[2/]	79	94	98	95
20. Metolachlor + Cyanazine 1	1.68 + 1.75	pre[2/]	89	96	99	99
21. Metolachlor + Cyanazine 2	1.68 + 1.75	pre[2/]	79	100	79	100
22. Cyanazine 0	1.75	pre[2/]	92	96	97	98
23. Cyanazine 1	1.75	pre[2/]	79	94	99	99
24. Cyanazine 2	1.75	pre[2/]	93	100	99	100
L.S.D. 5%			22	8	20	11

0 = 0 cultivation, 1 = 1 cultivation, 2 = 2 cultivations

[1/] pre broadcast

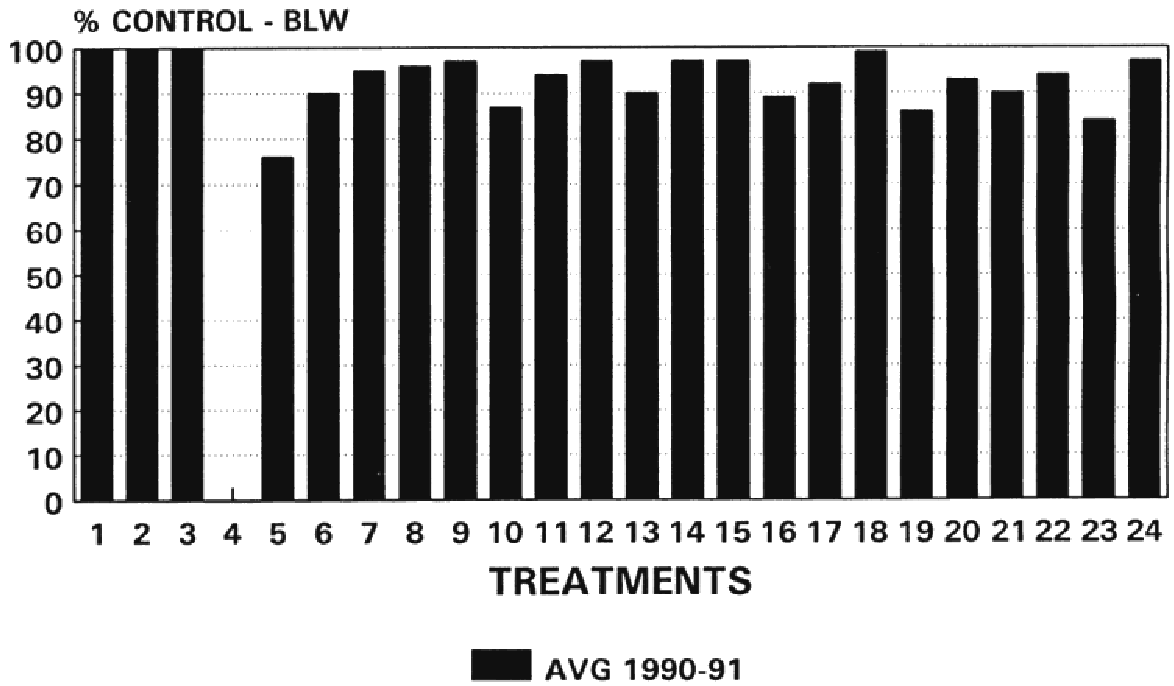
[2/] pre banded

(FIGURE 3)
ANNUAL BROADLEAF CONTROL COMPARISONS



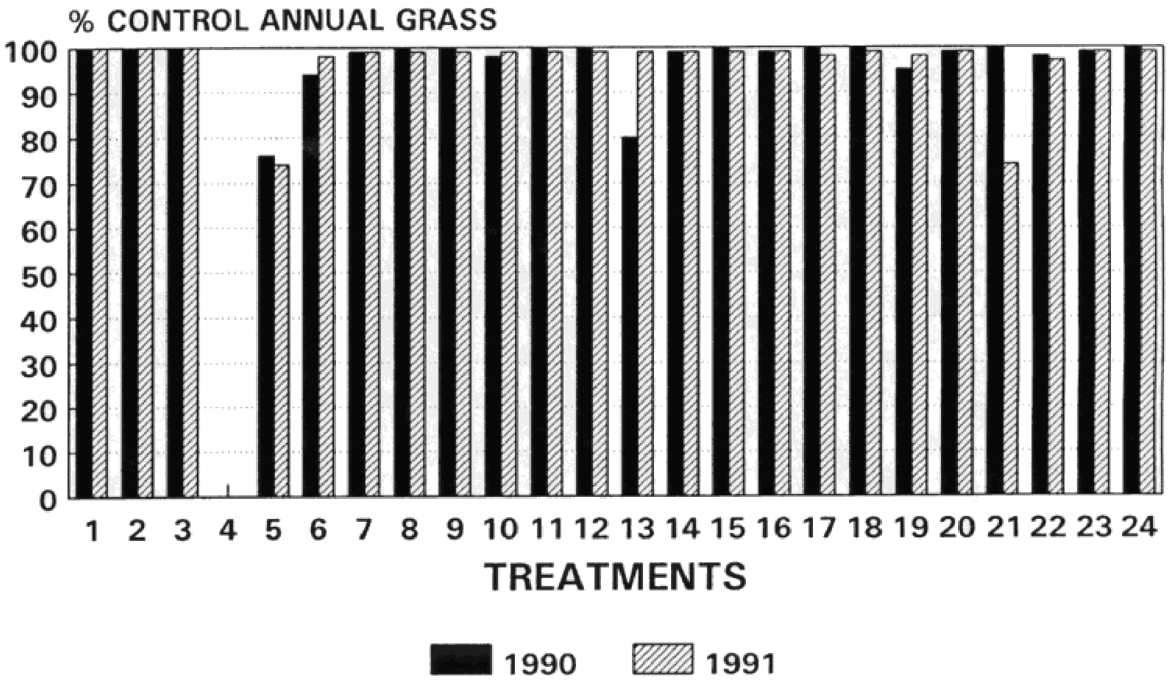
TREATMENT NUMBERS CORRESPOND
TO THE TREATMENT LIST IN TABLE 5

(FIGURE 4)
ANNUAL BROADLEAF WEED CONTROL COMPARISONS



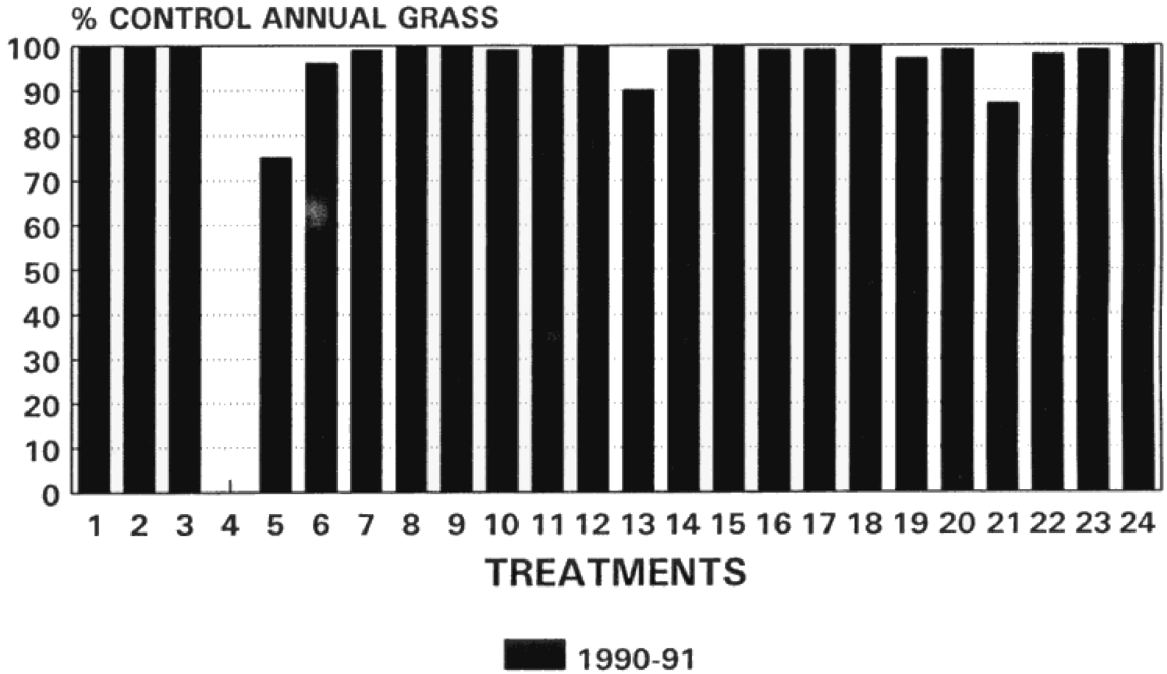
TREATMENT NUMBERS CORRESPOND
TO THE TREATMENT LIST IN TABLE 5

(FIGURE 5)
ANNUAL GRASS CONTROL COMPARISONS



TREATMENT NUMBERS CORRESPOND
TO THE TREATMENT LIST IN TABLE 5

(FIGURE 6)
ANNUAL GRASS CONTROL
COMPARISONS



TREATMENT NUMBERS CORRESPOND
TO THE TREATMENT LIST IN TABLE 5

Table 6. Annual weed biomass as affected by cultivation alone, cultivation plus high rate or low rate, broadcast or banded herbicides applied preemergently to no-till corn 1990 & 1991.

Treatment	Rate kg ai/ha	Applied	Weed Weights G/m^2 BLW 1990	BLW 1991	Grasses 1990	Grasses 1991
1. Check, 0 cult. weeded			0	0	0	0
2. Check, 1 cult. weeded			0	0	0	0
3. Check 2 cult. weeded			0	0	0	0
4. Check, 0 cult., weedy			636	202	0	40
5. Check, 1 cult., weedy			38	117	0	9
6. Check 2 cult. weedy	2.64 + 2.25	pre[1/]	188	84	0	10
7. Metolachlor + cyanazine 0	2.64 + 2.25	pre[1/]	17	20	0	0
8. Metolachlor + cyanazine 1	2.64 + 2.25	pre[1/]	8	44	0	2
9. Metolachlor + cyanazine 2	1.68 + 1.75	pre[1/]	42	14	0	0
10. Metolachlor + cyanazine 0	1.68 + 1.75	pre[1/]	623	35	0	10
11. Metolachlor + cyanazine 1	1.68 + 1.75	pre[1/]	130	47	0	0
12. Metolachlor + cyanazine 2	1.75	pre[1/]	33	11	0	0
13. Cyanazine 0	1.75	pre[1/]	58	61	2	239
14. Cyanazine 1	1.75	pre[1/]	16	38	0	9
15. Cyanazine 2	2.64 + 2.25	pre[1/]	1	33	2	10
16. Metolachlor + cyanazine 0	2.64 + 2.25	pre[2/]	305	168	0	19
17. Metolachlor + cyanazine 1	2.64 + 2.25	pre[2/]	137	84	42	0
18. Metolachlor + cyanazine 2	1.68 + 1.75	pre[2/]	84	20	0	5
19. Metolachlor + cyanazine 0	1.68 + 1.75	pre[2/]	103	142	0	20
20. Metolachlor + cyanazine 1	1.68 + 1.75	pre[2/]	69	50	0	1
21. Metolachlor + cyanazine 2	1.68 + 1.75	pre[2/]	246	10	0	0
22. Cyanazine 0	1.75	pre[2/]	106	70	0	55
23. Cyanazine 1	1.75	pre[2/]	398	48	0	3
24. Cyanazine 2	1.75		12	23	0	2
L.S.D. 5%			463	87	24	119

0 = 0 cultivation, 1 = 1 cultivation, 2 = 2 cultivations

[1/] - broadcast application

[2/] - banded application

Table 6. - cont'd.

Treatment	Rate kg ai/ha	Applied	Ave. Weed Weights G/M^2 BLW	GR
1. Check, 0 cult. weeded			0	0
2. Check, 1 cult. weeded			0	0
3. Check 2 cult. weeded			0	0
4. Check, 0 cult., weedy			419	20
5. Check, 1 cult., weedy			77.5	4.5
6. Check, 2 cult., weedy			136	5
7. Metolachlor + cyanazine 0	2.64 + 2.25	pre[1/]	18.5	0
8. Metolachlor + cyanazine 1	2.64 + 2.25	pre[1/]	26	1
9. Metolachlor + cyanazine 2	2.64 + 2.25	pre[1/]	28	0
10. Metolachlor + cyanazine 0	1.68 + 1.75	pre[1/]	329	5
11. Metolachlor + cyanazine 1	1.68 + 1.75	pre[1/]	88.5	0
12. Metolachlor + cyanazine 2	1.68 + 1.75	pre[1/]	22	0
13. Cyanazine 0	1.75	pre[1/]	59.5	120.5
14. Cyanazine 1	1.75	pre[1/]	27	4.5
15. Cyanazine 2	1.75	pre[1/]	17	6
16. Metolachlor + cyanazine 0	2.64 + 2.25	pre[2/]	263.5	9.5
17. Metolachlor + cyanazine 1	2.64 + 2.25	pre[2/]	110.5	21
18. Metolachlor + cyanazine 2	2.64 + 2.25	pre[2/]	52	2.5
19. Metolachlor + cyanazine 0	1.68 + 1.75	pre[2/]	122.5	10
20. Metolachlor + cyanazine 1	1.68 + 1.75	pre[2/]	59.5	0.5
21. Metolachlor + cyanazine 2	1.68 + 1.75	pre[2/]	128	0
22. Cyanazine 0	1.75	pre[2/]	88	27.5
23. Cyanazine 1	1.75	pre[2/]	223	1.5
24. Cyanazine 2	1.75	pre[2/]	17.5	1

0 = 0 cultivation, 1 = 1 cultivation, 2 = 2 cultivations

[1/] - broadcast application

[2/] - banded application

Table 7. Weed counts per M^2 as affected by cultivation alone, cultivation plus high rate or low rate, broadcast or banded herbicides applied preemergently to no-till corn 1990 & 1991.

