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Mark K. Peterman for the degree of Master of Science

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Title: Sweet Corn (Zea mays) Production in a White Clover (Trifolium repens) Living Mulch: The Second Year

Abstract approved Redacted for Privacy
Larry C. Burrill

Soil-related problems common to Oregon farmers are erosion, compaction, organic matter depletion, and nutrient loss. High costs of fertilizer, fuel, and weed control are additional management problems. Growing a secondary crop as a living mulch with a primary crop may ease some of these problems.

Sweet corn production in Oregon is commonly plagued by these problems and may be suitable for a living mulch system. Field experiments were begun to test the feasibility of growing sweet corn (*Zea mays* L. 'Jubilee') and white clover (*Trifolium repens* L. 'New Zealand') living mulch in the Willamette Valley in Oregon. Research was done at the Oregon State University Hyslop and Horticulture research farms near Corvallis. Management practices tested were fall-planted clover (1982) compared to spring-planted clover (1983), and clover suppression treatments in 1984. Suppression treatments were 0.84 and 1.4 kg ai/ha atrazine (6-chloro-

N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine), and mowing.

Corn yields were not reduced when clover was planted in the fall and suppressed with atrazine at 1.4 kg ai/ha. When clover suppression treatments were mowing or 0.84 kg ai/ha of atrazine, corn yields were reduced.

At the Horticulture farm, an additional screening trial was conducted to determine the effect of selected herbicides on second-year white clover. Results indicated that the dimethylamine 2,4-D ((2,4-dichlorophenoxy) acetic acid) applied at 2.24 kg ae/ha gave excellent initial and residual suppression of the clover (95% at 14 days after treatment and 82.5% at 67 days after treatment). A mixture of atrazine plus alachlor (2-chloro-*N*-(2,6-diethylphenyl-*N*-(methoxymethyl)acetamide) applied at 1.4 and 3.36 kg ai/ha, respectively, effectively suppressed the clover (80%), but was only slightly more severe than atrazine at 1.4 kg ai/ha.

Sweet Corn (*Zea mays*) Production in a White Clover (*Trifolium repens*) Living Mulch: The Second Year

by

Mark K. Peterman

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Assistant Professor of Crop Science in Charge of Major

Redacted for Privacy

Head of Department of Crop Science

Redacted for Privacy

Dean of Graduate School

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Typed by Mark K. Peterman

DEDICATION

This thesis is dedicated to my wife, Theresa, for her love, patience, support, and assistance throughout my graduate studies. Also, to my father, the late Vernon L. and to my mother, Alene H., for their love, guidance and support throughout all my endeavors.

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INTRODUCTION

Oregon farmers have relied on relatively inexpensive fuels, fertilizers, pesticides, and equipment to raise their productivity and efficiency in the past 4 decades. Early planting, late harvesting, large machinery, and multiple cropping have been common as farmers achieve greater efficiency. Results from such practices have not all been good. Early planting with heavy equipment on wet soils has compacted soils. Late-season harvests have similar results. Continuous production of row and cereal crops can cause depletion of soil organic matter and nutrients. Soil erosion further aggravates these problems. When yields drop, increased use of fertilizers and pesticides have been a common response by farmers. However, costs of these inputs are no longer low. Alternative systems of crop production may relieve these problems.

In the spring of 1982, a workshop was held at Oregon State University to discuss living-mulch production systems and identify those which might be useful in the Willamette Valley in Oregon. In the fall of 1982, Cooper (1985) began research by testing combinations of clover planting dates, weed control, and clover suppression methods as first-year management options. He concluded that it was possible to grow sweet corn in a suppressed white clover mulch during the clover establishment year. The objective of the research reported here was to continue testing the feasibility and management options, but in a second-year-clover sod. Additionally, a screening trial was conducted to determine the effectiveness of several herbicides in suppressing white clover.

LITERATURE REVIEW

Mulches have been utilized since humans first began farming (Unger and McCalla, 1980). Because only simple tools were available to the farmer in early times, much of the crop residue was not plowed into the soil. The advantages of cover crops and green manures in crop production systems were recognized soon. Mooers (1927) experimented by growing a legume, such as cowpeas (Vigna sinensis (Torner) Savi.) or soybeans (Glycine max (L.) Merr.) before growing field corn. He indicated that it was necessary to remove or plow under the cowpeas or soybeans in order to obtain corn yields comparable to corn grown without a second crop. Pieters and McKee (1938) studied hairy vetch (Vicia villosa Rothe) in different cereal production systems. They believed that growing the vetch before planting a grass, could supply 153 to 227 kg/ha of nitrogen to the grass crop. Moschler et al. (1967) compared several winter cover crops and concluded that rye (Secale cereale L.) was the most satisfactory mulch for no-tillage corn production because of its superior winter hardiness and ability to produce a dense mulch. They concluded that hairy vetch or crimson clover (Trifolium incarnatum L.) made poor mulches in a corn production system when compared to rye. Although legume mulches provided more forage material, corn yields were reduced. Peterson (1955) attempted to integrate alfalfa (Medicago sativa L.) and sweet corn production systems. He concluded that it was not possible to obtain yields comparable to conventionally grown corn unless weeds could be controlled and the alfalfa managed. He thought adequate control could be obtained by either new methods of tillage or by use of selective herbicides which were being developed. Suppression of the mulch itself would be possible only by chemical means.

Growing a mulch crop with a primary crop, is now receiving the attention and resources necessary to perfect the system. Several factors may be responsible for this new interest. In the early to mid 1900's the essential management tools were absent, even though benefits of the system were realized (Peterson, 1955). In the 1960's, the chemical tools were present but with the advent of inexpensive chemical fertilizers and fuel, there was less interest. Recently, increased costs of petroleum fuels and fertilizers has led to a renewed interest in cover crops and living mulches. There is increasing evidence that the potential for establishing an effective living-mulch program exists (Sweet 1982).

Vrabel (1981) studied the feasibility of using selected legumes as living mulch crops in sweet corn. He identified a number of mulch candidates, but was particularly interested in white clover. Mt. Pleasant (1982) also used white clover in a polyculture system with sweet corn. Cooper (1985), studied the feasibility and management options available for growing sweet corn with a white clover living mulch in the Willamette Valley of Oregon.

Akobundu (1980) defines the term "live mulch" as a crop production technique in which a food crop is planted directly into the living cover of an established cover crop without destruction of the fallow vegetation. A living mulch system offers the potential of: (1) adding nitrogen to the system, (2) preventing erosion, (3) stabilizing organic matter, (4) decreasing weed growth, and (5) decreasing the use of fuel.

1. Nitrogen Additions

Mitchell and Teel (1977) reported that 59% of the production costs of conventionally produced sweet corn are for fuel and nitrogen fertilizer. Nitrogen, the largest component, makes up 32% of the production costs. For no-till corn production, fertilizers make up 78% of the cost with nitrogen representing 68% of the total costs (Hargrove, 1981). Legumes, used as a living mulch, may provide significant quantities of fixed nitrogen. Workers in Kentucky showed that 90 to 100 kg nitrogen/ha per year over a five year period was released from hairy vetch (Blevins, 1980). Mt. Pleasant (1982) reported that 45 to 100 kg nitrogen/ha could be released from legumes when grown with corn. She speculated that a major proportion of the nitrogen was made available by either the sloughing off of root nodules or from exudates released by the clover plants. It is not known how quickly the additional nitrogen is made available to the associated crop. It was predicted that nitrogen, excreted in the form of aspartic acid, becomes available quickly (Simpson 1965). Campbell et al. (1974) reported that seasonal patterns of temperature and moisture can affect the amount of nitrogen mineralized from root nodule decomposition. Simpson (1965) indicates that a majority of clover root sloughage occurs in the winter as a result of cold weather. Thus, substantial amounts of nitrogen would then be available in the spring after conditions most favorable for microbial decomposition resume.

2. Control of Erosion

Water-caused soil erosion is a problem on an estimated 72 million of the 172 million arable hectares in the contiguous United States (Hayes and Kimberlin, 1978). Erosion may occur at almost any time, but the potential is greatest when the surface is bare during seedbed preparation, seedling establishment and after harvest (Unger and McCalla, 1980). Soil erosion is a process of soil detachment and transport. Precipitation impact has the potential of detaching soil aggregates and destroying granulation (Brady, 1974). Drop impact and transport also has the potential to promote surface sealing and crusting. Lowdermilk (1930) compared percolation rates of clear and muddy water and found that clear water entered the soil much more rapidly than did muddy water. He concluded that the suspended particles filled the pores within the soil, causing additional runoff and erosion.

The factors influencing erosion have been studied extensively. Guidelines for determining the potential for erosion have been published by Brady (1974), Hayes and Kimberlin (1978), Stewart et al. (1975), Unger and McCalla (1980), Wischmeier (1973), and Wischmeier and Smith (1978). All guidelines are site specific and are based on the universal soil loss-equation[a]. For effective erosion control, seeding and tillage practices should decrease raindrop impact, increase water infiltration, decrease runoff, and decrease soil detachability (Wischmeier, 1973).

A living mulch can reduce erosion. Batchelder and Jones (1972) measured rainfall and irrigation runoff over a 4 year period. They compared mulched topsoils to barren topsoils. They reported runoff to be lowest in the treatments containing a mulch. This agrees with Taylor et al. (1964), who reported that mulches decreased runoff in several of their seedbed studies. A mulch can

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a The universal soil loss equation is A = RKLSCP. A is computed soil per hectare; R, rainfall factor based on the erosion-index units in a normal year's rainfall at a specific location; K, soil erodibility factor; L, length of slope factor; S, slope gradient factor; C, crop management factor; and P, erosion control practiced factor.

reduce erosion by decreasing both precipitation impact and rate of precipitation runoff. Impact of rainfall on barren soil is decreased by the presence of a canopy. Runoff and infiltration are closely related. Increased infiltration influences erosion by allowing more rainfall to enter the soil, thereby decreasing the amount of precipitation runoff (Unger and McCalla, 1980). Infiltration is largely affected by soil permeability. Permeability is increased by the amount of organic matter in the topsoil. Enlow and Musgrave (1938) determined that runoff is decreased by the addition of organic matter. Infiltration is enhanced by the increased tilth associated with moderate to high amounts of soil organic matter (Smith et. al., 1937).

3. Organic Matter Stabilization

Organic matter content is determined by the amount of plant material returned to the soil and rate of subsequent decomposition. Albrecht (1938) concluded that high organic matter content is responsible for increased nutrient content and tilth. He believed that decreasing organic matter resulting from continued cultivation is responsible for declining productivity. Jenny (1933) studied a field continuously cropped to corn, wheat, and oats and compared these results to an adjacent undisturbed prairie soil. She showed a 32% reduction in organic matter in the field that had been continuously cropped. Concomitant with this loss was a 35% decrease in soil nitrogen content.