Treatment	Rate kg ai/ha	Applied	1990 Weed Counts No/1m² VL	LQ	CB	FT
1. Check, 0 cult. weeded			0	0	0	0
2. Check, 1 cult. weeded			0	0	0	0
3. Check, 2 cult. weeded			0	0	0	0
4. Check, 0 cult. weedy			6	0	0	0
5. Check, 1 cult. weedy			2	0	1	0
6. Check, 2 cult. weedy			4	0	0	0
7. Metolachlor + cyanazine 0	2.64 + 2.25	pre[1/]	2	0	0	0
8. Metolachlor + cyanazine 1	2.64 + 2.25	pre[1/]	3	0	0	0
9. Metolachlor + cyanazine 2	2.64 + 2.25	pre[1/]	6	0	0	0
10. Metolachlor + cyanazine 0	1.68 + 1.75	pre[1/]	11	3	0	0
11. Metolachlor + cyanazine 1	1.68 + 1.75	pre[1/]	5	0	0	0
12. Metolachlor + cyanazine 2	1.68 + 1.75	pre[1/]	3	0	0	0
13. Cyanazine 0	1.75	pre[1/]	10	0	0	1
14. Cyanazine 1	1.75	pre[1/]	2	0	0	0
15. Cyanazine 2	1.75	pre[1/]	4	0	0	3
16. Metolachlor + cyanazine 0	2.64 + 2.25	pre[2/]	2	1	1	0
17. Metolachlor + cyanazine 1	2.64 + 2.25	pre[2/]	3	0	0	0
18. Metolachlor + cyanazine 2	2.64 + 2.25	pre[2/]	1	0	0	0
19. Metolachlor + cyanazine 0	1.68 + 1.75	pre[2/]	3	0	0	0
20. Metolachlor + cyanazine 1	1.68 + 1.75	pre[2/]	3	0	0	0
21. Metolachlor + cyanazine 2	1.68 + 1.75	pre[2/]	7	0	0	0
22. Cyanazine 0	1.75	pre[2/]	5	1	1	0
23. Cyanazine 1	1.75	pre[2/]	11	0	0	0
24. Cyanazine 2	1.75	pre[2/]	1	0	0	0

0 = 0 cultivation, 1 = 1 cultivation, 2 = 2 cultivations

[1/] - broadcast application; [2/] - banded application

VL = velvetleaf; LQ = lamb's quarters; CB = cocklebur; FT = giant foxtail

Table 7. cont'd....

Weed counts per M^2 as affected by cultivation alone, cultivation plus high rate or low rate, broadcast or banded herbicides applied preemergently to no-till corn 1990 & 1991.

Treatment	Rate kg ai/ha	Applied	1991 Weed Counts No/m^2 VL	LQ	LT	RP	SP	FT	FP
1. Check, 0 cult. weeded			0	0	0	0	0	0	0
2. Check, 1 cult. weeded			0	0	0	0	0	0	0
3. Check 2 cult. weeded			0	0	0	0	0	0	0
4. Check, 0 cult., weedy			2	1	2	2	6	1	3
5. Check, 1 cult., weedy			1	1	1	2	5	1	1
6. Check, 2 cult., weedy			1	0	0	2	4	1	1
7. Metolachlor + cyanazine 1	2.64 + 2.25	pre[1/]	1	0	1	0	2	0	0
8. Metolachlor + cyanazine 1	2.64 + 2.25	pre[1/]	0	0	0	0	5	0	1
9. Metolachlor + cyanazine 2	2.64 + 2.25	pre[1/]	1	0	0	1	1	0	1
10. Metolachlor + cyanazine 0	1.68 + 1.75	pre[1/]	1	0	0	0	3	1	0
11. Metolachlor + cyanazine 1	1.68 + 1.75	pre[1/]	1	1	1	1	4	0	0
12. Metolachlor + cyanazine 2	1.68 + 1.75	pre[1/]	0	0	1	0	3	0	0
13. Cyanazine 0	1.75	pre[1/]	0	0	3	2	2	0	1
14. Cyanazine 1	1.75	pre[1/]	0	0	0	1	4	1	0
15. Cyanazine 2	1.75	pre[1/]	0	0	0	1	5	0	1
16. Metolachlor + cyanazine 0	2.64 + 2.25	pre[2/]	0	0	1	1	8	1	1
17. Metolachlor + cyanazine 1	2.64 + 2.25	pre[2/]	0	0	1	1	7	0	0
18. Metolachlor + cyanazine 2	2.64 + 2.25	pre[2/]	0	0	0	0	5	1	0
19. Metolachlor + cyanazine 0	1.68 + 1.75	pre[2/]	1	1	0	2	4	1	1
20. Metolachlor + cyanazine 1	1.68 + 1.75	pre[2/]	0	0	1	1	5	0	1
21. Metolachlor + cyanazine 2	1.68 + 1.75	pre[2/]	0	0	1	0	2	0	0
22. Cyanazine 0	1.75	pre[2/]	1	0	1	1	5	0	1
23. Cyanazine 1	1.75	pre[2/]	1	0	1	1	6	1	0
24. Cyanazine 2	1.75	pre[2/]	1	0	0	0	4	1	0

0 = 0 cultivation, 1 = 1 cultivation, 2 = 2 cultivations

[1/] - broadcast application; [2/] - banded application
VL = velvetleaf; LQ = lamb's quarters; LT = lady's thumb; RP = redroot pigweed;
SP = Shepherd's purse; FT = green foxtail; FP = fall panicum

4.0 <u>Experiment II</u>

Band Applied Preemergent Herbicide Performance in Reduced-till Corn

<u>Objective:</u>

To evaluate preemergent herbicide band application in reduced-tillage corn for weed control efficacy and crop tolerance when integrated with inter-row cultivation.

Introduction:

It was our hypothesis that many preemergence herbicides will perform well in an integrated program utilizing band applied herbicides followed by inter-row cultivation. This study was designed to show that many preemergent herbicide treatments can perform well and provide comparable weed control to overall broadcast applications. Herbicides applied in bands over the row at seeding time with the planter could eliminate a special trip over the field for either an overall broadcast application of preemergent or postemergent herbicide later on, while at the same time reducing the amount and the cost of herbicides significantly.

4.1 <u>Methods & Materials</u>

Field experiments were conducted in 1989 and 1990 in a grower's field and in 1991 at Ridgetown College. Soil types were Brookston clay, Haldimand loam and Brookston clay loam respectively. Precipitation data is presented in tables 1, 2 and 3 for the three years. Previous crops were soybeans in 1989, red kidney beans in 1990 and oats in 1991. The 1991 site had been ploughed immediately after harvest, levelled and left until the following spring.

Prior to seeding the corn crop the research area was treated with a burndown of glyphosate at 0.9 kg ai/ha plus Agral 90 at 0.1% v/v and ammonium sulfate at 2 kg ai/ha on May 1 in 1991. In 1990 the entire site was treated with 0.45 kg ai/ha glyphosate + 0.62 kg ai/ha 2,4-D. No burndown was applied in 1989 because the area was relatively weed free at seeding time. Burndown applications were applied with a field sprayer.

The 1989 and 1990 trials were seeded with a Kinze 6 row wide double frame planter (rows 95 cm.) equipped with no-till accessories including band spray equipment which was used to apply 2,4-D plus metolachlor at 0.6 + 2.4 kg ai/ha at planting in 1989 and metolachlor at 2.4 kg ai/ha preemergently in a 30 cm. band at planting in 1990. Starter fertilizer was banded applied with the planter.

The 1991 trial was seeded with a Kinze 4 row narrow double frame planter (rows 75 cm.). No herbicide was applied by the planter. Metolachlor at 2.4 kg ai/ha, however, was applied at a tank mixture with each herbicide tested in this trial. All fertilizer was applied in the dry form prior to seeding to the soil surface in a broadcast treatment.

Hyland 2803, Hyland 2729 and Asgrow RX 409 were the corn varieties seeded May 8/89, April 30/90 and May 11/91 respectively. Seeding rates were as recommended for each variety. Plant stands were uniform in each year.

In 1989 and 1990 plots consisted of 2 rows 9m in length (1.9 x 9m plots) and in 1990 plots were 4 row x 8m in length (3 x 8m plots). Each treatment was replicated 4 times in a randomized block design.

Preemergent treatments were applied with an Oxford Precision sprayer calibrated to deliver 200 L/ha of spray solution at 240 kpa. Band applications were applied in a 30 cm. band in each test. Preemergent applications were made May 17/89, May 11/90 and May 14/91.

Sidedress nitrogen in the form of 28% UAN solution was applied and the entire plot areas cultivated simultaneously on June 26/89 and June 15/90. In 1991 the nitrogen was applied broadcast prior to seeding. The plot area, except the weedy check plots, was cultivated twice, May 30/91 and June 21/91.

Observations

Weed control ratings are expressed as percent control relative to the weedy check plots. In each trial the entire plot was considered for weed control ratings. Weed biomass (above ground) or fresh weed weight data were obtained by removing the shoots of weeds from a M^2 area and separating weeds into broadleaf weeds and grass groupings and recording the fresh weights. Weed count data was obtained by further separating the weeds into groups by species and recording the number of each species. Weed count and biomass data are from the area inside a M^2 frame randomly placed in the vicinity of the centre of each plot over one row. Weed ratings were recorded Aug. 1/89, July 24/90 and July 4/91 and weed weights and counts were recorded Aug. 1/89, July 18/90 and July 4/91.

Yields were obtained by harvesting the whole plot in 1989 and 90. In 1991 the centre two rows were harvested, weighed, moisture tested and expressed as tonne/ha @ 15.5% moisture. Data was statistically analyzed using analysis of variance.

4.2 Results & Discussions

In 1989 there was plenty of moisture early but July rainfall was well below normal (Table 1). Yields were very low and there were no significant differences (Table 8). The next year growing conditions were much better as the yield data indicates. Six treatments were significantly better yielding than the weedy check; none were better than the weeded check. Treatments containing metribuzin at 0.75 kg ai/ha yield significantly less than the weeded check. This rate of metribuzin is quite high for a loam soil and perhaps caused injury to the crop but the level of weed control may have also contributed to the lower yield. In 1991 five treatments yielded better than the weedy check. The other treatments all yielded higher than the weedy check but differences were not significant.

Most herbicide treatments provided very good to excellent control of annual broadleaf weeds and grasses particularly in 1989 and 1991 (table 9). In 1990, the most favourable year, dicamba at 0.6 kg ai/ha, and cyanazine + dicamba 2.25 + 0.6 kg ai/ha failed to provide adequate control of redroot pigweed and lamb's quarters. Also linuron + atrazine 1.1 + 1.1 kg ai/ha failed to control fall panicum and metribuzin at 0.75 kg ai/ha failed to control foxtail (Table 11). Weed escapes were primarily in the crop row. Cultivation provided very good to excellent control between crop rows.

Atrazine at 1.1 kg ai/ha banded applied followed by cultivation provided equal control to the broadcast atrazine treatment.

These data support the hypothesis that band applying preemergent herbicides and following up with a thorough, shallow, inter-row cultivation will provide weed control comparable to broadcast herbicide applications.

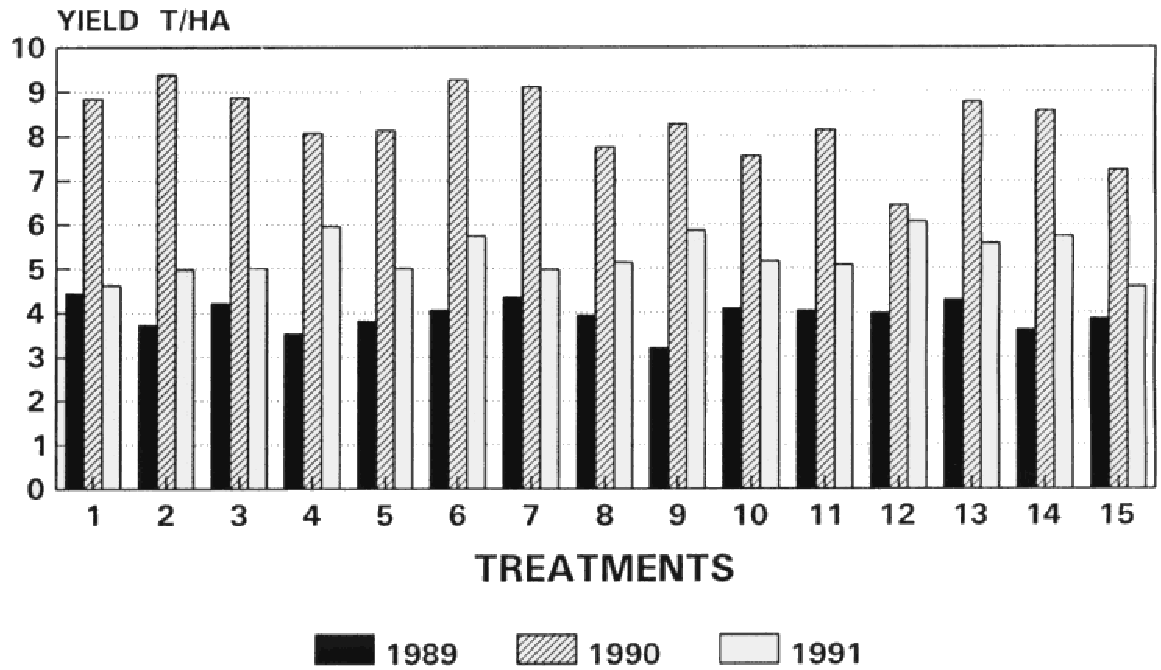
Table 8. The effect on yield of herbicides band applied preemergence to no-till corn in conjunction with one inter-row cultivation, 1989 - 1991.

Treatment *	kg ai/ha	Applied	Yield t/ha @ 15.5% 1989	1990	1991	Ave.
Atrazine	1.1	pre[1/]	4.44	8.84	4.62	5.97
Atrazine	1.1	pre[2/]	3.72	9.38	4.98	6.04
Dicamba	0.6	pre[2/]	4.22	8.87	5.01	6.03
Atrazine + Dicamba	1.1 + 0.6	pre[2/]	3.53	8.07	5.96	5.85
Linuron	2.0	pre[2/]	3.81	8.13	5.00	5.65
Cyanazine	3.25	pre[2/]	4.06	9.27	5.74	6.36
Cyanazine + Atrazine	2.25 + 1.1	pre[2/]	4.35	9.11	4.98	6.15
Atrazine + Metribuzin	1.1 + 0.3	pre[2/]	3.94	7.75	5.14	5.61
Cyanazine + Dicamba	2.25 + 0.6	pre[2/]	3.20	8.27	5.87	5.78
Linuron + Atrazine	1.1 + 1.1	pre[2/]	4.10	7.55	5.17	5.61
Dicamba/Atrazine	1.75	pre[2/]	4.05	8.14	5.08	5.76
Metribuzin	0.75	pre[2/]	3.99	6.44	6.07	5.50
Atrazine + 2,4-D L.V. Ester	1.1 + 1.0	pre[2/]	4.28	8.77	5.57	6.21
Check, weeded			3.62	8.57	5.74	5.98
Check, weedy			3.86	7.23	4.59	5.23
LSD (.05)			1.54	1.58	1.01	

* All plots received metolachlor at 2.4 kg ai/ha in a 30 cm. band at planting.

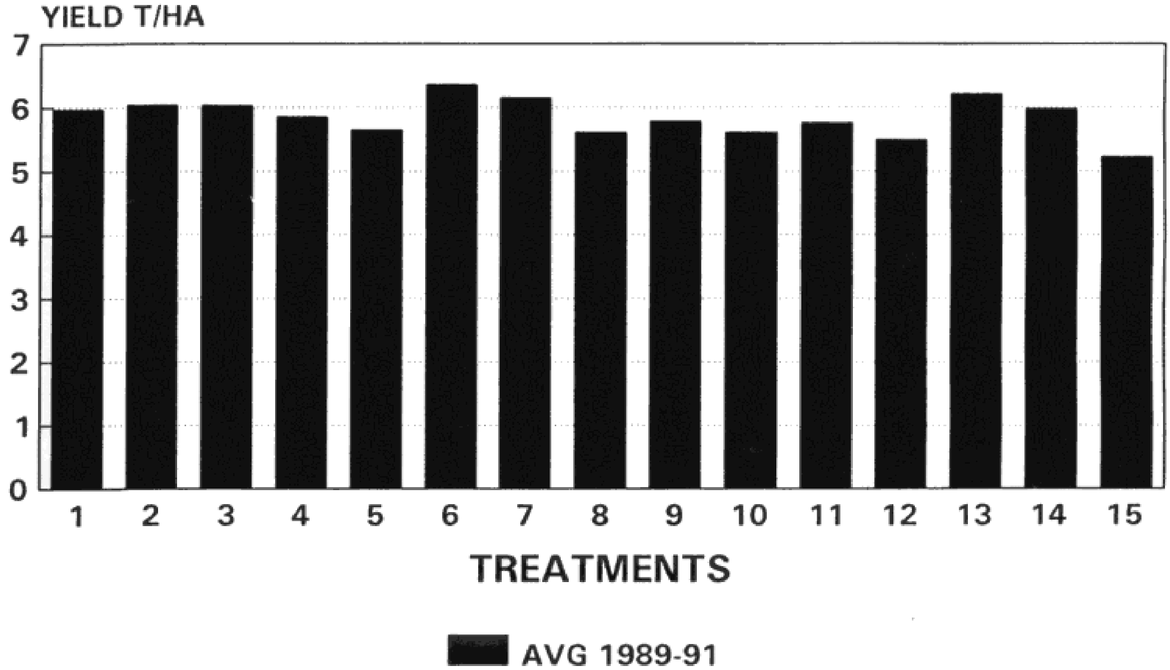
[1/] - applied pre overall; [2/] - applied pre banded

(FIGURE 7)
PRE BANDED HERBICIDE APPLICATIONS IN NO-TILL CORN



TREATMENT NUMBERS CORRESPOND
TO THE TREATMENT LIST IN TABLE 8

(FIGURE 8)
PRE BAND HERBICIDE APPLICATIONS IN NO-TILL CORN



TREATMENT NUMBERS CORRESPOND
TO THE TREATMENT LIST IN TABLE 8

Table 9. Annual weed control ratings for herbicides applied in a band preemergent to no-till corn followed by one inter-row cultivation 1989-1991.

			% Broadleaf Weed Control			% Grass Weed Control		
Treatment	kg ai/ha	Applied	1989	1990	1991	1989	1990	1991
1. Atrazine	1.1	pre[1/]	100	94	95	100	95	98
2. Atrazine	1.1	pre[2/]	95	81	96	100	93	98
3. Dicamba	0.6	pre[2/]	95	79	100	98	88	100
4. Atrazine + Dicamba	1.1+0.6	pre[2/]	95	91	100	100	84	98
5. Linuron	2.0	pre[2/]	93	81	100	100	91	99
6. Cyanazine	3.25	pre[2/]	99	89	100	100	94	100
7. Cyanazine + Atrazine	2.251.1	pre[2/]	100	95	100	100	93	100
8. Atrazine + Metribuzin	1.1+0.3	pre[2/]	99	86	100	100	95	100
9. Cyanazine + Dicamba	2.25+0.6	pre[2/]	99	79	100	100	90	100
10. Linuron + Atrazine	1.1+1.1	pre[2/]	98	88	100	99	78	100
11. Dicamba/Atrazine	1.75	pre[2/]	90	93	99	99	85	100
12. Metribuzin	0.75	pre[2/]	91	83	99	99	70	100
13. Atrazine + 2,4-D L.V. Ester	1.1+1.0	pre[2/]	96	94	100	100	88	100
14. Check, weeded			100	100	100	100	100	100
15. Check, weedy			0	0	0	0	0	0
LSD (.05)			6	28	18	3	25	18

[1/] applied pre overall;
[2/] applied pre banded

* All plots received metolachlor at 2.4 kg ai/ha in a 30 cm. band at planting.

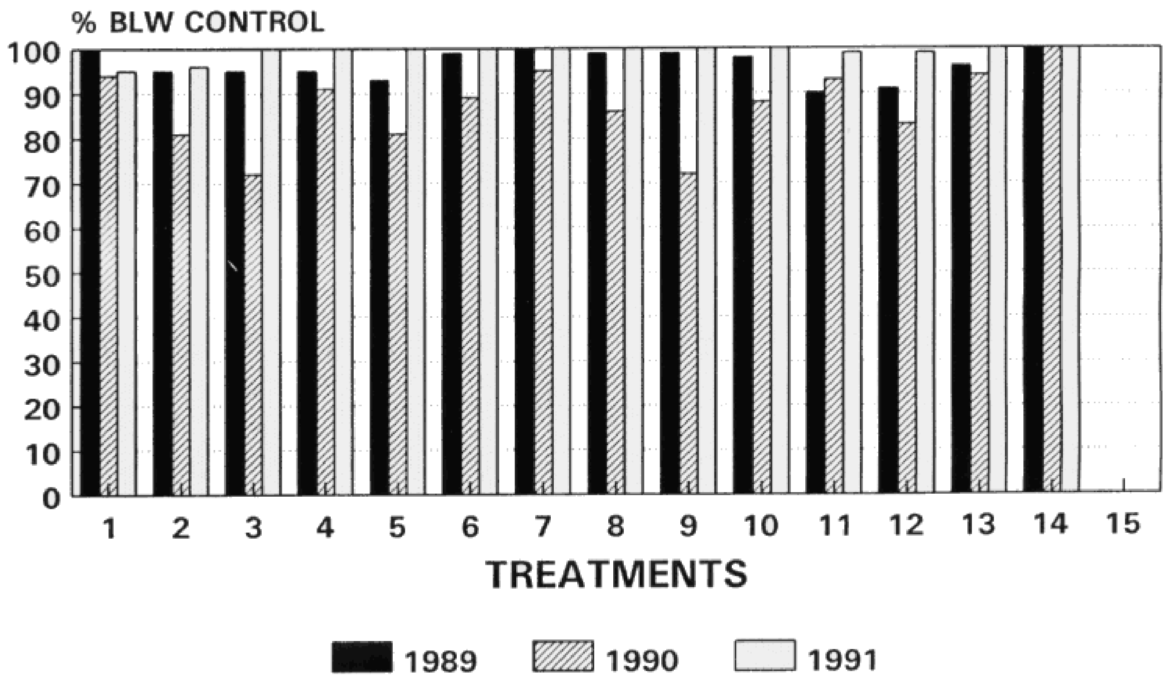
Table 9. - cont'd.

Treatment		kg ai/ha	Applied	% Weed Control Ave. BLW	Ave. GR
1.	Atrazine	1.1	pre[1/]	96.3	96.5
2.	Atrazine	1.1	pre[2/]	90.6	95.5
3.	Dicamba	0.6	pre[2/]	89.0	94.0
4.	Atrazine + Dicamba	1.1+0.6	pre[2/]	95.3	91.0
5.	Linuron	2.0	pre[2/]	91.3	95.0
6.	Cyanazine	3.25	pre[2/]	96.0	97.0
7.	Cyanazine + Atrazine	2.25+1.1	pre[2/]	98.3	96.5
8.	Atrazine + Metribuzin	1.1 + 0.3	pre[2/]	95.0	97.5
9.	Cyanazine + Dicamba	2.25 + 0.6	pre[2/]	90.3	95.0
10.	Linuron + Atrazine	1.1 + 1.1	pre[2/]	95.3	89.0
11.	Dicamba/Atrazine	1.75	pre[2/]	94.0	92.5
12.	Metribuzin	0.75	pre[2/]	91.0	85.0
13.	Atrazine 2,4-D L.V. Ester	1.1+1.0	pre[2/]	96.6	94.0
14.	Check, weeded			100	100
15.	Check, weedy			0	0

[1/] - Applied pre overall;
[2/] - applied pre banded

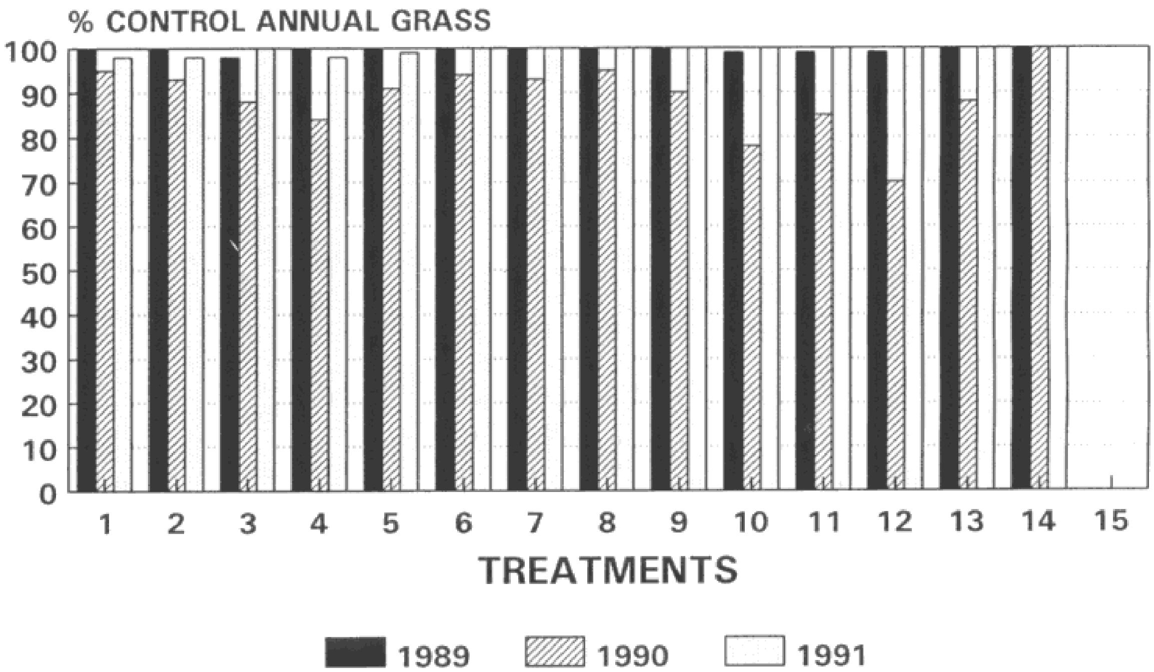
* All plots received metolachlor at 2.4 kg ai/ha in a 30 cm. band at planting.