4. Weed Control

Weeds compete with crops for light, nutrients, and moisture; therefore effective control of weeds is essential to crop production. Weeds are less likely to be a problem if a high density mulch is maintained. Kurtz et al. (1952) found that clovers seeded in the fall would not develop a sod thick enough to control erosion in the winter or weeds in the summer. It was only after substantial growth of the clover that the density needed for adequate weed control could be obtained. Cooper (1985) indicated that little early season control of broadleaf or grass weeds was obtained from clover planted in fall or spring. But good control of these weeds was obtained when either EPTC (s-ethyl dipropylthiocarbamate) or vernolate (a-propyl-dipropylcarbamethioate) was applied prior to planting clover. Vrabel (1981) believed that high seeding rates of white clover would cause the canopy to fill most quickly, thereby avoiding major weed problems during clover establishment. Hartwig (1984) found that crownvetch suppressed weed growth. He indicated that weeds caused decreased corn yields, except in plots with crownvetch. Grass cover crops have also been found useful in controlling weeds. Nicholson (1982), reported that chewing fescue (*Festuca rubra* Gaud.), Kentucky bluegrass (*Poa pratensis* L.), and three cultivars of white clover reduced weed growth and did not reduce corn yield.

5. Fuel and Fertilizer Reduction

For a new system to be economically advantageous over an existing system it must be more efficient. A new system can be less expensive if it requires less labor, less fuel, or less fertilizer. The percentage of fuel and fertilizer making up the costs of current production system has previously been cited. The costs of a living mulch production system have not yet been fully determined, but the system has the potential to decrease the major inputs. Cooper (1985) reported that a $ 217/ha decrease in production costs may be obtained during the establishment year. This net return is based on a proposed "best alternative" management scheme which includes a preplant mowing, in which the clover could be sold as forage, followed by application of 1.0 kg ai/ha of atrazine. Added nitrogen fertilizer can be reduced by using a leguminous mulch (Blevins 1980, Hargrove 1982, Mitchel and Teel 1977, Mt. Pleasant 1982, and Touchton et al., 1982). Nutrient and organic matter losses by erosion can be decreased, thereby further reducing the amounts of fertilizer used. The fuel required for tillage could be decreased with a mulching system (Unger and McCalla, 1980). Fuel would also be decreased if weed control is achieved by the living mulch and if the planting and spraying operations can be combined.

Mulch Species

Research by Akobundu and Okigbo (1984) identified characteristics of ground covers for use as a living mulch in corn production. They cited major attributes as being easy to establish, able to survive prolonged dry periods, able to smother weeds, and should not compete with the corn plants too severely. In order to increase corn yields, it is expected that a legume living mulch must be used (Mt. Pleasant 1982). As noted earlier, sloughed off root nodules can account for up to 90 kg/ha organic nitrogen. The organic matter would improve soil structure. Mooers (1927), found that soil aggregation would be improved only when legumes were in rotations. He stated that the soil with a legume crop in the rotation was more friable and granular.

Vrabel (1981) tested white clover, ladino clover, red clover (*Trifolium pratense* L.) hairy vetch, and alfalfa for use as a mulch with sweet corn. He concluded that white clover was best suited for this system because (1) clover suppressed with atrazine, allowed release of previously fixed nitrogen which could be utilized by the corn, and (2) it has a stoloniferous growth habit, thus is quick to become established. He stated that after about 1 year's growth, the white clover would provide full cover, even after summer suppression. The white clover sod also provided a firm ground cover which was much easier to travel on during the winter season. These factors, combined with white clover's insect, disease, and slug tolerance made it a good candidate for use as a long-term living mulch. Butler et al. (1959) determined that because of the stoloniferous growth habit of white clover and associated extensive root system, it was capable of turning over much root and nodule tissue resulting in the addition of large amounts of organic matter and nitrogen.

Other legumes have generally been found to be too competitive, hard to manage or slow establishing. Sweet (1982) noted that red clover, although popular with farmers, was loose growing and let weeds grow through. He also noted that alfalfa was very hard to manage. Blaser et al. (1965), in a rating of the aggressiveness of different legumes, found red clover and alfalfa to be very aggressive; ladino and several varieties of birdsfoot trefoil (Lotus corniculata L.) to be aggressive; three varieties of white clover and several other varieties of birdsfoot trefoil were judged to be least aggressive.

The use of grasses as a living mulch was discussed at a living mulch workshop at Oregon State University in 1982. Cook (1982) stated at this meeting that his first choice for a grass mulch would be perennial ryegrass (Lolium perenne L.). He noted that other grasses are good colonizers, whereas perennial ryegrass is a bunch grass and does not move much. But this trait would not aid in weed control and it cannot fix nitrogen.

Suppression of the living mulch during the corn growing season is important to minimize competition with the corn crop. But it should not be suppressed to a point where adequate regrowth would not occur for winter survival or weed control. Vrabel (1983) and Cooper (1985) found significant reductions in total yield and number of marketable ears of sweet corn grown in unsuppressed white clover. But both reported no yield losses when the clover was suppressed with 0.84 kg ai/ha of atrazine . Pendleton et al. (1956) found that when alfalfa was approaching a full cover, lowest corn yields were obtained. Overall, the need for adequate suppression during the corn growing cycle is essential to maintaining high corn yields (Cooper 1985, Vrabel 1983, and Mt. Pleasant 1982). Hartwig (1977) believed that a 10 to 15% reduction in corn yield was worth the increased organic matter, nitrogen, weed control, erosion control, and forage value that a living mulch may have provided.

Insects, Plant Diseases and Vertebrates

It is anticipated that disease, insect and vertebrate relationships may change in response to corn being produced in clover. But little research has been directed at determining these changes. It is unknown if these practices will have any effect on the plant disease, insect or vertebrate interactions. Sumner et al. (1981) states that tillage practices influence pathogens by changing physical and chemical properties of the soil, soil moisture and temperature, and indirectly by influencing the vectors of that pathogen. Phillips and Young (1973) found that disease problems were similar for conventional and no-tillage systems. Exceptions included anthracnose (*Colletotrichum graminicola* (Ces.) G. W. Wils.) and yellow corn leaf blight (*Phyllosticta maydis* Arny and Nelsen). Phillips and Young (1973) also reported that insects that may be increased by this system were cutworms (Family Nocterideae), armyworms (*Prodenia* spp.), and root aphids (*Aneviaphis maidiradicis*). But Wilson (1981) reported that a reduction of flea beetles and aphids (unspecified genera) occurred in treatments with living mulches present. Wilson attributes this to increased trapping of carabid and staphylinid insect predators. Phillips and Young (1973) also reported that slugs (*Deroceras loeve* Muller) caused greater problems in no-tillage corn production. Cooper (1985) indicated that his clover was a good source of cover and feed for mice and gophers. Akobundu and Okigbo (1984) found that earthworm activity was lowest in plots with no residue and highest in plots with a living mulch present.

FIELD EXPERIMENTS TO TEST THE FEASIBILITY OF GROWING SWEET CORN IN A SECOND-YEAR WHITE CLOVER LIVING MULCH

MATERIALS AND METHODS

In the spring of 1984 research reported in this paper was initiated at the Oregon State University Horticulture and Hyslop research farms near Corvallis, Oregon. At both locations, second-year suppression treatments were superimposed on establishment-year treatments. Appendix Table 1 describes the overlap of treatments between the two years. In April, 1984 the white clover density was low and not uniform (Appendix Table 11). But when the sweet corn was planted, a relatively dense and uniform stand of clover existed in all plots.

At the Hyslop and Horticulture farms, clover was mowed and the clippings were removed from the research sites 10 and 18 days, respectively, prior to planting corn. A "Northwest" rotary tiller was modified to cut three 10-cm-wide strips through the soil and clover. Sweet Corn, var. 'Jubilee' was planted with Model 70 John Deere planters using double disks to open furrows. Planters were mounted on the rotary tiller so that corn was planted in each newly tilled strip.

Corn rows were 76 cm apart and spacing between plants in the row was approximately 23 cm, resulting in about 57,400 plants/ha. Six rows, equalling about 120 corn plants, were planted in each plot. Plot size was

4.6 by 6.1 m and treatments were in a randomized complete block design with four replications.

Liquid fertilizer was applied to all treatments in a band by subsurface injection at corn planting. The nozzles were located between the planter disks. The liquid fertilizer was applied at the rate of 110:190:0 kg/ha (N:P:K). An additional 112 kg/ha of urea (45:0:0, N:P:K) was applied in a surface band next to the corn with a hand-pushed "Gandy" spreader when the corn was about 50 cm high.

After planting, atrazine plus alachlor at 1.68 and 2.24 kg ai/ha, respectively, was applied in a 15-cm band over the corn row. Application was made with a unicycle, compressed-air plot sprayer. The sprayer was equipped with a 2.1-m boom with three Tee Jet 6501-E nozzle tips. The tips were located on extensions so application was from 10 cm above the ground.

Clover-suppression treatments at Hyslop research farm were two rates of atrazine (1.12 and 1.68 kg ai/ha), two mowings, and no suppression. Treatments at the Horticulture research farm were 1.12 kg ai/ha atrazine, 1.68kg ae/ha glyphosate (N-(phosphonomethyl)glycine), two mowings, and no suppression. In addition to these treatments, a conventional corn production plot was included in each block. The conventional treatment consisted of mechanical preparation of the seedbed and preemergence application of 1.68 kg ai/ha of atrazine plus 2.24 kg ai/ha of alachlor broadcast by a compressed-air plot sprayer. On the sprayer was a 2.1-m boom with seven Tee Jet 8003 flat-fan nozzle tips. Sprayer pressure was 172 KPa.

Estimates of weed and clover density were recorded in the summer of 1983 and spring of 1984. Corn height was measured five times during the season. Heights reported are the average of five randomly selected plants from each plot. Corn yield was determined by harvesting the ears from five plants within the four middle rows of the plot. Fresh weights were of unhusked, marketable-size ears. Planter skips and slug feeding resulted in occasional row segments with missing plants. Corn ears were harvested from sections of the rows containing no missing plants.

Dry weights of ears, leaves, and stems from five randomly selected plants from each plot were measured after drying for 2 weeks at 60 C. Fresh weights of ears designated for drying were taken just after harvest so moisture content could be determined.

RESULTS

Hyslop Farm Location

White clover and weed density evaluations were made on April 19, 1984 (Tables 1 and 2). The density of fall-planted clover was always higher than that of spring-planted clover. Weed densities were highest in those plots with lowest clover density. Weeds present on this date were mostly broadleaves. Prominent weeds were bittercress (Cardamine oligosperma Nutt.), spring whitlowgrass (Draba verna L.), common chickweed (Stellaria media (L) Vill.), and common groundsel (Senecio vulgaris L.). Annual bluegrass (Poa annua L.) was present, but was not uniformly distributed.

At corn planting, clover density was not recorded, but clover appeared to be uniform in all plots and had reached nearly 100% cover. Weeds were less prevalent than earlier in the spring and were not uniform.