(FIGURE 9)
PRE BANDED HERBICIDE APPLICATIONS IN NO-TILL CORN



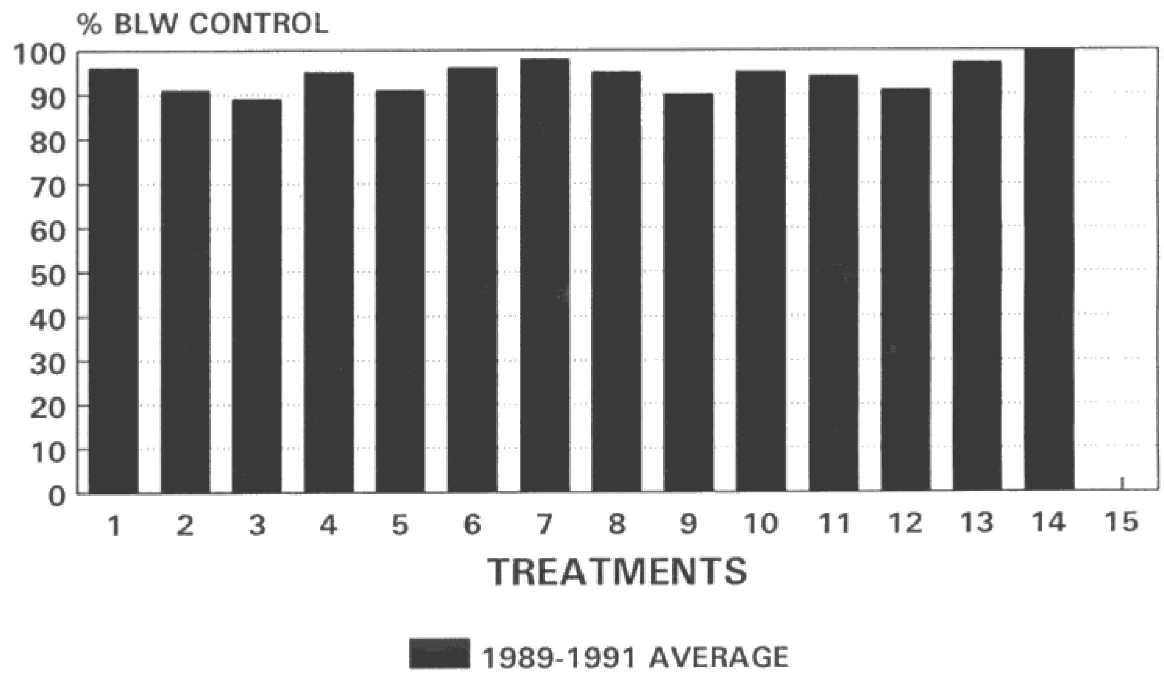
TREATMENT NUMBERS CORRESPOND
TO THE TREATMENT LIST IN TABLE 9

(FIGURE 10)
PRE BANDED HERBICIDE APPLICATIONS
IN NO-TILL CORN



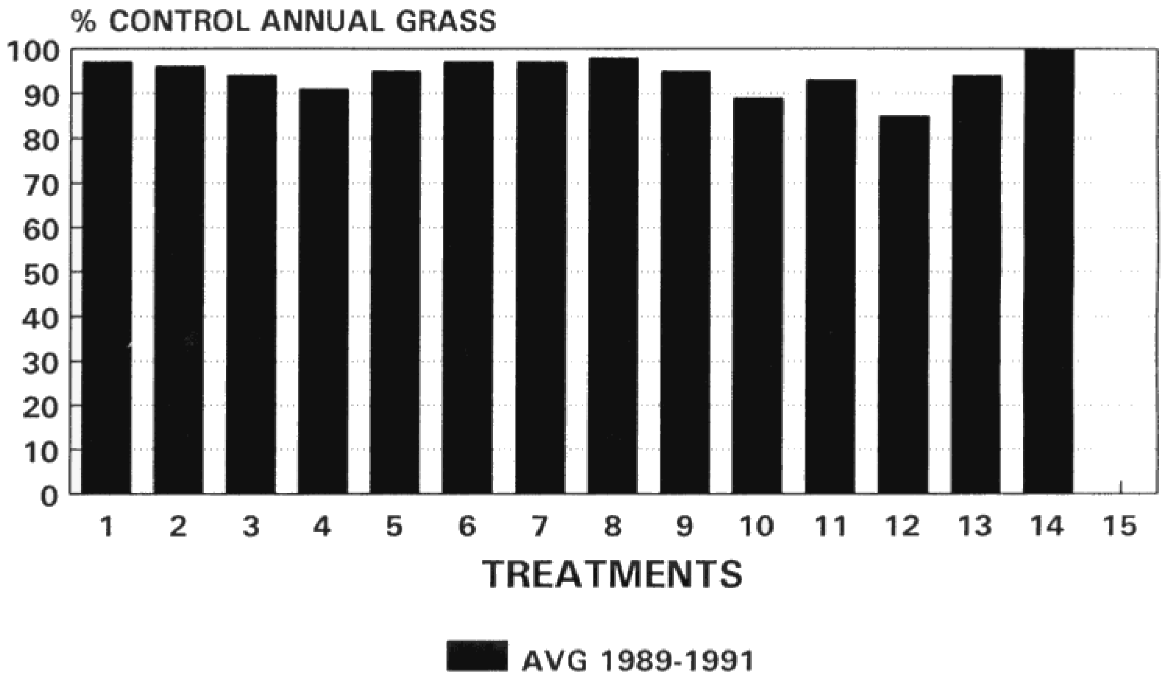
TREATMENT NUMBERS CORRESPOND
TO THE TREATMENT LIST IN TABLE 9

(FIGURE 11)
PRE BANDED HERBICIDE APPLICATIONS
IN NO-TILL CORN



TREATMENT NUMBERS CORRESPOND
TO THE TREATMENT LIST IN TABLE 9

(FIGURE 12)
PRE BANDED HERBICIDE APPLICATIONS IN NO-TILL CORN



THE TREATMENT NUMBERS CORRESPOND
TO THE TREATMENT LIST IN TABLE 9

Table 10. Annual weed biomass as affected by herbicides applied preemergently to no-till corn followed by one inter-row cultivation 1989-1990.

Treatment		kg ai/ha	Applied	BLW G/m[2/] 1989	1990	1991	Grasses G/m[2/] 1989	1990	1991
1.	Atrazine	1.1	pre[1/]	0	145	25	0	28	7
2.	Atrazine	1.1	pre[2/]	0	266	40	0	25	0
3.	Dicamba	0.6	pre[2/]	0	298	20	0	129	0
4.	Atrazine + Dicamba	1.1+0.6	pre[2/]	0	160	16	0	91	21
5.	Linuron	2.0	pre[2/]	0	316	6	0	287	17
6.	Cyanazine	3.25	pre[2/]	0	160	41	0	2	0
7.	Cyanazine + Atrazine	2.25+1.1	pre[2/]	0	27	13	0	5	1
8.	Atrazine+Metribuzin	1.1+0.3	pre[2/]	0	79	18	0	287	1
9.	Cyanazine+Dicamba	2.25+0.6	pre[2/]	0	416	19	0	26	0
10.	Linuron + Atrazine	1.1+1.1	pre[2/]	10	56	15	0	458	11
11.	Dicamba/Atrazine	1.75	pre[2/]	0	780	12	0	35	0
12.	Metribuzin	0.75	pre[2/]	0	470	31	0	268	0
13.	Atrazine + 2,4-D L.V. Ester	1.1+1.0	pre[2/]	0	30	14	0	165	0
14.	Check, weeded			0	0	0	0	0	0
15.	Check, weedy			11	849	145	0	197	187
16.	LSD (.05)			6	536	43	0	445	80

[1/] - applied pre overall;
[2/] - applied pre banded

* All plots received metolachlor at 2.4 kg ai/ha in a 30 cm. band at planting.

Table 11. Annual weed escapes as affected by herbicides applied preemergently to no-till corn followed by one inter-row cultivation 1989-1990.

Treatment	kg ai/ha	Applied	1989 Weed Counts No/m² VL	LT	1990 Weed Counts No/m² RP	LQ	FT	FP
1. Atrazine	1.1	pre[1/]	0	0	0	8	2	1
2. Atrazine	1.1	pre[2/]	0	0	2	3	1	1
3. Dicamba	0.6	pre[2/]	1	0	2	5	1	17
4. Atrazine + Dicamba	1.1+0.6	pre[2/]	0	0	2	3	11	1
5. Linuron	2.0	pre[2/]	0	0	1	4	0	17
6. Cyanazine	3.25	pre[2/]	1	0	1	4	0	1
7. Cyanazine + Atrazine	2.25+1.1	pre[2/]	0	0	0	3	2	0
8. Atrazine + Metribuzin	1.1+0.3	pre[2/]	0	0	0	2	24	0
9. Cyanazine + Dicamba	2.25+0.6	pre[2/]	0	0	1	6	1	0
10. Linuron + Atrazine	1.1+1.1	pre[2/]	1	0	0	2	2	22
11. Dicamba/Atrazine	1.75	pre[2/]	1	0	4	10	2	6
12. Metribuzin	0.75	pre[2/]	0	0	1	4	36	1
L.V. Ester	1.1+1.0	pre[2/]	0	0	0	2	7	0
13. Check, weeded			0	0	0	0	0	0
14. Check, weedy			1	1	2	18	0	11

[1/] - applied pre overall;
[2/] - applied pre banded

All plots received metolachlor at 2.4 kg ai/ha in a 30 cm. band at planting.

VL = velvetleaf; LT = lady's thumb; RP = redroot pigweed; LQ = lamb's quarters; FT = green foxtail; FP = fall panicum

Table 12. Annual weed escapes as affected by herbicides applied preemergently to no-till corn followed by one inter-row cultivation, 1991.

Treatment		kg ai/ha	Applied	1991 Weed Counts Ave. No/1 m^2 VL	RP	SP	RG	BY	FT	FP
1.	Atrazine	1.1	pre[1/]	0	0	6	0	0	0	1
2.	Atrazine	1.1	pre[2/]	1	0	3	1	0	0	0
3.	Dicamba	0.6	pre[2/]	0	0	1	0	1	0	0
4.	Atrazine + Dicamba	1.1+0.6	pre[2/]	0	0	4	0	0	0	0
5.	Linuron	2.0	pre[2/]	0	1	4	0	0	1	1
6.	Cyanazine	3.25	pre[2/]	0	0	3	1	0	0	0
7.	Cyanazine + Atrazine	2.25+1.1	pre[2/]	0	0	1	1	0	1	0
8.	Atrazine + Metribuzin	1.1+0.3	pre[2/]	0	0	3	0	0	0	0
9.	Cyanazine + Dicamba	2.25+0.6	pre[2/]	0	0	1	0	0	0	1
10.	Linuron + Atrazine	1.1+1.1	pre[2/]	0	1	3	0	1	0	0
11.	Dicamba/Atrazine	1.75	pre[2/]	0	0	1	0	0	0	1
12.	Metribuzin	0.75	pre[2/]	0	0	3	0	0	0	0
13.	Atrazine + 2,4-D L.V. Ester	1.1+1.0	pre[2/]	1	0	2	0	0	0	0
14.	Check, weeded			0	0	0	0	0	0	0
15.	Check, weedy			1	1	10	1	1	3	1

[1/] - applied pre overall;
[2/] - applied pre banded

* All plots received metolachlor at 2.4 kg ai/ha in a 30 cm. band at planting

VL = velvetleaf; RP = redroot pigweed; SP = shepherd's purse; RG = ragweed; BY = barnyard grass; FT = green foxtail; FPT = fall panicum

5.0 <u>Experiment III</u>

Band Applied Postemergent Herbicide Performance In Reduced-Tillage Corn

Objective:

To evaluate postemergent herbicide band applications in reduced-tillage corn for weed control efficacy and crop tolerance when integrated with shallow inter-row cultivation.

Introduction:

Postemergence herbicides applied in a band could also be practical when applied at the same time as an inter-row cultivation. Herbicides could be effectively directed on to the weeds in the row from spray equipment mounted on the cultivator. This technique offers all the advantages of the preemergent scenarios discussed in Experiment II with the additional advantage of being able to spot spray; that is run the sprayer only when passing weedy areas and conserving herbicide in weed-free areas. Unfortunately at this time, postemergence grass control in crops like corn is weak particularly once grass exceeds the three leaf stage. In this study herbicides for postemergence broadleaf weed control are evaluated.

5.1 Methods & Materials

These experiments were conducted side by side with the preemergent trials previously described. The methods are the same except for herbicide treatments and timing of application.

Postemergence treatments were applied June 23/89, May 23/90 and May 29/91 corresponding to the 7 leaf stage, 4 leaf stage and 5 leaf stage of corn respectively.

5.2 Results & Discussion

Yields in the various years reflect the growing conditions that prevailed in those years. No significant yield difference occurred in 1989 or 1990. In 1991 all herbicide treatments yielded significantly more than the weedy check which was unsprayed and uncultivated (Table 13). The checks were cultivated in 89 and 90. The cultivator performed well providing excellent control of weeds between the crop rows thus reducing the weed interference and effects on yield of the weedy checks in 89 and 90.

All herbicide treatments provided good to excellent annual weed control particularly in the drier years of 89 and 91. In 1990 weed populations were higher and growth more vigorous because of better growing conditions resulting in the rating of some treatments being slightly lower (table 14).

The banded application of atrazine/dicamba followed by one inter-row cultivation performed equally as well as the overall application.

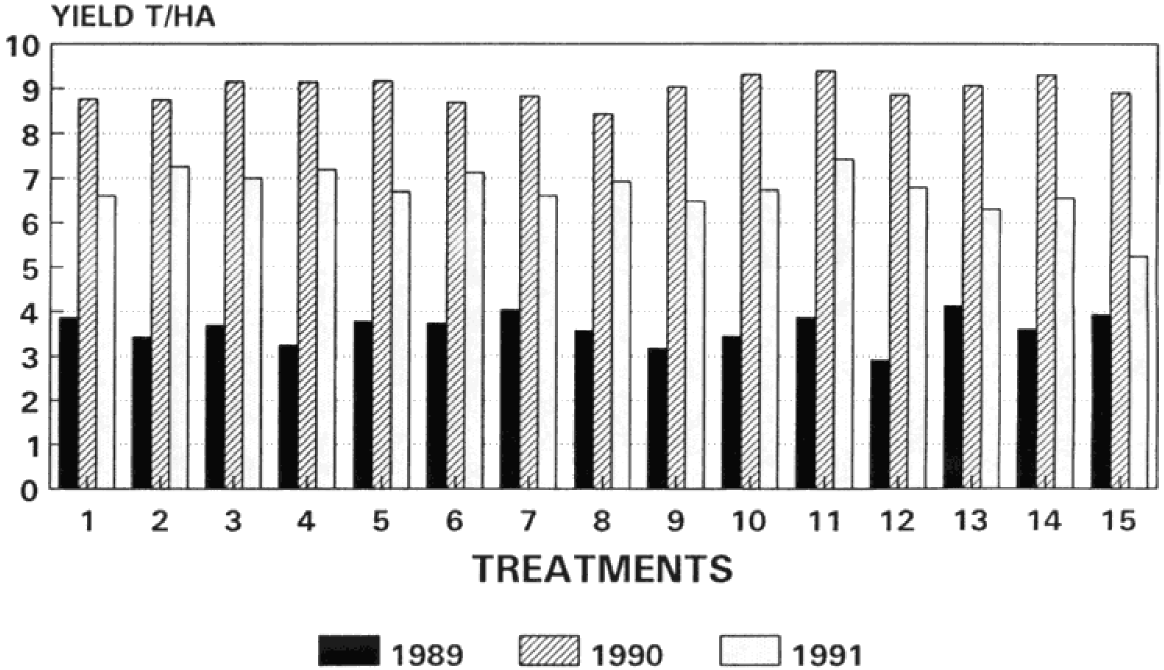
Table 13. The effect on yield of herbicides band applied postemergently to no-till corn in conjunction with one inter-row cultivation 1989-1991.

Treatment*		kg ai/ha	Applied	Yield T/ha @ 15.5% 1989	1990	1991	Ave. Yield
1.	Atrazine/Dicamba	1.75	post[1/]	3.86	8.77	6.6	6.41
2.	Atrazine/Dicamba	1.75	post[2/]	3.43	8.74	7.25	6.47
3.	Atrazine/Bentazon + Assist	1.6+1%	post[2/]	3.68	9.15	6.99	6.60
4.	Atrazine + Bromoxynil	1.1+0.28	post[2/]	3.24	9.14	7.19	6.52
5.	Bromoxynil	0.34	post[2/]	3.77	9.16	6.69	6.54
6.	Bromoxynil/MCPA	0.56	post[2/]	3.73	8.69	7.12	6.51
7.	2,4-D	0.50	post[2/]	4.04	8.84	6.6	6.49
8.	2,4-DB	1.5	post[2/]	3.57	8.43	6.92	6.30
9.	2,4-D/Mecoprop/ Dicamba	0.53	post[2/]	3.17	9.04	6.47	6.22
10.	Atrazine + Oil	1.1+10L	post[2/]	3.44	9.31	6.72	6.49
11.	Bentazon + Assist	1.1+1%	post[2/]	3.87	9.39	7.41	6.89
12.	Dicamba	0.6	post[2/]	2.9	8.86	6.78	6.18
13.	MCPB/MCPA	1.7	post[2/]	4.13	9.06	6.3	6.49
14.	Check, weeded			3.59	9.3	6.54	6.47
15.	Check, weedy			3.92	8.9	5.23	6.01

* All plots received metolachlor at 2.4 kg ai/ha in a 30 cm. band at planting.

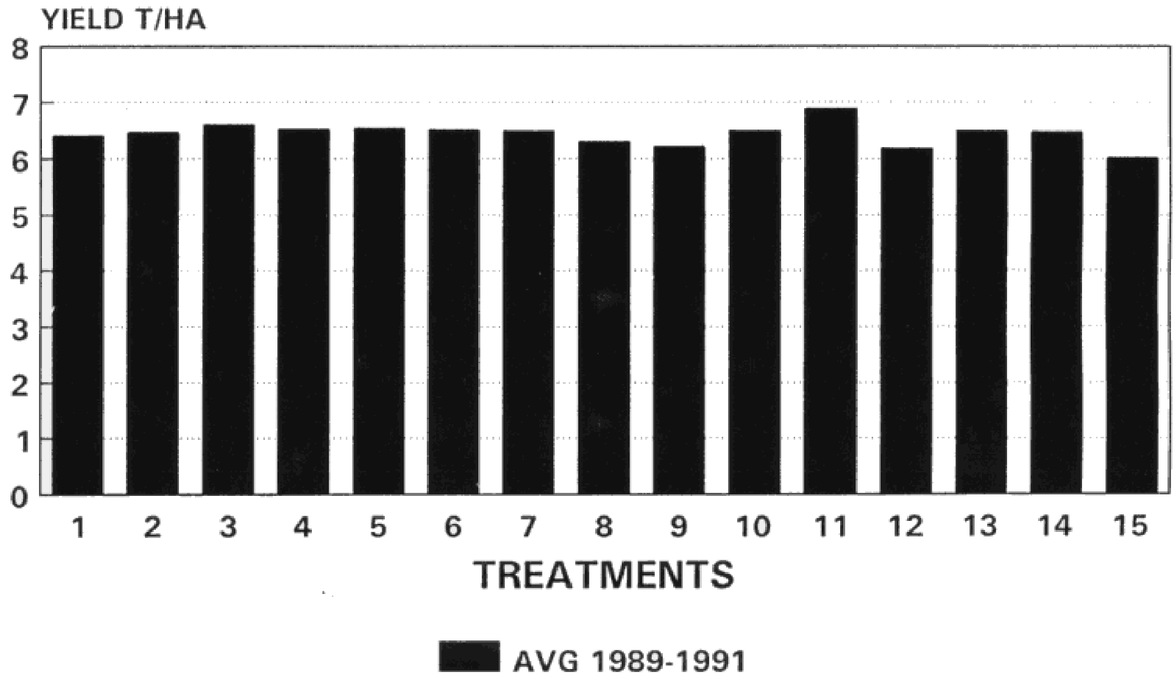
[1/] - post overall;
[2/] post banded

(FIGURE 13)
POST BANDED HERBICIDE APPLICATIONS IN NO-TILL CORN



TREATMENT NUMBERS CORRESPOND
TO THE TREATMENT LIST IN TABLE 13

(FIGURE 14)
POST BAND HERBICIDE APPLICATIONS
IN NO-TILL CORN



TREATMENT NUMBERS CORRESPOND
TO THE TREATMENT LIST IN TABLE 13

Table 14. Annual weed control ratings for herbicides applied postemergently to no-till corn in conjunction with one inter-row cultivation 1989-1991.

Treatment*	kg ai/ha	Applied	% Weed Control Broadleaf 1989	1990	1991	% Weed Control Grass 1989	1990	1991
1. Atrazine/Dicamba	1.75	post[1/]	100	99	97	100	99	98
2. Atrazine/Dicamba	1.75	post[2/]	98	94	97	100	94	100
3. Atrazine/Bentazon+Assist	1.6+1%	post[2/]	95	96	100	100	93	100
4. Atrazine + Bromoxynil	1.1+0.28	post[2/]	93	95	99	100	95	100
5. Bromoxynil	0.34	post[2/]	91	94	95	100	98	99
6. Bromoxynil/MCPA	0.56	post[2/]	96	92	96	100	90	100
7. 2,4-D	0.50	post[2/]	96	77	98	100	92	100
8. 2,4-DB	1.5	post[2/]	94	85	99	100	88	100
9. 2,4-D/Mecoprop/Dicamba	0.53	post[2/]	96	95	100	100	79	100
10. Atrazine + Oil	1.1+10L	post[2/]	96	88	99	100	87	100
11. Bentazon + Assist	1.1+1%	post[2/]	89	89	99	100	86	98
12. Dicamba	0.6	post[2/]	95	88	96	100	88	99
13. MCPB/MCPA	1.7	post[2/]	94	86	94	100	86	98
14. Check, weeded			100	100	100	100	100	100
15. Check, weedy			0	0	0	0	0	0
16. L.S.D. 5%			8	15	4	0	12	2

[1/] - applied post overall;
[2/] - applied postemergence in a band

* All plots received metolachlor at 2.4 kg ai/ha in a 30 cm. band at planting.

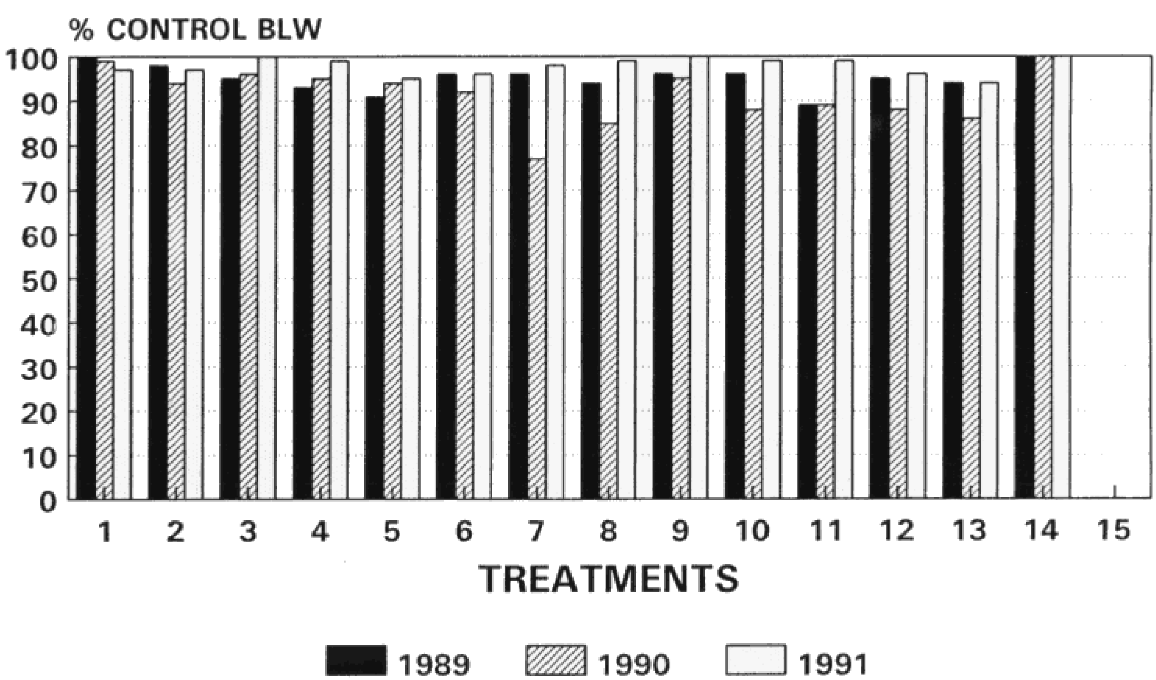
Table 14 - cont'd....