Height of corn differed throughout the season as a result of treatments. Corn in the conventional-system plots was always the tallest. At the evaluation taken on September 5, 1984, only corn in plots treated with atrazine at 1.4 kg ai/ha in fall-planted clover was as tall as in the check plot (Figure 1).

Only corn with the clover suppressed with the high rate of atrazine and in fall planted clover produced yields comparable to the conventional system (Table 3). Corn yields in plots having spring-planted clover and receiving the high rate of atrazine were slightly less than yields of the conventional system. The clover sod treated with the low rate of atrazine, mowed, or not suppressed proved to be highly competitive and severely reduced corn yields.

Dry weights of corn ears did not correlate well with the above results. The sample size of 5 plants/plot was most likely too small, which lead to a high variance within samples. These measurements indicated that all treatments differed from the check in yield (Table 4). Corn-ear moisture content was about 70% throughout the trial at harvest.

Table 1. Percentage of the soil surface covered by white clover on April 19, 1984 at Hyslop Farm.

	TREATMENT				Percent clover	
	Planting season[a]	Weed control	Clover Suppression Treatment	Kg ai/ha	Mean	Arcsin[b]
1.	fall	EPTC	atrazine	0.84	54	51 abcde
2.	fall	EPTC	atrazine	1.40	80	65 ab
3.	fall	EPTC	mow	----	70	61 abcd
4.	fall	none	atrazine	0.84	59	51 abcdef
5.	fall	none	atrazine	1.40	76	62 abc
6.	fall	none	mow	----	83	67 a
7.	spring	vernolate	atrazine	0.84	1	4 g
8.	spring	vernolate	atrazine	1.40	38	37 ef
9.	spring	vernolate	mow	----	49	45 cdef
10.	spring	none	atrazine	0.84	8	4 g
11.	spring	none	atrazine	1.40	45	42 ef
12.	spring	none	mow	----	54	47 bcdef
13.	check	----	----	----	----	----

a Planting season refers to time of clover planting; seeding in the fall of 1982 or the spring of 1983.

b Values of arcsin means having a common letter are not significantly different at the 5% level as determined by Duncan's multiple range test.

Table 2. Percentage of the soil surface covered by weeds on April 19, 1984 at Hyslop Farm.

	TREATMENT				Percent clover	
	Planting season[a]	Weed control	Clover Suppression Treatment	Kg ai/ha	Mean	Arcsin[b]
1.	fall	EPTC	atrazine	0.84	22	28 bc
2.	fall	EPTC	atrazine	1.40	4	9 d
3.	fall	EPTC	mow	----	19	28 bc
4.	fall	none	atrazine	0.84	13	22 c
5.	fall	none	atrazine	1.40	3	7 d
6.	fall	none	mow	----	16	23 c
7.	spring	vernolate	atrazine	0.84	41	40 ab
8.	spring	vernolate	atrazine	1.40	10	19 cd
9.	spring	vernolate	mow	----	49	45 a
10.	spring	none	atrazine	0.84	39	39 ab
11.	spring	none	atrazine	1.40	21	27 bc
12.	spring	none	mow	----	36	40 ab
13.	check	----	----	----	----	----

a Planting season refers to time of clover planting; seeding in the fall of 1982 or the spring of 1983.

b Values of arcsin means having a common letter are not significantly different at the 5% level as determined by Duncan's multiple range test.

Figure 1. Height of sweet corn plants at harvest at Hyslop Farm.

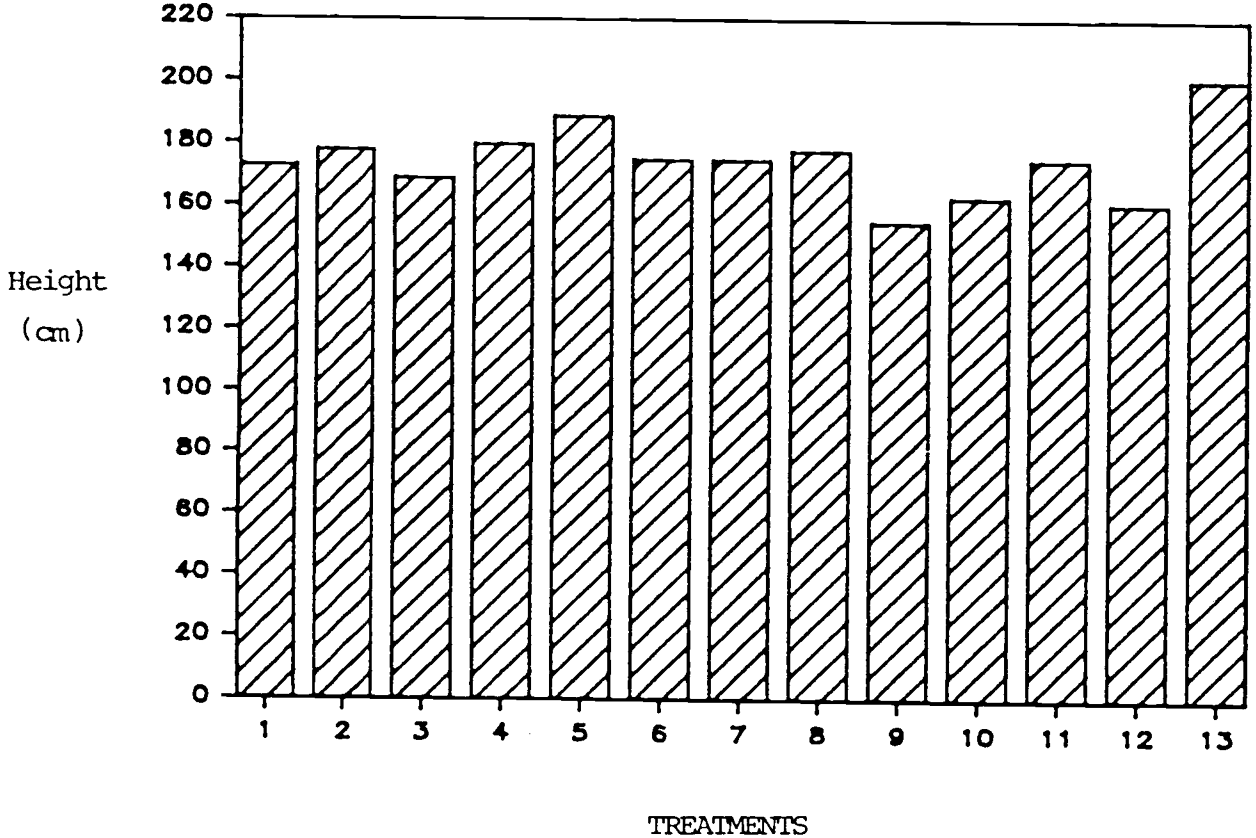


Table 3. Fresh weight of unhusked 'Jubilee' sweet corn ears taken on October 15, 1984 at Hyslop Farm.

	TREATMENT				
	Planting[a] season	Weed control	Clover Suppression Treatment	Clover Suppression Kg ai/ha	Yield[b] (mt/ha)
1.	fall	EPTC	atrazine	0.84	15.8 cde
2.	fall	EPTC	atrazine	1.40	19.4 abc
3.	fall	EPTC	mow	----	15.3 cde
4.	fall	none	atrazine	0.84	15.2 cde
5.	fall	none	atrazine	1.40	20.7 ab
6.	fall	none	mow	----	16.5 cde
7.	spring	vern	atrazine	0.84	15.6 cde
8.	spring	vern	atrazine	1.40	17.0 bcd
9.	spring	vern	mow	----	13.6 de
10.	spring	none	atrazine	0.84	12.5 e
11.	spring	none	atrazine	1.40	17.5 bcd
12.	spring	none	mow	----	13.4 de
13.	check	----	----	----	22.1 a

a Planting season refers to time of clover planting; seeding in the fall of 1982 or the spring of 1983.

b Means having a common letter are not significantly different at the 5% level as determined by Duncan's multiple range test.

Table 4. Dry weight of unhusked 'Jubilee' sweet corn taken on October 15, 1984 at Hyslop Farm.

	TREATMENT				
	Planting season[a]	Weed control	Clover Suppression Treatment	Clover Suppression Kg ai/ha	Yield[b] (g/plant)
1.	fall	EPTC	atrazine	0.84	452 ab
2.	fall	EPTC	atrazine	1.40	516 ab
3.	fall	EPTC	mow	----	402 ab
4.	fall	none	atrazine	0.84	584 ab
5.	fall	none	atrazine	1.40	626 a
6.	fall	none	mow	----	386 ab
7.	spring	vern	atrazine	0.84	485 ab
8.	spring	vern	atrazine	1.40	500 ab
9.	spring	vern	mow	----	372 b
10.	spring	none	atrazine	0.84	391 ab
11.	spring	none	atrazine	1.40	487 ab
12.	spring	none	mow	----	344 b
13.	check	----	----	----	578 ab

a Planting season refers to time of clover planting; seeding in the fall of 1982 or the spring of 1983.

b Means having a common letter are not significantly different at the 5% level as determined by Duncan's multiple range test

Horticulture Farm Location

Corn-planting at the Horticulture Farm location was delayed by rain for 2 weeks. The soil dried slowly under the clover canopy. Consequently, when the rotary tiller was used to prepare the strips for planting, the soil was too wet and large clods were left in the strip. Some of the corn seedlings were unable to grow through or around the clods. Germination also seemed to be slow at this location. Unsatisfactory planting conditions resulted in poor placement of the liquid fertilizer and may have been partially responsible for the slow germination. Soil often clogged the double disk openers causing fertilizer to be placed on the soil surface. Phosphorous is almost immobile in the soil and is required for good seedling growth. If injection of the fertilizer was not near the seed, the phosphorous would have been unavailable to the corn. At this location, mowing of the clover was done 18 days before planting; substantial regrowth had occurred and the herbicides were less suppressive. Shading of the seedlings by the taller clover also could have caused slow germination. A high population of slugs were present in the clover; the extent of damage they caused was not measured but extensive feeding was noticed in several of the plots.

Although clover ground cover was not measured, it appeared to be 100% for all plots at planting time. Weeds were barnyard grass [Echinochloa crus-galli (L.)

Beauv.], bittercress, common groundsel, and shepherd's purse [*Capsella bursa-pastoris* (L.) Medic.].

Under the conditions of this experiment, more severe suppression of the white clover appeared to be necessary. Corn yields in all clover-mulch plots were lower than in the conventional plots (Table 5).

Table 5. Fresh weight of unhusked 'Jubilee' sweet corn ears taken October 22, 1984 at the Horticulture Farm.