Treatment*	kg ai/ha	Applied	% Weed Control Ave. BLW	Ave. GR
1. Atrazine/Dicamba	1.75	post[1/]	98.6	99
2. Atrazine/Dicamba	1.75	post[2/]	96.3	98
3. Atrazine/Bentazon + Assist	1.6+1%	post[2/]	97	97.6
4. Atrazine + Bromoxynil	1.1+0.28	post[2/]	95.6	98.3
5. Bromoxynil	0.34	post[2/]	93.3	99
6. Bromoxynil/MCPA	0.56	post[2/]	94.6	96.6
7. 2,4-D	0.50	post[2/]	90.3	97.3
8. 2,4-DB	1.5	post[2/]	92.6	96
9. 2,4-D/Mecoprop/Dicamba	0.53	post[2/]	97	93
10. Atrazine + Oil	1.1+10L	post[2/]	94.3	95.6
11. Bentazon + Assist	1.1+1%	post[2/]	92.3	94.6
12. Dicamba	0.6	post[2/]	93	95.6
13. MCPB/MCPA	1.7	post[2/]	91.3	94.6
14. Check, weeded			100	100
15. Check, weedy			0	0

[1/] - applied postemergence overall;
[2/] - applied postemergence in a band

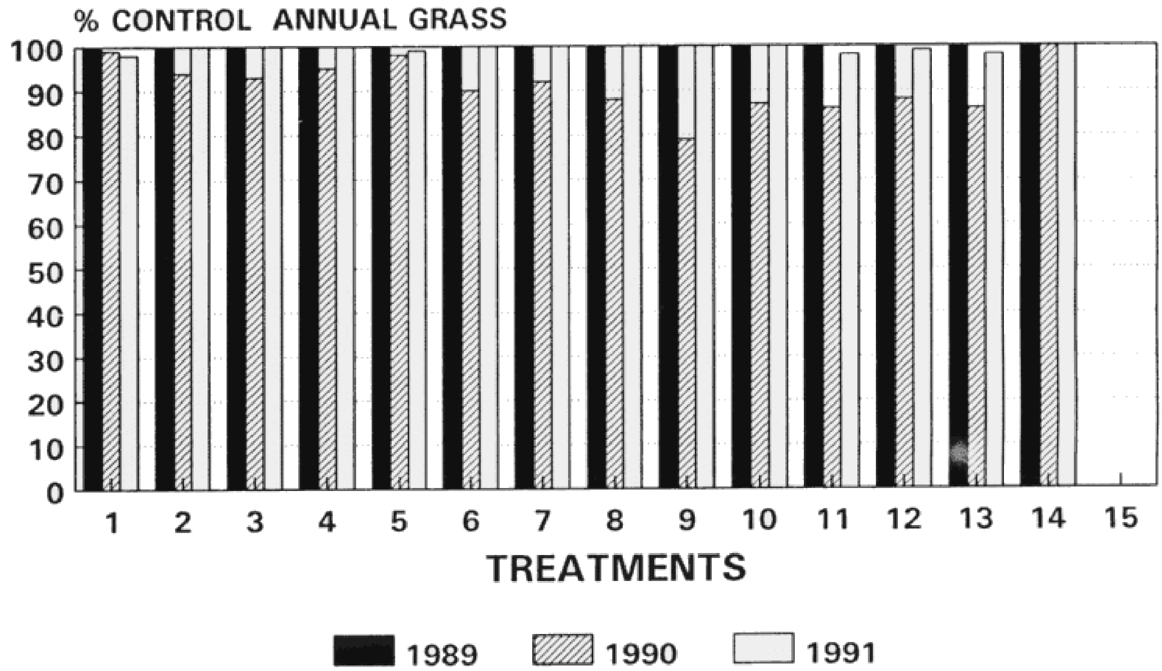
* All plots received metolachlor at 2.4 kg ai/ha in a 30 cm. band at planting.

(FIGURE 15)
POST BAND HERBICIDE APPLICATIONS
IN NO-TILL CORN



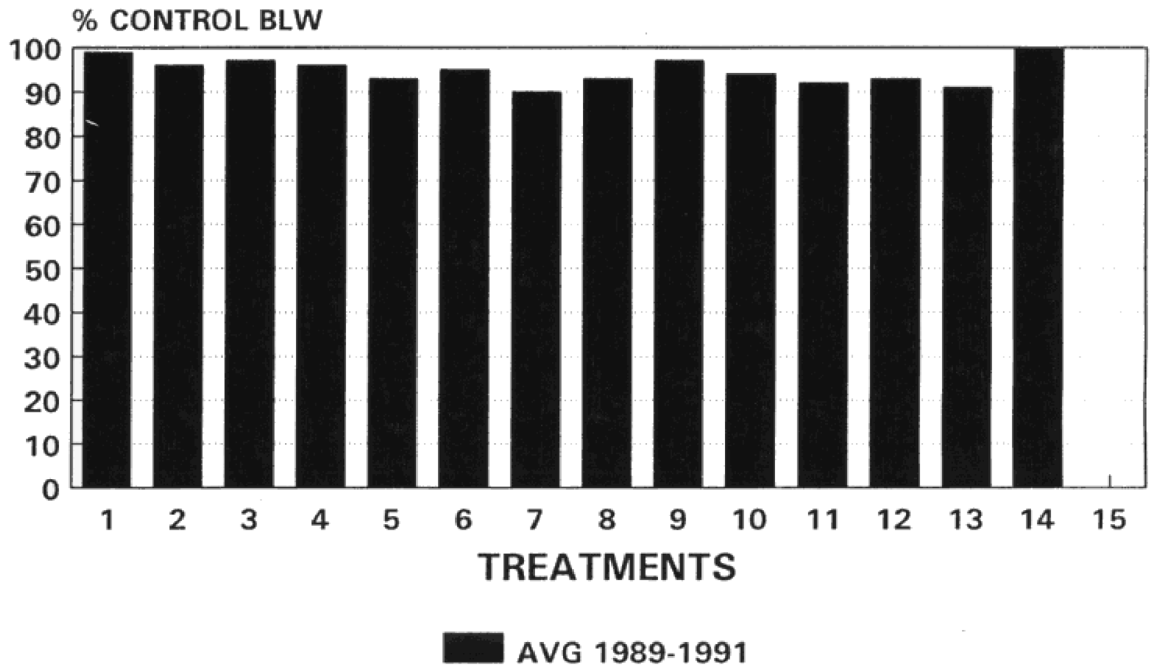
TREATMENT NUMBERS CORRESPOND
TO THE TREATMENT LIST IN TABLE 14

(FIGURE 16)
POST BAND HERBICIDE APPLICATIONS
IN NO-TILL CORN



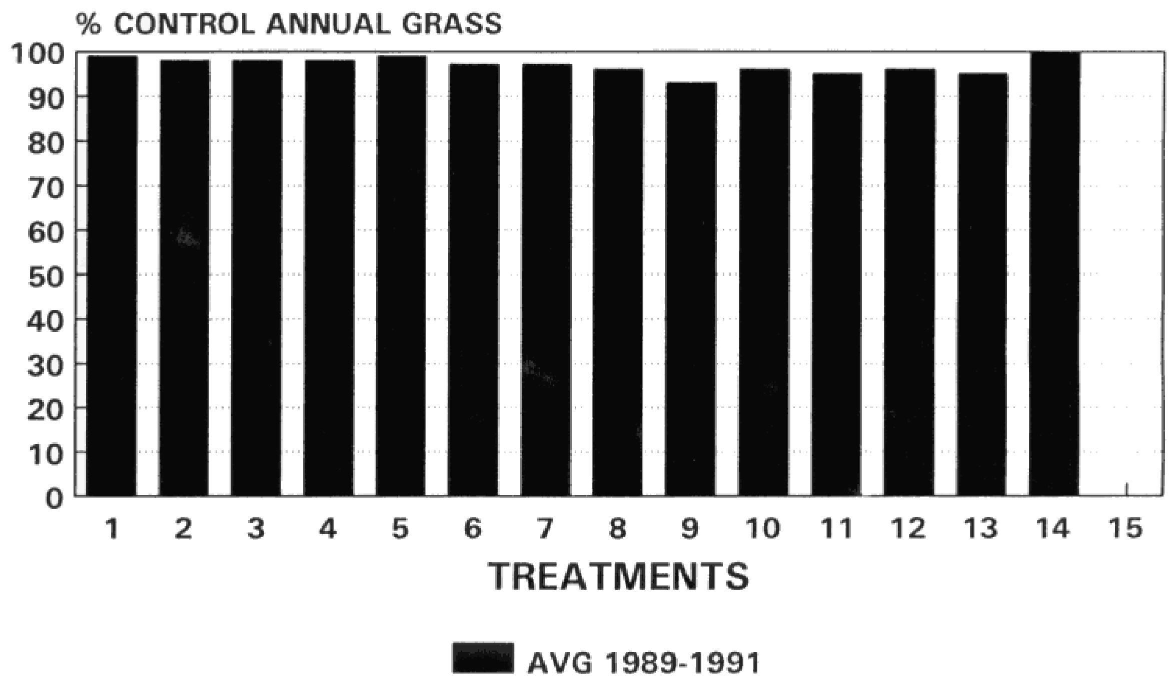
TREATMENTS CORRESPOND
TO THE TREATMENT LIST IN TABLE 14

(FIGURE 17)
POST BAND HERBICIDE APPLICATIONS IN NO-TILL CORN



TREATMENT NUMBERS CORRESPOND TO THE TREATMENT LIST IN TABLE 14

(FIGURE 18)
POST BAND HERBICIDE APPLICATIONS
IN NO-TILL CORN



TREATMENT NUMBERS CORRESPOND
TO THE TREATMENT LIST IN TABLE 14

Table 15. Annual weed biomass as affected by herbicides applied postemergently to no-till corn followed by one inter-row cultivation 1989-1991.

			Weed Weights Ave. G/m^2					
			Broadleaf			Grasses		
Treatment*	kg ai/ha	Applied	1989	1990	1991	1989	1990	1991
1. Atrazine/Dicamba	1.75	post[1/]	5	0	117	1	12	6
2. Atrazine/Dicamba	1.75	post[2/]	0	15	69	0	23	0
3. Atrazine/Bentazon + Assist	1.6+1%	post[2/]	0	36	60	0	5	0
4. Atrazine + Bromoxynil	1.1+0.28	post[2/]	0	10	40	0	16	0
5. Bromoxynil	0.34	post[2/]	0	33	105	0	0	0
6. Bromoxynil/MCPA	0.56	post[2/]	0	52	34	0	17	1
7. 2,4-D	0.50	post[2/]	1	78	72	0	9	0
8. 2,4-DB	1.5	post[2/]	0	67	44	0	9	0
9. 2,4-D/Mecoprop/ Dicamba	0.53	post[2/]	0	34	42	0	38	0
10. Atrazine + Oil	1.1+10L	post[2/]	0	42	76	0	33	1
11. Bentazon + Assist	1.1+1%	post[2/]	3	76	73	0	56	0
12. Dicamba	0.6	post[2/]	0	78	28	0	28	0
13. MCPB/MCPA	1.7	post[2/]	0	64	135	0	17	17
14. Check, weeded			0	0	0	0	0	0
15. Check, weedy			2	535	314	1	1	3
16. L.S.D. 5%			4	211	105	1	NS	13

[1/] - applied postemergence overall;
[2/] - applied postemergence in a band

* All plots received metolachlor at 2.4 kg/ha in a 30 cm. band at planting.

Table 15. - cont'd....

Treatment*	kg ai/ha	Applied	Ave. Weed Weights G/m^2 BLW	GR
1. Atrazine/Dicamba	1.75	post[1/]	41	6
2. Atrazine/Dicamba	1.75	post[2/]	28	7
3. Atrazine/Bentazon + Assist	1.6+1%	post[2/]	32	1
4. Atrazine + Bromoxynil	1.1+0.28	post[2/]	17	5
5. Bromoxynil	0.34	post[2/]	46	0
6. Bromoxynil/MCPA	0.56	post[2/]	29	6
7. 2,4-D	0.50	post[2/]	50	3
8. 2,4-DB	1.5	post[2/]	37	3
9. 2,4-D/Mecoprop/ Dicamba	0.53	post[2/]	25	13
10. Atrazine + Oil	1.1+10L	post[2/]	39	11
11. Bentazon + Assist	1.1+1%	post[2/]	51	19
12. Dicamba	0.6	post[2/]	34	9
13. MCPB/MCPA	1.7	post[2/]	66	11
14. Check, weeded			0	0
15. Check, weedy			284	2

[1/] - applied postemergence overall;
[2/] - applied postemergence in a band

* All plots received metolachlor at 2.4 kg ai/ha in a 30 cm. band at planting.

Table 16. Annual weed escapes as affected by herbicides applied postemergently to no-till corn followed by one inter-row cultivation 1989 and 1990.

Treatment*		kg ai/ha	Applied	1989 Weed Counts Ave. No/m^2			
				VL	LT	WB	FT
1.	Atrazine/Dicamba	1.75	post[1/]	1	0	0	1
2.	Atrazine/Dicamba	1.75	post[2/]	0	0	0	0
3.	Atrazine/Bentazon + Assist	1.6+1%	post[2/]	0	0	0	0
4.	Atrazine+Bromoxynil	1.1+0.28	post[2/]	0	0	0	0
5.	Bromoxynil	0.34	post[2/]	0	0	0	0
6.	Bromoxynil/MCPA	0.56	post[2/]	0	0	0	0
7.	2,4-D	0.50	post[2/]	1	0	0	0
8.	2,4-DB	1.5	post[2/]	0	0	0	0
9.	2,4-D/Mecoprop/Dicamba	0.53	post[2/]	0	0	0	0
10.	Atrazine + Oil	1.1+10L	post[2/]	0	0	0	0
11.	Bentazon + Assist	1.1+1%	post[2/]	0	0	0	0
12.	Dicamba	0.6	post[2/]	0	0	0	0
13.	MCPB/MCPA	1.7	post[2/]	1	0	0	0
14.	Check, weeded			0	0	0	0
15.	Check, weedy			0	1	1	0

[1/] - applied postemergence overall;
[2/] - applied postemergence in a band

*All plots received metolachlor at 2,4 kg ai/ha in a 30 cm. band at planting.

VL = velvetleaf; LT = lady's thumb; WB = wild buckwheat; FT = green foxtail

Table 16 - cont'd....

Treatment	kg ai/ha	Applied	1990 Weed Counts Ave. No/ lm^2				
			RP	LQ	BN	VL	FT
1. Atrazine/Dicamba	1.75	post"	0	0	0	1	0
2. Atrazine/Dicamba	1.75	post[2/]		20	0	0	1
3. Atrazine Bentazon +Assist	1.6+1%	post[2/]	1	1	0	0	4
4. Atrazine + Bromoxynil	1.1+0.28	post[2/]	0	2	1	0	3
5. Bromoxynil	0.34	post[2/]	1	1	0	1	4
6. Bromoxynil/MCPA	0.56	post[2/]	0	1	0	1	2
7. 2,4-D	0.5	post[2/]	1	1	1	2	0
8. 2,4-DB	1.5	post[2/]	1	2	1	1	1
9. 2,4-D/Mecoprop/ Dicamba	0.53	post[2/]	1	2	0	0	2
10. Atrazine + Oil	1.1+ 10L	post[2/]	1	3	0	1	1
11. Bentazon + Assist	1.1+1%	post[2/]	0	1	1	0	1
12. Dicamba	0.6	post[2/]	0	7	0	0	6
13. MCPB/MCPA	1.7	post[2/]	1	1	0	1	1
14. Check, weeded			0	0	0		
					0	1	3

1/ - applied postemergence overall; 2/ - applied postemergence in a band

RP = redroot pigweed; LQ = lamb's quarters; BN = eastern black nightshade; VL = velvetleaf; FT = green foxtail

* All plots received metolachlor at 2.4 kg ai/ha in a 30 cm. band at planting.

Table 17. Annual weed escapes as affected by herbicides applied postemergently to no-till corn followed by one inter-row cultivation 1991.

Treatment*	kg ai/ha	Applied	1991 Weed Counts Ave. No/m²							
			SP	LT	VL	RP	CD	WC	FT	BY
1. Atrazine/Dicamba	1.75	post [1/]	6	1	1	0	0	1	1	1
2. Atrazine/Dicamba	1.75	post [2/]	6	0	1	0	0	0	0	0
3. Atrazine Bentazon + Assist	1.6+1%	post [2/]	8	0	0	0	0	0	1	0
4. Atrazine + Bromoxynil	1.1+0.28	post [2/]	5	0	1	0	0	0	0	0
5. Bromoxynil	0.34	post [2/]	9	0	0	1	0	0	0	0
6. Bromoxynil/MCPA	0.56	post [2/]	5	0	1	0	0	0	1	0
7. 2,4-D	0.5	post [2/]	11	0	0	0	0	0	0	0
8. 2,4-DB	1.5	post [2/]	5	1	0	0	1	1	0	0
9. 2,4-D/Mecoprop/ Dicamba	0.53	post [2/]	5	0	0	0	1	1	0	1
10. Atrazine + Oil	1.1+10L	post [2/]	8	1	1	0	0	1	1	0
11. Bentazon + Assist	1.1+1%	post [2/]	8	0	1	0	0	0	0	0
12. Dicamba	0.6	post [2/]	4	0	0	0	0	0	0	0
13. MCPB/MCPA	1.7	post [2/]	7	1	0	1	0	1	2	1
14. Check, weeded			0	0	0	0	0	0	0	0
15. Check, weedy			12	2	1	0	1	1	1	1

[1/] - applied postemergence overall; [2/] - applied postemergence in a band

SP = shepherd's purse; LT = lady's thumb; VL = velvetleaf; RP = redroot pigweed; CD = curled dock; WC = wild carrot; FT = green foxtail; BY = barnyard grass

* All plots received metolachlor at 2.4 kg ai/ha in a 30 cm. band at planting.

6.0 Experiment IV

Band applied preemergent and postemergent herbicide treatments integrated with inter-row cultivation in reduced-tillage corn using field scale equipment.

Objective:

To evaluate this integrated method of weed control for reduced tillage corn production under the same condition experienced by farmers utilizing large plots and commercially available field equipment.

Introduction:

One concern frequently raised regarding no-till and reduced-till production systems is that more reliance is placed on chemical weed control and this dependency may lead to more frequent use of a greater variety of herbicides and thus increase a producer's herbicide cost. No-till farmers have noticed how efficiently weeds can be controlled in the ridge-till system and are envious of the reduced herbicide bill.

In the interest of economy and efficiency farmers want to make the most of each trip across the field. When the crop to be grown is corn, consideration must also be given to nitrogen application. Because of the large quantity required often a special trip is necessary just for that purpose when the corn is approximately 30 cm. tall.

In order to make efficient use of herbicides and trips across the field a grower might consider band applying a herbicide at seeding time with the planter, and following up with an inter-row cultivation, or applying the herbicide at cultivation time as long as the cultivation and simultaneous band spray application is early enough to avoid serious weed competition. If the cultivation process can be coupled with sidedress nitrogen application this concept has even more practical appeal. This study was initiated to determine if this integrated method of weed control would have practical farm application.

6.1 Methods and Materials

Procedure

Field experiments were conducted in 1990 and 1991 in a growers' field using field scale no-till equipment. A Kinze 6 row wide planter (95 cm. rows) was used to seed the plot areas. A 6 row wide heavy duty cultivator, equipped with nitrogen sidedressing accessories and a postemergence herbicide kit was used to cultivate, sidedress and apply postemergence herbicide on each row of the crop in the plot area. Plots were large consisting of 6 row wide strips down the length of the field. In 1990 the strips were 5.7m x 122m = 695$m^2$and in 1991 the strips were 5.7m x 224m = 1276.8m^2 in area. In each year each treatment was replicated four times in a completely randomized design.

Hyland 2729 was the corn variety grown in both years, seeded on April 30/91 and May 5/92 into a Haldimand loam and a Fox gravelly loam respectively. At seeding each plot received metolachlor at 2.4 kg ai/ha in a 30 cm. band applied over the row with the planter. Also starter fertilizer was applied with the planter in a band to the side of the seed. In each year an excellent crop stand was achieved. In each year a burndown of glyphosate was used. In 1990 the area was treated preplant with glyphosate + 2,4-D at 0.45 + 0.6 kg ai/ha and in 1991 the plot area was only spot sprayed with glyphosate at 0.9 kg ai/ha to control quackgrass.

In 1990 the corn crop was cultivated and sidedressed with 28% UAN solution on June 15th. The overall broadcast application was applied June 16th when the corn was in the 8 leaf stage. The banded application was applied with the cultivator during the second cultivation on June 22 when the corn was in the 9 leaf stage.
In 1991 the crop was cultivated and sidedressed with 28% UAN solution on June 1. The overall broadcast application was applied with a field sprayer on June 6 when the corn was in the 61eaf stage. Banded applications were applied with the cultivator during the second cultivation on June 10 when the corn was in the 7 to 8 leaf stage

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Observations

Weed control ratings, weed biomass, and weed counts were taken at four locations at random within each plot and the mean recorded. Weed control ratings are expressed as a percent control relative to small weedy checks (areas nearby that received no weed control). Weed biomass and weed counts were taken from four randomly selected 1m^2 quadrants throughout the plot area. Each datum recorded in the tables reported is a mean of 4 x 4 = 16 observations. Weed control ratings were recorded on July 24/90 and July 4/91. Weed biomass and counts were recorded on July 18/90 and July 4/91. Yield data was obtained by harvesting four crop rows the entire length of the plot with the farmer's combine. Each plot was weighed in a weigh wagon and representative samples were moisture tested. Results are expressed as tonnes of corn/ha at 15% moisture. Harvest was completed Nov. 16/90 and Sept. 17/91. All data was statistically analyzed using an analysis of variance.

6.2 Results and Discussion

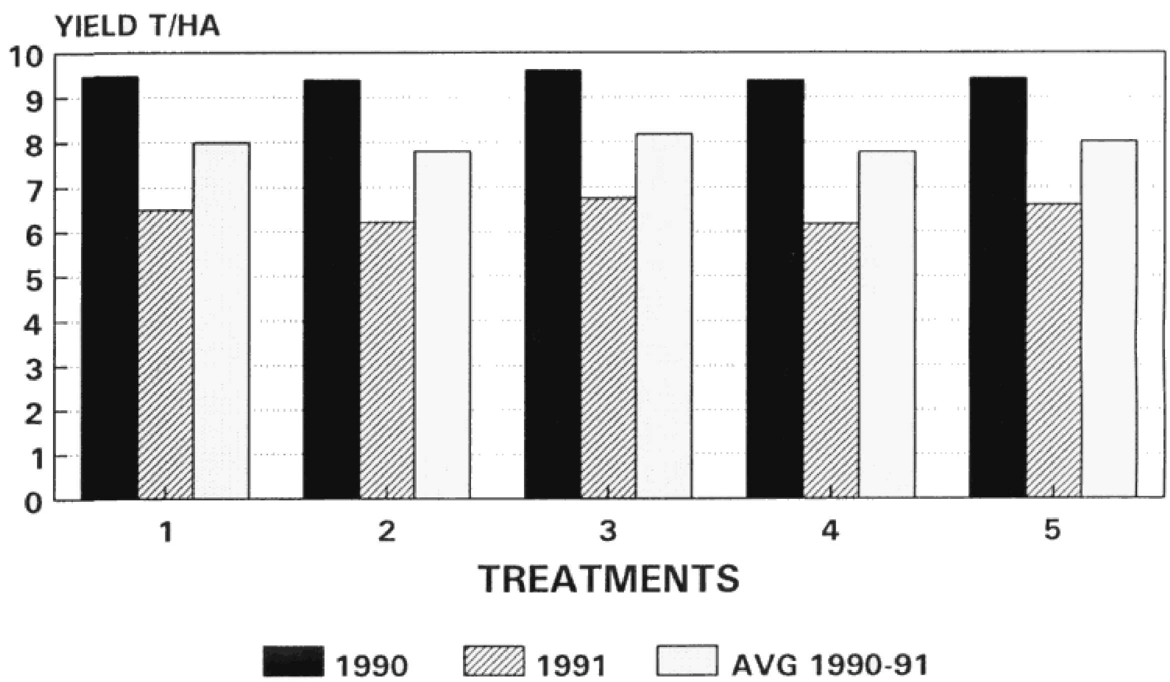
Yield data (Table 18) showed no significant difference between any treatment in either 1990 or 1991. All banded treatments in conjunction with two inter-row cultivations provide yields equal to the overall broadcast treatment.

Weed control was very good to excellent in all treatments (Table 19). Annual weed pressures were reasonably high in both locations both years. The two cultivations provided excellent weed control between rows and the split application of metolachlor applied preemergently in the band followed by a banded postemergence herbicide treatment performed very well and provided broad spectrum weed control comparable to the overall herbicide treatment.

Table 18. No-till corn yields as affected by herbicides applied in a band followed by two inter-row cultivations suing field scale equipment in large plots, 1990 and 1991.