	TREATMENT				
	Planting Season[a]	Weed Control	Clover Suppression Treatment	Clover Suppression kg/ha	Yield[b] (mt/ha)
1.	spring	vernolate	atrazine	0.84	12.5 bc
2.	spring	vernolate	PP333	1.68	11.3 bc
3.	spring	vernolate	mow	----	13.7 b
4.	spring	None	atrazine	0.84	14.3 b
5.	spring	None	mow	----	12.0 bc
6.	spring	vernolate	atrazine	0.84	9.2 c
7.	spring	vernolate	mow	----	11.4 bc
8.	spring	None	atrazine	0.84	9.2 c
9.	spring	None	mow	----	14.7 b
10.	check	----	----	----	21.1 a

a Planting season refers to time of clover planting

b Means having a common letter are not significantly different at the 5% level as determined by Duncan's multiple range test.

SCREENING OF HERBICIDES FOR USE AS WHITE CLOVER SUPPRESSANTS

MATERIALS AND METHODS

A screening trial was conducted to determine the effect of selected herbicides on established white clover. This test was conducted in anticipation of the need for herbicides with different clover suppressant characteristics. Herbicides offering a selection of suppression severity and duration, time of application, weeds controlled, and cost may improve the performance of the mulch system. This trial was initiated at the Oregon State University Horticulture Farm near Corvallis, Oregon, on July 20, 1984. The white clover was planted in the spring of 1983. It was well established and provided 100% ground cover. A randomized complete block design with 23 treatments and two replications was used. Plot size was 2.4 by 6.1 m. The clover was mowed and the clippings removed 8 days prior to treatment. Herbicide applications were made with a compressed-air plot sprayer equipped with a 2.1-m boom and seven Tee Jet 8003 nozzle tips. A check plot receiving no clover suppression was included in each replication

Visual evaluations of the effect of the herbicides on white clover were taken at five dates, which are recorded as days after treatment (DAT). White clover suppression was scored by percentage injury and percentage ground cover, as compared to the check.

Ratings were on a scale of zero to 100. Zero indicated no effect and 100 indicated complete kill of the clover.

RESULTS

Different levels of white clover suppression were obtained with different herbicides and combinations of herbicides (Table 6). But these differences were often small, indicating that the least expensive herbicides may be best. 2,4-D at 2.24 kg ae/ha gave excellent initial and residual suppression of the white clover (95% at 14 DAT and 82.5% at 67 DAT). Atrazine at 1.40 kg ai/ha gave good initial suppression (70% at 14 DAT), but its ability to suppress the clover had decreased to 40% by 42 DAT. A mixture of alachlor and atrazine applied at 1.4 and 3.36 kg ai/ha respectively, provided good suppression (80% through 21 DAT). Their suppression was only slightly higher than the atrazine (1.40 kg ai/ha) treatment, but their combined effects were noticed for a longer period (67 DAT, figure 2).

Other combinations of herbicides resulted in similar levels of suppression. Atrazine (0.84 kg ai/ha) plus glyphosate (1.68 kg ai/ha) suppressed clover throughout most of the growing season. A mixture of atrazine, alachlor, and glyphosate applied at 0.84 kg ai/ha, 3.36 kg ai/ha, and 1.12 kg ae/ha respectively, was only as good as the atrazine and glyphosate combination. Atrazine and paraquat (0.84 and 0.37 kg ai/ha) together gave suppression similar to the atrazine and alachlor combination; 83% at 21 DAT but only 53% at 28 DAT (figure 3). Although the costs are high at these rates, a wider spectrum of weed control may be obtained with these mixtures of herbicides.

Dicamba (3,6-dichloro-2-methoxybenzoic acid) at 2.24 kg ae/ha completely killed the white clover in 20 DAT; this would not be acceptable for this production system. A lower rate should be tested. Glufosinate [ammonium(3-amino-3-carboxypropyl)-methylphosphinate] gave nearly 100% suppression 21 DAT at a rate of 0.74 kg ai/ha. Paraquat (1,1'-dimethyl-4,4'-bipyridinium ion), dinoseb [2-(1-methylpropyl)-4,6-dinitrophenol], and cyanazine {2[[4-chloro-6-(ethylamino)-1,3,5,-triazin-2-yl]amino]-2-methylpropanenitrile} suppressed the clover only slightly (Figure 4). At the rates used, these herbicides would not be effective at reducing the clover's competitive ability.

Table 6. Suppression of white clover by herbicide applications made September 14, 1984 at the Horticulture Farm.

	TREATMENT		DAYS AFTER TREATMENT					
	Suppression method	rate (kg/ha)	14	21	28	42	56	70
			Percent Suppression					
1.	atrazine	0.84	68	70	53	40	10	0
2.	atrazine	1.40	70	75	60	40	15	15
3.	glyphosate	1.12	75	85	80	80	80	85
4.	glyphosate	1.68	80	88	85	83	80	83
5.	glyphosate	0.56	60	78	80	73	65	45
6.	atrazine	0.84 +						
	glyphosate	1.12	88	93	78	85	85	83
7.	alachlor	3.36	10	15	5	10	0	0
8.	atrazine	0.84 +						
	alachlor	3.36	80	80	60	68	25	23
9.	atrazine	0.84 +						
	glyphosate	1.12 +						
	alachlor	3.36	88	93	83	83	83	83
10.	2,4-D	2.24	95	95	85	83	75	68
11.	2,4-D	4.48	93	93	80	78	55	43
12.	2,4-D	1.32 +						
	dicamba	0.66	93	97	100	100	100	100
13.	dicamba	2.24	95	99	100	100	100	100
14.	paraquat	0.37	48	55	25	10	0	0
15.	paraquat	0.74	60	45	23	15	0	0
16.	atrazine	0.84 +						
	paraquat	0.37	78	83	53	50	40	28
17.	glufosinate	0.37	90	85	55	60	20	13
18.	glufosinate	0.74	99	93	78	73	50	35
19.	cyanazine	0.84	48	35	25	5	0	0
20.	cyanazine	1.40	55	60	30	15	5	0
21.	dinoseb	3.36	8	0	0	0	0	0
22.	dinoseb	6.72	48	0	0	0	0	0
23.	check	----	0	0	0	0	0	0

Figure 2. Suppression effects of 2,4-D, atrazine, and a combination of atrazine and alachlor on white clover.

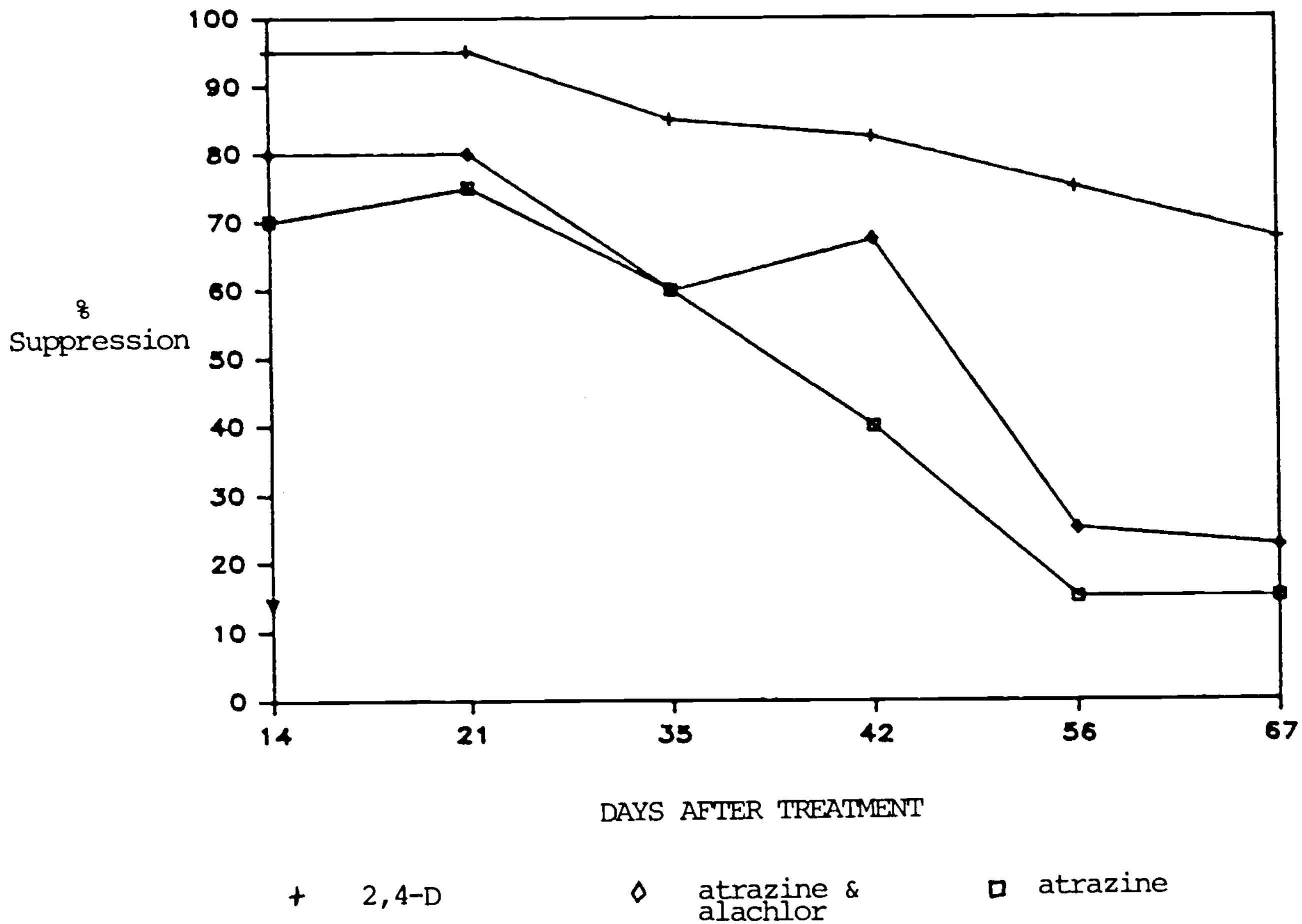


Figure 3. Suppression effects of glyphosate, paraquat, alachlor, and glyphosate and alachlor in combination with atrazine.

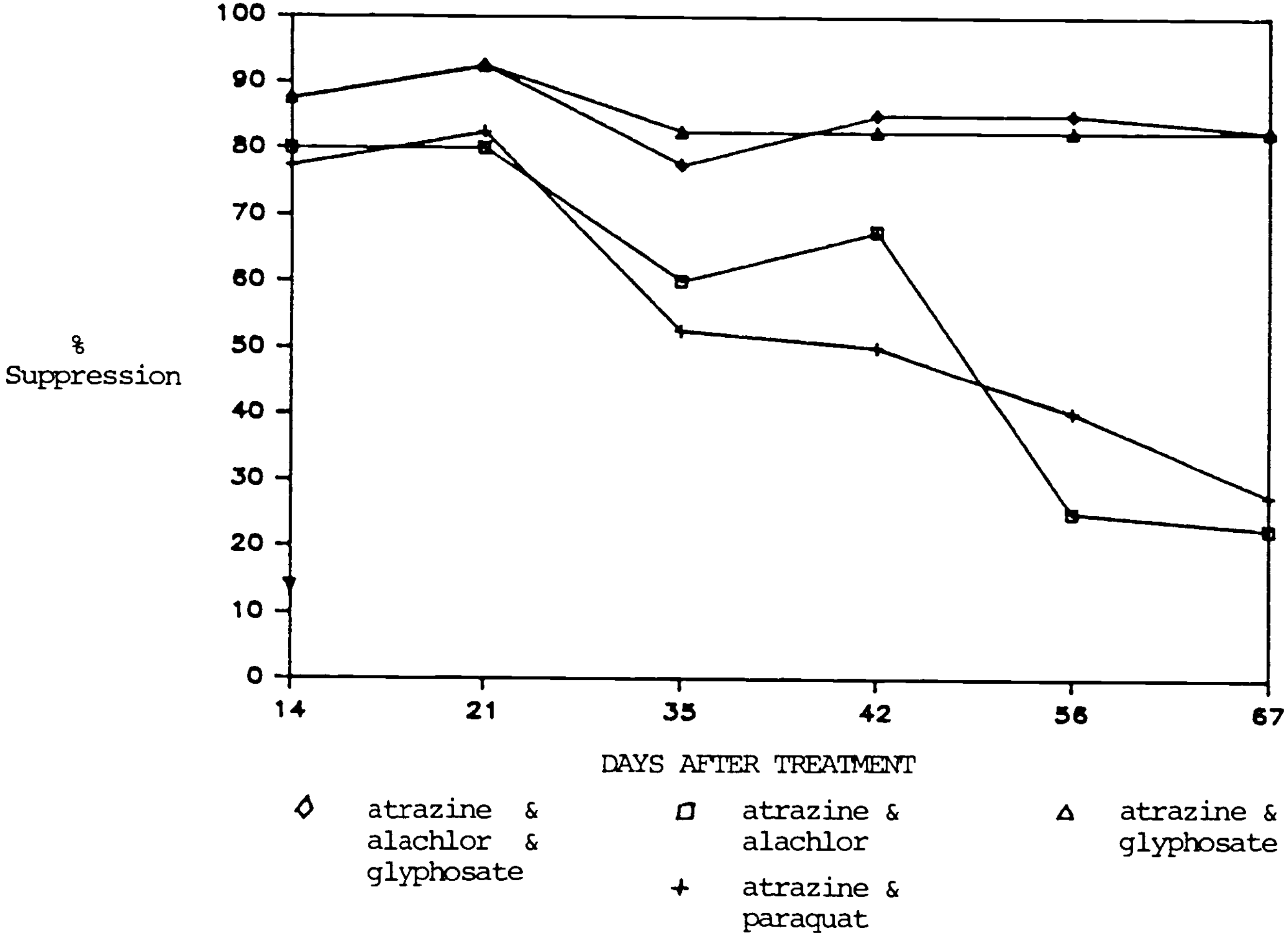
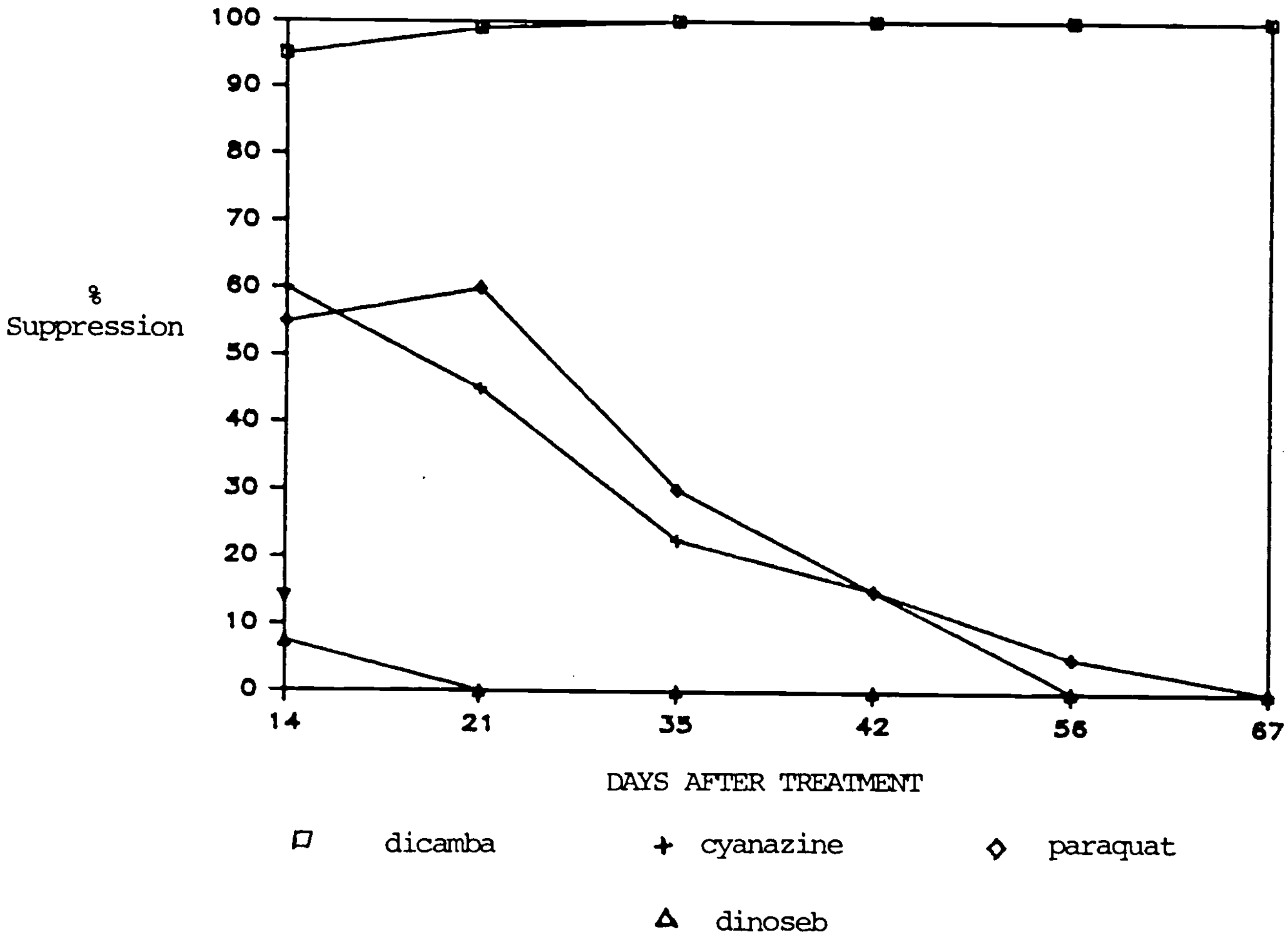


Figure 4. Suppression effects of dicamba, cyanazine, paraquat, and dinoseb on white clover



DISCUSSION

This study provides additional evidence that it is possible to grow sweet corn in a suppressed white clover living mulch. Also, this study shows that corn may be successfully grown in well-established, second-year white clover. Corn yields of treatments with a combination of fall clover planting and 1.40 kg ai/ha atrazine were the same as the yields of the conventional check at the Hyslop Farm location. Even though corn yields receiving other treatments were lower than the check, a trend was noticed; the fall-planted clover treatments were slightly higher in corn yield than the treatments with spring-planted clover. Why this occurred can only be speculated. One reason may be the differences in clover ground cover during the establishment year. Data on percent clover cover taken on April 19, 1984, showed that plots with fall-planted clover had more clover throughout the first year than plots with spring-planted clover (Table 1, p. 18). Perhaps the more dense and vigorous clover produced more nitrogen, which was subsequently available to the corn. Additionally, more weeds were present in the spring-planted clover. These weeds could have usurped more nutrients from the soil than did the dormant clover. Yield differences, however, only indicated a trend; they did not always exist between planting dates and they were not statistically different.

Several research workers suggest that we should seek a mulch species which exerts little competitive pressure on the crop to receive maximum benefit from the cover crop (Akobundo and Okigbo 1984, Volckner 1979, and Cook 1982). Competitive pressure can be reduced by either choosing a mulch species which will not compete with the crop or choose a more competitive species which can be managed by suppression. Studies on nitrogen release by Vrabel (1983) indicate that white clover releases previously fixed nitrogen in response to atrazine or other s-triazine herbicide treatments. He also noted that white clover was quick to outgrow the suppression treatments and often produced nitrogen at levels higher than unsuppressed clover. In this study, it was found that adequate suppression of the white clover, especially in a second-year clover sod, was important to maintenance of corn yield. Therefore, a mulch which is competitive, but can be managed is desirable. It should be competitive throughout the winter in order to give weed and erosion control.

Even though corn yields in the treatment with 1.40 kg ai/ha rate of atrazine and fall-planted clover was not different from the check treatment, this level of atrazine may not give enough suppression of well-established white clover. I believe that a higher rate of atrazine is needed. Other suppressants may be useful, as indicated from results of the herbicide screening trial. Atrazine (0.84 kg ai/ha) plus alachlor (3.34 kg ai/ha) gave similar results to atrazine alone at 1.40 kg ai/ha. This combination of herbicides is a standard treatment for corn production in many areas. It controls a wide range of both grasses and broadleaf weeds. This treatment would become important in controlling weeds if severe suppression treatments are required. 2,4-D also shows promise. It is inexpensive and is registered for use on sweet corn. Dicamba, at lower rates, may have potential, but is registered for use only on field corn.

In the research conducted in 1984, equipment was developed which could drill corn seed into strips rototilled through clover. Fertilizer also could be applied during this operation. Further development of equipment should seek to combine the herbicide suppression treatment and weed control band into one operation. This will minimize the number of machinery trips over the field. Preventing soil compaction by heavy machinery is especially important in soils which are plowed yearly (Vomocil 1982).

Methods to determine nitrogen release from the living mulch should be sought. Bioassays using corn to measure nitrogen content were used by Vrabel (1983). He noted that this method is limited to periods when corn may be grown. Laboratory analysis of nitrogen content in the soil is unpredictable. Nitrogen measurements are complicated by the rate of organic matter decomposition.

Environmental conditions, such as moisture and temperature, greatly influence these rates. Hence, seasonal or weekly variations in nitrogen might be great.

Spacing of the rows, number of plants within the rows, and width of the strip-tilled rows are other areas of concern. Optimum planting densities for conventionally grown corn has been thoroughly studied. But when one considers the extensive root system of a living mulch which has grown unchecked for several months, it becomes necessary to decrease the potential of the living mulch to compete with the corn. In this experiment, movement of clover stolons into the corn rows did not occur. The atrazine and alachlor combination banded at planting was largely responsible for this. Additional options must be identified.