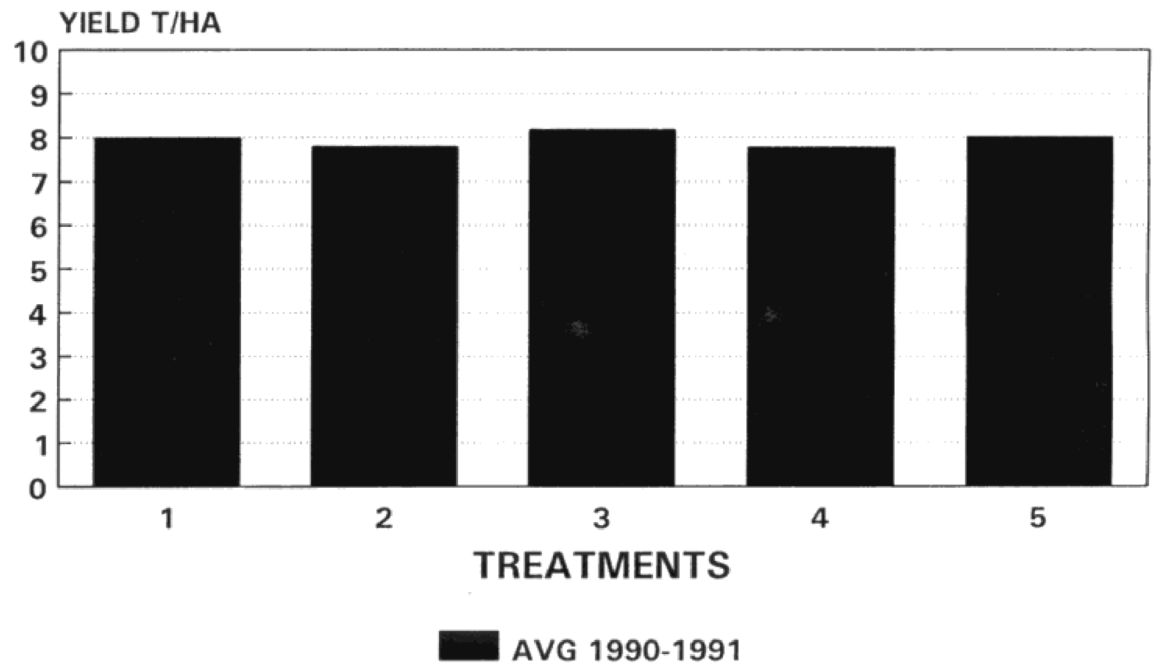
Treatment		kg ai/ha	Applied	T/ha @ 15.5% 1990	1991	Ave. Yield T/ha
1.	Metolachlor,	2.4	pre, banded	9.48	6.49	7.99
	Atrazine/Dicamba	1.75	post, overall			
2.	Metolachlor,	2.4	pre, banded	9.39	6.21	7.80
	Atrazine/Dicamba	1.75	post, banded			
3.	Metolachlor,	2.4	pre, banded	9.60	6.75	8.18
	Atrazine/Bentazone	1.6	post, banded			
	+ Assist	1.0%				
4.	Metolachlor,	2.4	pre, banded	9.38	6.17	7.78
	2,4-D Amine	0.5	post, banded			
5.	Metolachlor,	2.4	pre, banded	9.42	6.6	8.01
	Atrazine +	1.5	post, banded			
	Kornoil	5.0%				
	L.S.D. 5%			0.43	0.62	

(FIGURE 19) BAND APPLIED HERBICIDE APPLICATIONS INTEGRATED WITH INTER-ROW CULTIVATION



TREATMENT NUMBERS CORRESPOND TO THE TREATMENT LIST IN TABLE 18

(FIGURE 20) BAND APPLIEID HERBICIDE APPLICATIONS INTEGRATED WITH INTER-ROW CULTIVATION

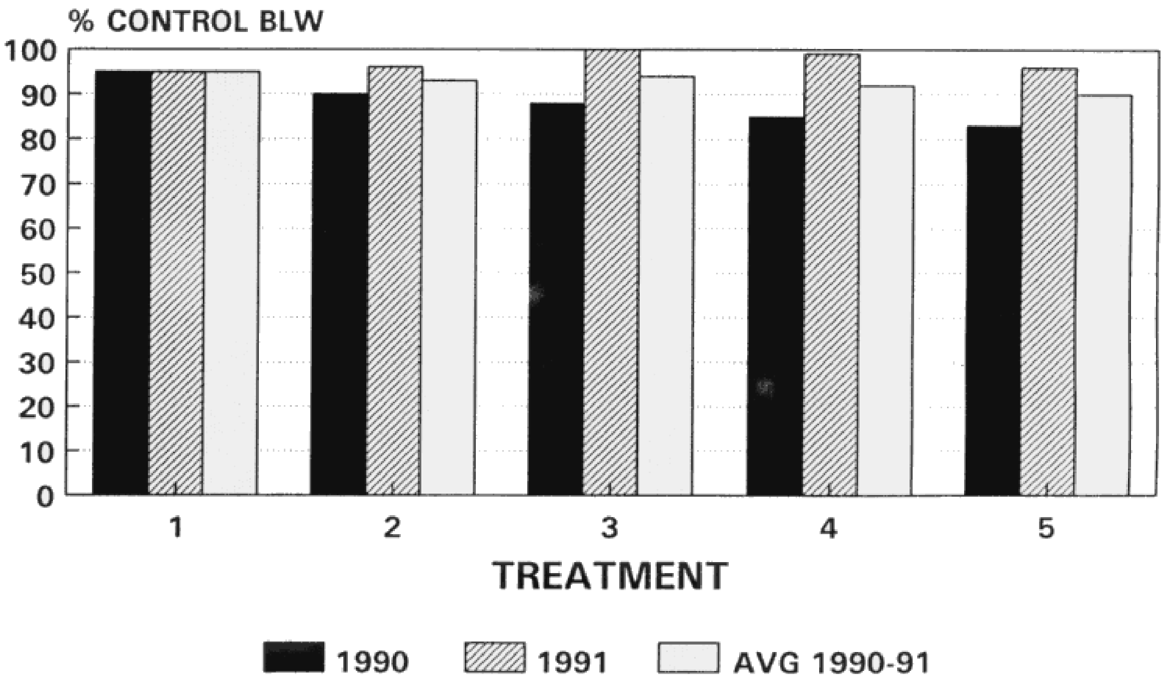


TREATMENT NUMBERS CORRESPOND
TO THE TREATMENT LIST IN TABLE 18

Table 19. Annual weed control ratings as affected by herbicides applied in a band followed by two inter-row cultivations using field scale equipment in large plots 1990 and 1991.

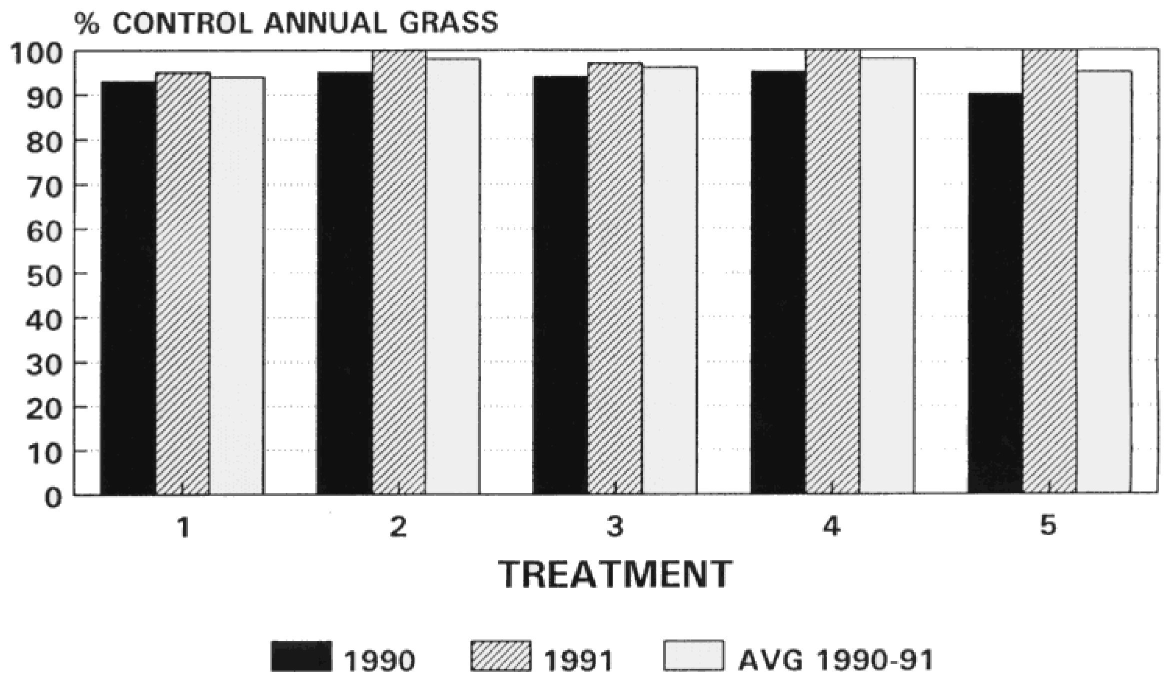
Treatment	kg ai/ha	Applied	% Weed Control BLW 1990	BLW 1991	Grass 1990	Grass 1991	Average % Weed Control BLW	GR
1. Metolachlor,	2.5	pre, banded	95	95	95	95	95	95
Atrazine/ Dicamba	1.75	post, overall						
2. Metolachlor,	2.4	pre, banded	90	95	95	100	93	97.5
Atrazine/ Dicamba	1.75	post, banded						
3. Metolachlor,	2.4	pre, banded	88	100	94	97	94	95.5
Atrazine/ Bentazon	1.6	post banded						
+ Assist	1.0%							
4. Metolachlor,	2.4	pre, banded	85	99	95	100	92	97.5
2,4-D Amine	0.5	post, banded						
5. Metolachlor	2.4	pre, banded	83	96	90	100	89.5	95
Atrazine	1.5	post, banded						
+ Kornoil	5.0%							
L.S.D. 5%			8	8	4	8		

(FIGURE 21) BAND APPLIED HERBICIDE APPLICATION INTEGRATED WITH INTER-ROW CULTIVATION



TREATMENT NUMBERS CORRESPOND
TO THE TREATMENT LIST IN TABLE 19

(FIGURE 22) BAND APPLIED HERBICIDE INTEGRATED WITH INTER-ROW CULTIVATION



TREATMENT NUMBER CORRESPOND
TO THE TREATMENT LIST IN TABLE 19

Table 20. Annual weed biomass as affected by herbicides applied in a band followed by two inter-row cultivations using field scale equipment in large plots 1990 and 1991.

			Weed Weights g/m^2					
			1990		1991		Ave. g/m^2	
Treatment	**kg ai/ha**	**Applied**	**BLW**	**GR**	**BLW**	**GR**	**BLW**	**GR**
l. Metolachlor,	2.4	pre, banded	8	26	6	37	7	31
Atrazine/Dicamba	1.75	post, overall						
2. Metolachlor,	2.4	pre, banded	46	1	11	1	28	1
Atrazine/Dicamba	1.75	post, banded						
3. Metolachlor,	2.4	pre, banded	67	90	5	76	36	83
Atrazine Bentazon +	1.6	post, banded						
Assist	1.0%							
4. Metolachlor,	2.4	pre, banded	90	1	30	3	64	2
2,4-D Amine	0.5	post, banded						
5. Metolachlor,	2.4	pre, banded	53	2	17	8	35	5
Atrazine +	1.5	post, banded						
Kornoil	5.0%							
L.S.D. 5%			NS	NS	NS	NS		

Table 21. Annual weed escapes as affected by herbicides applied in a band followed by two inter-row cultivations using field scale equipment in large plots 1990 and 1991.

			Weed Counts Ave. No/m^2								
			1990			1991					
Treatment	**kg ai/ha**	**Applied**	**RP**	**LQ**	**FP**	**RP**	**LQ**	**BN**	**BY**	**FT**	**FP**
1. Metolachlor,	2.4	pre, banded	0	1	3	0	0	2	1	1	3
Atrazine/Dicamba	1.75	post, overall									
2. Metolachlor,	2.4	pre, banded	0	5	1	1	2	1	0	0	1
Atrazine/Dicamba	1.75	post, banded									
3. Metolachlor,	2.4	pre, banded	0	9	5	1	1	1	1	0	1
Atrazine Bentazon	1.6	post, banded									
+ Assist	1.0%										
4. Metolachlor,	2.4	pre, banded	7	2	0	1	3	1	0	1	1
2,4-D Amine	0.5	post, banded									
5. Metolachlor,	2.4	pre, banded	1	16	1	1	1	1	1	1	1
Atrazine +	1.5	post, banded									
Kornoil	5.0%										

RP = redroot pigweed; LQ = lamb's quarters; FP = fall panicum; BN = eastern black nightshade; BY = barnyard grass; FT = green foxtail

A FARMER'S PERSPECTIVE

INTER-ROW CULTIVATION AND HERBICIDE BANDING

IN A NO-TILL ENVIRONMENT

Inter-row cultivation and herbicide banding can work successfully in a no-till system. We have used this system, both in plot work with Jim Shaw and in our farm operation for the past three years. As with most operations there are trade-offs, but I feel the advantages outweigh the disadvantages. With cultivation we are disturbing the soil structure near the surface. This requires that the combine tires be aligned to run between the rows at harvest. If this is not done the combine will tend to slide off the undisturbed row area during a wet fall, especially on side hills. In stoney fields a problem may arise with stones being dislodged from the soil and deposited in the row area where they may be picked up by the combine header. By cultivating we disturb the habitat of the soil life, however, I feel with shallow cultivation the disturbance is minimal, the recovery rate is fairly fast and the benefits outweigh the risks.

The cultivation should be done at a shallow depth because we don't want to prune crop roots, bring weed seeds to a germination depth or disturb soil structure. We had hoped we would need only one cultivation but have found we need to cultivate twice for a satisfactory job.

With cultivation we have been able to reduce our herbicide usage by 60%. Cultivation saves us a great deal of herbicide dollars and reduces our impact on the environment. Below is a chart showing our weed control costs with broadcast spray and with band spray and cultivation showing a cost savings of $17.00 an acre in favour of band spraying with cultivation.

Broadcast Spray		**Band Spray & Cultivate**
Plant & Spray		Plant & Band Spray
Dual & 2-4,D		Dual & 2-4,D
Spray Banvel	5.00	
Apply Nitrogen	7.00	
		Cult., Band Spray & Apply N. 8.00
		Cultivate 7.00
.8L Dual	15.2	.25L Dual 4.75
.5L 2-4,1)	1.88	.17L 2-4,1) .64
.5L Banvel	12.38	.17L Banvel 4.21
TOTAL	41.46	TOTAL 24.60

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