Multidisciplinary research is needed to study the microbiology, biochemistry, chemistry, and physics of the plant-soil relationships. Specialists from other disciplines, namely entomology, fisheries, wildlife, plant pathology, and soil science are needed to fully explore the feasibility of this system. This is a relatively complicated system. All options and problems must be considered before widespread use is promoted.

LITERATURE CITED

Akobundu, I. O. 1980. Live mulch: a new approach to weed control and crop production in the tropics. Proc. 1980 British Crop Prot. Conf.-Weeds. 2:377-382.

Akobundu, I. O. and B. N. Okigbo. 1984. Preliminary evaluation of ground covers for use as a live mulch in maize production. Field Crops Res. 8:177-186.

Batchelder, A. R., and J. N. Jones, Jr. 1972. Soil management factors and growth of Zea mays on topsoil and exposed subsoil. Agron. J. 64:648-652.

Blaser, R. E., T. Taylor, W. Griffith, and W. Skrdla. 1965. Seedling competition in establishing forage plants. Agron. J. 48:1-6.

Blevins, R. L. 1980. Use of annual legumes as winter cover for no-till corn. Dep. of Agronomy, Univ. of Kentucky, Lexington. Soil Sci. News Views. Vol 1. 2pp.

Brady, N. C. 1974. The nature and properties of soils. 8th. Page 234. Macmillan Pub. Co., Inc., New York.

Butler, G. W., R. M. Greenwood, and K. Soper. 1959. Effects of shading and defoliation on the turnover of root and nodule tissue of plants of Trifolium repens, Trifolium pratense, and Lotus uliginosus. N. Z. J. Agric. Res. 2:415-426.

Campbell C. A., D. W. Stewart, W. Nicholaichuk, and V. O. Biederbeck. 1974. Effects of growing season soil temperature, moisture, and NH4-N on soil nitrogen. Can. J. of Soil Sci. 54:403-412.

Cook, T. 1982. The potential of turfgrasses as living mulches in cropping systems. Page 23 in Workshop Proc. Crop Production Using Cover and Sods as Living Mulches. Oregon State Univ. IPPC Doc.

Cooper, A. S. 1985. Sweet corn (Zea mays) production in a white clover (Trifolium repens) living mulch: the establishment year. MS Thesis, Oregon State Univ. Corvallis, Oregon. 58 pp.

Hargrove, W. L. (ed.) 1982 Proceedings of the minisymposium on legume cover crops for conservation tillage production systems. Univ. of Georgia College of Agriculture. Spec. Publ. 19. 21 pp.

Hartwig, N. L. 1977. Nutsedge control in no-tillage corn with and without a crownvetch cover crop. Proc. Northeast Weed Sci. Soc. 31:20-23.

Hartwig, N. L. 1984. Crownvetch - a perennial legume "living mulch" for no-tillage crop production. Dept. of Crop Sci., Penn. State Univ.

Hayes, W. A., and L. W. Kimberlin. 1978. A guide for determining crop residue for water erosion. Page 35 in Crop Residue Management Systems (W. R. Oschwald, ed.), pp 35-48. Am. Soc. Agron. Spec. Pub. 31.

Jenny, H. 1933. Soil fertility losses under Missouri conditions. Agr. Expt. Sta. Bull. 324. 10 p.

Kurtz, T., S. W. Melsted, and R. H. Bray. 1952. The importance of nitrogen and water in reducing competition between intercrops and corn. Agron. J. 44:13-17.

Mooers, C. A. 1927. Influence of cowpea crop on yield of corn: 1. Experiments in a cowpea-corn rotation, 2. Effects of cowpeas and soybeans planted with corn. Tennessee Ag. Expt. Station Bul. No. 137.

Moschler, W. W., G. M. Shear, D. L. Hallock, R. D. Sears, and G. D. Jones. 1967. Winter cover crops for sod-planted corn: their selection and management. Agron. J. 59:547-551.

Mt. Pleasant, Jane. 1982. Corn polyculture systems in New York. MS Thesis, Cornell University, Ithaca, N. Y. 258 pp.

Nicholson, A. G. 1982. Screening of turfgrasses and legumes for use as living mulches in vegetable production. March 1982, 4 pp.

Pendleton, J. W., J. A. Jackobs, F. W. Slife, and H. P. Bateman. 1956. Establishing legumes in corn. Agron. J. 49:44-48.

Peterson, A. E. 1955. Establishing alfalfa in wide row corn. Plant Food Rev. 1:16-17, 30-31.

Phillips, S. H., and H. M. Young, Jr. 1973. No-tillage Farming. Reiman, Milwaukee, Wisconsin. 224 pp.

Phillips, R. E., and S. H. Phillips. 1984. No-tillage agriculture principles and practices. Van Norstrand Reinhold Co., 1984. 306 pp.

Pieters, A. J. and R. McKee. 1938. The use of cover and green manure crops. Soils and Man. USDA Yearb. Agric. pp. 431-444.

Simpson, J. R. 1965. The transference of nitrogen from pasture legumes to and associated grass under several systems of management in pot culture. Aust. J. Agric. Res. 16:915-926.

Smith, F. B., P. E. Brown, and J. A. Russell. 1937. The effects of organic matter on the infiltration capacity of Clarion loam. J. Soil and Water Conserv. 29:521-525.

Stewart, B. A., D. A. Woolhiser, W. H. Wischmeier, J. H. Caro, and M. H. Frere. 1975. Control of water pollution from cropland, Vol I: A manual for guideline development. USDA rep ARS-H-5-1. U.S. Govt. Printing Office, Washington, D.C.

Sumner, D. R., B. Doupnik, Jr., and M. G. Boosalis. 1981. Effects of reduced tillage and multiple cropping on plant diseases. Ann. Rev. Phytopath. 19:167-87.

Sweet, R. D. 1982. Observations on the uses and effects of cover crops in agriculture. Page 7 in Workshop Proc. Crop Production Using Cover and Sods as Living Mulches. Oregon State Univ. IPPC Doc. 45-A-82.

Taylor, R. E., O. E. Hays, and R. M. Dixon. 1964. Corn stover mulch for control of runoff and erosion on land planted to corn after corn. Soil Sci. Soc. Am. Proc. 28:123-125.

Touchton, J. T. 1980. Soil fertility management for grain sorghum production. Page 1 in R. R. Duncan (ed.) Proc. Sorghum Short Course. Univ. of Georgia Spec. Pub. 6.

Unger, P. W., and T. M. McCalla. Conservation tillage systems. Adv. in Agronomy. Vol. 33. 58 pp.

Vomocil, J. A. 1982. Wind Erosion (discussion). Page 85 *in* Workshop Proc. Crop Production Using Cover and Sods as Living Mulches. Oregon State Univ. IPPC Doc. 45-A-82.

Vrabel, T. E. 1983. Effect of suppressed white clover (*T. repens* L.) on sweet corn (*Z. mays* L.) yield and nitrogen availability in a living mulch cropping system. Ph.D. Thesis, Cornell Univ., Ithaca, N. Y. 1983. 162 pp.

Wilson, H. R. 1981. Insects in living mulches. Modified Tillage Reporting Conf. Cornell Univ. Ithaca, New York.

Wilson, H. R., P. R. Kelly, and A. G. Nicholson. 1981. Observations of insect activity in living mulch systems. Paper Presented at 43rd Ann. N.Y. State Pest Cont. Conf.

Wischmeier, W. H. 1973. Conservation tillage to control wind eroson. Page 132 *in* Conservation tillage: the proceedings of a National Conference. Soil Conserv. Soc. Am., Ankeny, Iowa.

Wischmeier, W. H., and D. D. Smith. 1978. Predicting rainfall erosion losses. USDA, Agr. Handb. 537. U.S. Govt. Printing Office, Washington, D.C.

APPENDICES

Appendix Table 1. Clover planting season, weed control, and suppression methods for the establishment year combined with second-year treatments at Hyslop Farm.

	TREATMENTS				
	Establishment Year			Second Year	
	Planting Season[a]	Weed Control	Clover Suppression	Clover Suppression	Rate kg/ha
1.	fall	EPTC	atrazine	atrazine	0.84
2.	fall	EPTC	mow	atrazine	1.40
3.	fall	EPTC	PP333	mow	----
4.	fall	None	atrazine	atrazine	0.84
5.	fall	None	mow	atrazine	1.40
6.	fall	None	PP333	mow	----
7.	spring	vernolate	atrazine	atrazine	0.84
8.	spring	vernolate	mow	atrazine	1.40
9.	spring	vernolate	PP333	mow	----
10.	spring	None	atrazine	atrazine	0.84
11.	spring	None	mow	atrazine	1.40
12.	spring	None	PP333	mow	----
13.	check	----	----	----	----

a Planting season refers to time of clover planting; seeding in the fall of 1982 or the spring of 1983.

Appendix Table 2. Clover planting season, weed control, and suppression methods for the establishment combined with second-year treatments at the Horticulture Farm.

	TREATMENTS				
	Establishment Year			Second Year	
	Planting Season[a]	Weed Control	Clover Suppression	Clover Suppression	Rate kg/ha
1.	Spring	vernolate	atrazine	atrazine	0.84
2.	spring	vernolate	PP333	glyphosate	1.68
3.	spring	vernolate	mow	mow	----
4.	spring	None	atrazine	atrazine	0.84
5.	spring	None	mow	mow	----
6.	spring	vernolate	atrazine	atrazine	0.84
7.	spring	vernolate	mow	mow	----
8.	spring	None	atrazine	atrazine	0.84
9.	spring	None	mow	mow	----
10.	check	----	----	----	----

a Planting season refers to time of clover planting; seeding in the fall of 1982 or the spring of 1983.

Appendix Table 3. Fresh weight of unhusked Jubilee' sweet corn ears taken on October 15, 1984 at Hyslop Farm.

	TREATMENT			Yield mt/ha					
	Planting Season[a]	Weed Control	Supp. Method[b]	R1	R2	R3	R4	Mean[c]	
1.	fall	EPTC	at,lo	14.5	15.9	14.3	18.5	15.8	cde
2.	fall	EPTC	at,hi	17.0	17.0	17.0	26.5	19.4	abc
3.	fall	EPTC	mow	14.2	19.0	15.1	12.7	15.3	cde
4.	fall	none	at,lo	12.5	17.3	17.2	13.6	15.2	cde
5.	fall	none	at,hi	17.4	24.0	22.6	18.7	20.7	ab
6.	fall	none	mow	16.0	20.4	18.0	10.9	16.5	cde
7.	spring	vernolate	at,lo	15.0	20.0	13.5	13.9	15.6	cde
8.	spring	vernolate	at,hi	17.5	10.5	18.7	13.3	17.0	bcd
9.	spring	vernolate	mow	14.3	14.2	14.3	11.7	13.6	de
10.	spring	none	at,lo	11.7	13.4	12.0	12.8	12.5	e
11.	spring	none	at,hi	19.2	20.2	13.9	16.5	17.5	bcd
12.	spring	none	mow	13.3	13.3	14.8	12.2	13.4	de
13.	check	----	----	25.0	24.2	21.0	18.0	22.1	a

a Planting season refers to time of clover planting; seeding in the fall of 1982 or the spring of 1983.

b At,lo = atrazine at 0.84 kg ai/ha. At,hi = atrazine at 1.40 kg ai/ha.

c Means having a common letter are not significantly different at the 5% level as determined by Duncan's multiple range test.

Appendix Table 4. Average height of sweet corn plants, as affected by treatments, at Hyslop Farm on October 15, 1984.

	TREATMENTS			Plant height (cm)				
	Planting Season[a]	Weed Control	Supp. Method[b]	R1	R2	R3	R4	Mean[c]
1.	fall	EPTC	at,lo	175	185	150	183	173 bcd
2.	fall	EPTC	at,hi	178	196	173	168	178 bc
3.	fall	EPTC	mow	165	178	160	173	169 cde
4.	fall	none	at,lo	178	191	185	165	180 bc
5.	fall	none	at,hi	180	198	198	178	189 ab
6.	fall	none	mow	168	178	193	163	175 bcd
7.	spring	vernolate	at,lo	165	188	165	183	175 bcd
8.	spring	vernolate	at,hi	178	175	191	168	178 bc
9.	spring	vernolate	mow	157	165	155	142	155 e
10.	spring	none	at,lo	168	160	155	170	163 cde
11.	spring	none	at,hi	170	188	160	183	175 bcd
12.	spring	none	mow	163	160	152	168	161 de
13.	check	----	----	203	201	211	188	201 a

a Planting season refers to time of clover planting; seeding in the fall of 1982 or the spring of 1983.

b At,lo = atrazine at 0.84 kg ai/ha. At,hi = atrazine at 1.40 kg ai/ha.

c Means having a common letter are not significantly different at the 5% level as determined by Duncan's multiple range test.

Appendix Table 5. Average height of sweet corn plants taken at Hyslop Farm on September 20, 1984.

	TREATMENTS			Plant height (cm)				
	Planting Season[a]	Weed Control	Supp. Method[b]	R1	R2	R3	R4	Mean[c]
1.	fall	EPTC	at,lo	165	178	157	180	170 abc
2.	fall	EPTC	at,hi	178	191	178	183	182 abc
3.	fall	EPTC	mow	160	170	160	173	166 bc
4.	fall	none	at,lo	165	191	178	175	177 abc
5.	fall	none	at,hi	188	203	206	180	194 ab
6.	fall	none	mow	173	175	191	157	174 abc
7.	spring	vernolate	at,lo	170	145	163	178	164 bc
8.	spring	vernolate	at,hi	175	173	168	170	172 bc
9.	spring	vernolate	mow	157	163	157	170	162 c
10.	spring	none	at,lo	157	165	152	175	163 bc
11.	spring	none	at,hi	168	183	170	180	175 abc
12.	spring	none	mow	155	163	170	165	163 bc
13.	check	----	----	203	203	211	198	204 a

a Planting season refers to time of clover planting; seeding in the fall of 1982 or the spring of 1983.

b At,lo = atrazine at 0.84 kg ai/ha. At,hi = atrazine at 1.40 kg ai/ha.

c Means having a common letter are not significantly different at the 5% level as determined by Duncan's multiple range test.

Appendix Table 6. Average height of sweet corn plants on September 5, 1984 at Hyslop Farm.

	TREATMENT			Plant height (cm)				
	Planting Season[a]	Weed Control	Supp. method[b]	R1	R2	R3	R4	Mean[c]
1.	fall	EPTC	at,lo	165	175	142	183	166 bc
2.	fall	EPTC	at,hi	175	185	165	175	175 b
3.	fall	EPTC	mow	147	163	145	173	157 c
4.	fall	none	at,lo	165	183	178	178	176 b
5.	fall	none	at,hi	183	203	206	183	194 a
6.	fall	none	mow	155	173	178	160	166 bc
7.	spring	vernolate	at,lo	157	155	163	191	166 bc
8.	spring	vernolate	at,hi	170	155	183	165	168 bc
9.	spring	vernolate	mow	150	157	155	155	154 c
10.	spring	none	at,lo	163	155	152	170	160 bc
11.	spring	none	at,hi	160	183	157	175	169 bc
12.	spring	none	mow	152	155	165	168	160 bc
13.	check	----	----	203	201	213	203	205 a

a Planting season refers to time of clover planting; seeding in the fall of 1982 or the spring of 1983.

b At,lo = atrazine at 0.84 kg ai/ha. At,hi = atrazine at 1.40 kg ai/ha.

c Means having a common letter are not significantly different at the 5% level as determined by Duncan's multiple range test.

Appendix Table 7. Average height of sweet corn plants on August 25, 1984 at Hyslop Farm.

	TREATMENT			Plant height (cm)					
	Planting Season[a]	Weed Control	Supp. method[b]	R1	R2	R3	R4	Mean[c]	
1.	fall	EPTC	at,lo	132	155	124	147	140	cd
2.	fall	EPTC	at,hi	145	165	122	147	145	bcd
3.	fall	EPTC	mow	124	140	109	122	124	de
4.	fall	none	at,lo	147	155	150	140	148	bc
5.	fall	none	at,hi	157	178	173	137	161	b
6.	fall	none	mow	130	127	142	112	128	cde
7.	spring	vernolate	at,lo	142	130	145	170	147	bc
8.	spring	vernolate	at,hi	142	122	130	152	137	cd
9.	spring	vernolate	mow	114	114	112	109	112	e
10.	spring	none	at,lo	145	124	119	117	126	cde
11.	spring	none	at,hi	140	147	127	152	142	bcd
12.	spring	none	mow	104	91	119	119	109	e
13.	check	----	----	185	185	191	188	187	a

a Planting season refers to time of clover planting; seeding in the fall of 1982 or the spring of 1983.

b At,lo = atrazine at 0.84 kg ai/ha. At,hi = atrazine at 1.40 kg ai/ha.

c Means having a common letter are not significantly different at the 5% level as determined by Duncan's multiple range test.

Appendix Table 8. Average height of sweet corn plants at Hyslop Farm on August 9, 1984.

	TREATMENT			Plant height (cm)				
	Planting[a] Season	Weed Control	Supp.[b] method	R1	R2	R3	R4	Mean[c]
1.	fall	EPTC	at,lo	69	53	43	53	55 bc
2.	fall	EPTC	at,hi	61	53	48	56	55 bc
3.	fall	EPTC	mow	51	61	48	51	53 bcd
4.	fall	none	at,lo	64	64	51	51	57 bc
5.	fall	none	at,hi	66	71	64	51	63 b
6.	fall	none	mow	58	61	64	46	57 bc
7.	spring	vernolate	at,lo	51	41	58	56	51 cd
8.	spring	vernolate	at,hi	56	46	51	56	52 bcd
9.	spring	vernolate	mow	41	51	36	48	44 d
10.	spring	none	at,lo	56	46	51	51	51 cd
11.	spring	none	at,hi	53	58	46	53	53 bcd
12.	spring	none	mow	46	46	46	51	47 cd
13.	check	----	----	79	76	84	76	79 a

a Planting season refers to time of clover planting; seeding in the fall of 1982 or the spring of 1983.

b At,lo = atrazine at 0.84 kg ai/ha. At,hi = atrazine at 1.40 kg ai/ha.

c Means having a common letter are not significantly different at the 5% level as determined by Duncan's multiple range test.

Appendix Table 9. Dry weight of corn ears at harvest at Hyslop Farm.

	TREATMENT			g / five plants				
	Planting Season[a]	Weed Control	Supp. method[b]	R1	R2	R3	R4	Mean[c]
1.	fall	EPTC	at,lo	498	535	176	599	452 ab
2.	fall	EPTC	at,hi	440	562	331	730	516 ab
3.	fall	EPTC	mow	376	394	403	435	403 ab
4.	fall	none	at,lo	521	703	771	340	584 ab
5.	fall	none	at,hi	576	626	685	617	626 a
6.	fall	none	mow	376	344	513	308	385 ab
7.	spring	vernolate	at,lo	467	535	413	526	485 ab
8.	spring	vernolate	at,hi	621	471	635	272	500 ab
9.	spring	vernolate	mow	226	621	327	313	372 b
10.	spring	none	at,lo	362	317	200	685	391 ab
11.	spring	none	at,hi	371	562	485	526	486 ab
12.	spring	none	mow	322	276	531	245	344 b
13	check	----	----	557	417	721	617	578 ab

a Planting season refers to time of clover planting; seeding in the fall of 1982 or the spring of 1983.

b At,lo = atrazine at 0.84 kg ai/ha. At,hi = atrazine at 1.40 kg ai/ha.

c Means having a common letter are not significantly different at the 5% level as determined by Duncan's multiple range test.

Appendix Table 10. Dry weight of corn leaves at harvest at Hyslop Farm.

	TREATMENT			g / five plants				
	Planting[a] Season	Weed Control	Supp.[b] method	R1	R2	R3	R4	Mean[c]
1.	fall	EPTC	at,lo	209	181	100	168	164 ab
2.	fall	EPTC	at,hi	209	186	123	290	202 ab
3.	fall	EPTC	mow	200	113	177	136	157 ab
4.	fall	none	at,lo	286	231	308	86	228 ab
5.	fall	none	at,hi	377	222	281	304	296 ab
6.	fall	none	mow	136	163	245	95	160 ab
7.	spring	vernolate	at,lo	168	186	204	218	194 ab
8.	spring	vernolate	at,hi	209	195	204	95	176 ab
9.	spring	vernolate	mow	91	240	123	95	137 b
10.	spring	none	at,lo	154	145	104	195	150 ab
11.	spring	none	at,hi	159	336	159	313	242 ab
12.	spring	none	mow	113	113	154	82	116 b
13.	check	----	----	367	200	395	132	273 a

a Planting season refers to time of clover planting; seeding in the fall of 1982 or the spring of 1983.

b At,lo = atrazine at 0.84 kg ai/ha. At,hi = atrazine at 1.40 kg ai/ha.

c Means having a common letter are not significantly different at the 5% level as determined by Duncan's multiple range test.

Appendix Table 11. Percentage of the soil surface covered by white clover at Hyslop Farm on April 19, 1984.

	TREATMENT			Percent Cover					
	Planting Season[a]	Weed Control	Supp. method[b]	R1	R2	R3	R4	Mean	Arcsin[c]
1.	fall	EPTC	at,lo	70	90	20	35	54	51 abcdef
2.	fall	EPTC	at,hi	75	95	65	85	80	65 ab
3.	fall	EPTC	mow	80	95	35	70	70	61 abcd
4.	fall	none	at,lo	40	65	80	50	59	51 abcdef
5.	fall	none	at,hi	75	80	90	60	76	62 abc
6.	fall	none	mow	80	65	95	90	83	67 a
7.	spring	vernolate	at,lo	0	0	5	0	1	4 g
8.	spring	vernolate	at,hi	50	50	45	5	38	37 ef
9.	spring	vernolate	mow	40	45	30	80	49	45 cdef
10.	spring	none	at,lo	5	0	5	20	8	4 g
11.	spring	none	at,hi	40	55	45	40	45	42 ef
12.	spring	none	mow	50	40	65	60	45	47 bcdef
13.	check	----	----	--	--	--	--	--	----

a Planting season refers to time of clover planting; seeding in the fall of 1982 or the spring of 1983.

b At,lo = atrazine at 0.84 kg ai/ha. At,hi = atrazine at 1.40 kg ai/ha.

c Values of arcsin means having a common letter are not significantly different at the 5% level as determined by Duncan's multiple range test.

Appendix Table 12. Percentage of the soil surface covered by weeds at Hyslop Farm on April 19, 1984.

	TREATMENT			Percent Cover					
	Planting Season[a]	Weed Control	Supp. method[b]	R1	R2	R3	R4	Mean	Arcsin[c]
1.	fall	EPTC	at,lo	20	14	30	25	22	28 bc
2.	fall	EPTC	at,hi	10	0	0	5	4	9 d
3.	fall	EPTC	mow	5	20	35	15	19	28 bc
4.	fall	none	at,lo	13	15	10	15	13	22 c
5.	fall	none	at,hi	0	5	5	0	3	7 d
6.	fall	none	mow	5	25	15	20	16	23 c
7.	spring	vernolate	at,lo	45	45	30	45	41	40 ab
8.	spring	vernolate	at,hi	10	15	10	5	10	19 cd
9.	spring	vernolate	mow	45	65	40	45	49	45 a
10.	spring	none	at,lo	60	30	25	40	39	39 ab
11.	spring	none	at,hi	15	30	10	30	21	27 bc
12.	spring	none	mow	45	35	20	45	36	40 ab
13.	check	----	----	--	--	--	--	--	----

a Planting season refers to time of clover planting; seeding in the fall of 1982 or the spring of 1983.

b At,lo = atrazine at 0.84 kg ai/ha. At,hi = atrazine at 1.40 kg ai/ha.

c Values of arcsin means having a common letter are not significantly different at the 5% level as determined by Duncan's multiple range test.

Appendix Table 13. Fresh weight of unhusked Jubilee' sweet corn ears taken October 22, 1984 at the Horticulture Farm.

Treatment		mt/ha				
		R1	R2	R3	R4	Mean[a]
1.	atrazine	11.0	11.0	15.2	12.7	12.5 bc
2.	mow	8.3	10.0	11.0	15.8	11.3 bc
3.	atrazine	11.7	13.9	13.9	15.1	13.7 b
4.	mow	16.1	14.2	14.2	12.5	14.3 b
5.	atrazine	10.9	9.2	12.6	15.1	12.0 bc
6.	mow	9.5	10.7	9.1	7.5	9.2 c
7.	atrazine	10.0	11.8	13.2	10.5	11.4 bc
8.	mow	12.7	5.4	7.8	11.0	9.2 c
9.	glyphosate	16.0	13.5	13.7	15.6	14.7 b
10.	check	24.0	22.8	18.5	18.9	21.1 a

Appendix Table 14. Average height of sweet corn plants taken at the Horticulture Farm on October 22, 1984.

TREATMENT		cm				
		R1	R2	R3	R4	Mean[a]
1.	atrazine	193	203	203	188	197 bcd
2.	mow	180	180	178	211	187 bcd
3.	atrazine	203	198	206	208	204 b
4.	mow	211	196	178	180	191 bcd
5.	atrazine	178	178	201	198	189 bcd
6.	mow	173	185	203	168	182 cd
7.	atrazine	191	180	196	170	184 bcd
8.	mow	188	160	173	188	177 d
9.	glyphosate	213	188	183	211	199 bc
10.	check	262	257	246	257	255 a

a Means having a common letter are not significnatly different at the 5% level as determined by Duncan's multiple range test.

Appendix Table 15. Average height of sweet corn plants at the Horticulture Farm on September 20, 1984.

TREATMENT		cm				
		R1	R2	R3	R4	Mean[a]
1.	atrazine	191	201	206	188	196 b
2.	mow	170	178	175	208	183 bc
3.	atrazine	191	191	203	208	198 b
4.	mow	203	193	178	183	189 bc
5.	atrazine	170	168	201	201	185 bc
6.	mow	170	183	173	163	172 bc
7.	atrazine	191	178	196	168	183 bc
8.	mow	183	163	168	180	173 bc
9.	glyphosate	213	188	178	203	196 b
10.	check	262	246	244	257	252 a

Appendix Table 16. Average height of sweet corn plants at the Horticulture Farm on September 7, 1984.

TREATMENT		cm				
		R1	R2	R3	R4	Mean[a]
1.	atrazine	165	180	193	160	175 bc
2.	mow	122	122	142	165	138 de
3.	atrazine	180	185	183	196	186 b
4.	mow	198	180	130	132	160 bcd
5.	atrazine	150	127	170	178	156 bcd
6.	mow	124	109	122	94	112 e
7.	atrazine	152	145	160	122	145 cde
8.	mow	150	104	89	160	126 e
9.	glyphosate	198	170	168	188	181 bc
10.	check	257	234	229	241	240 a

a Means having a common letter are not significnatly different at the 5% level as determined by Duncan's multiple range test.

Appendix Table 17. Average height of sweet corn plants at the Horticulture Farm on August 27, 1984.

TREATMENT		cm				
		R1	R2	R3	R4	Mean[a]
1.	atrazine	122	114	150	107	123 bcd
2.	mow	79	74	84	119	89 ef
3.	atrazine	137	124	152	142	139 b
4.	mow	160	127	84	81	113 bcde
5.	atrazine	91	89	104	117	100 def
6.	mow	74	81	84	74	78 f
7.	atrazine	119	104	97	112	108 cde
8.	mow	84	56	61	112	78 f
9.	glyphosate	147	122	130	140	135 bc
10.	check	206	198	191	201	199 a

Appendix Table 18. Average height of sweet corn plants at the Horticulture Farm on August 10, 1984.

TREATMENT		cm				
		R1	R2	R3	R4	Mean[a]
1.	atrazine	53	51	64	51	55 bcd
2.	mow	36	48	48	56	47 cd
3.	atrazine	61	56	53	53	56 bc
4.	mow	66	51	41	48	51 bcd
5.	atrazine	48	51	51	56	51 bcd
6.	mow	46	46	46	41	44 d
7.	atrazine	51	51	51	46	50 bcd
8.	mow	53	48	41	46	47 cd
9.	glyphosate	71	53	53	56	58 b
10.	check	86	74	71	61	73 a

a Means having a common letter are not significnatly different at the 5% level as determined by Duncan's multiple range test.

Appendix Table 19. Dry weight of sweet corn ears taken at the Horticulture Farm at harvest.

TREATMENT		g /five plants				
		R1	R2	R3	R4	Mean[a]
1.	atrazine	190	272	553	268	321 abc
2.	mow	204	236	227	286	238 bc
3.	atrazine	685	281	354	381	425 ab
4.	mow	358	326	218	272	294 abc
5.	atrazine	227	191	304	440	290 abc
6.	mow	136	263	222	156	194 c
7.	atrazine	159	290	422	227	274 abc
8.	mow	250	107	168	272	198 c
9.	glyphosate	485	318	299	277	345 abc
10.	check	445	222	617	576	465 a

Appendix Table 20. Dry weight of sweet corn leaves taken at the Horticulture Farm at harvest.

TREATMENT		g /five plants				
		R1	R2	R3	R4	Mean[a]
1.	atrazine	77	77	118	95	92 bc
2.	mow	82	82	45	68	69 c
3.	atrazine	136	95	86	100	104 ab
4.	mow	104	104	77	77	91 bc
5.	atrazine	91	77	109	86	91 bc
6.	mow	86	95	82	77	85 bc
7.	atrazine	82	100	113	82	94 bc
8.	mow	86	59	73	113	83 bc
9.	glyphosate	109	136	123	136	126 a
10.	check	136	118	141	100	124 a

a Means having a common letter are not significnatly different at the 5% level.as determined by Duncan's multiple range test.

Appendix Table 21. List of weed species present at Hyslop Farm on April 19, 1985 .

Species	Common Name
Broadleaves	
Cardamine oligosperma Nutt.	bittercress
Draba verna L.	spring whitlowgrass
Senecio vulgaris L.	common groundsel
Stellaria media (L.) Vill.	common chickweed
Grasses	
Poa annua L.	annual bluegrass

Weed species present on April 19, 1985 at the Horticulture Farm.

Species	Common Name
Broadleaves	
Capsella bursa-pastoris (L.) Medic	shepherdspurse
Senicio vulgaris L.	common groundsel
Stellaria media (L.) Vill.	common chickweed
Grasses	
Echinochloa crus-galli (L.) Beauv.	barnyard grass

Appendix Table 22. Analysis of Variance for fresh weight of unhusked Jubilee' sweet corn ears taken on October 15, 1984 at Hyslop Farm.

Source	SS	DF	MS	F[a]
treatment	385	12	32	4.7**
replication	61	3	21	
error	247	36	7	
total	694	51		

Duncan's LSD = 10

Appendix Table 23. Analysis of Variance for average height of sweet corn plants, as affected by treatments, at Hyslop Farm on October 15, 1984.

Source	SS	DF	MS	F
treatment	1037	12	86	5.24**
replication	132	3	44	
error	594	51	16	
total	1762			

Duncan's LSD = 15

Appendix Table 24. Analysis of Variance for average height of sweet corn plants taken at Hyslop Farm on September 20, 1984.

Source	SS	DF	MS	F
treatment	1933	12	161	2.42*
replication	217	3	72	
error	2401	36	67	
total	4550	51		

Duncan's LSD = 30

a * and ** indicate significance at the 5% and 1% levels respectively.

Appendix Table 25. Analysis of Variance for average height of sweet corn plants on September 5, 1984 at Hyslop Farm.

Source	SS	DF	MS	F[a]
treatment	1558	12	130	7.5**
replication	115	3	38	
error	627	36	17	
total	2301	51		

Duncan's LSD = 15

Appendix Table 26. Analysis of Variance for average height of sweet corn plants on August 25, 1984 at Hyslop Farm.

Source	SS	DF	MS	F
treatment	3205	12	267	10.0**
replication	32	3	11	
error	964	36	27	
total	4202	51		

Duncan's LSD = 19

Appendix Table 27. Analysis of Variance for average height of sweet corn plants at Hyslop Farm on August 9, 1984.

Source	SS	DF	MS	F
treatment	541	12	45	7.0**
replication	27	3	9	
error	232	36	7	
total	801	51		

Duncan's LSD = 9

a * and ** indicate significance at the 5% and 1% levels respectively.

Appendix Table 28. Analysis of Variance for dry weight of corn ears at harvest at Hyslop Farm.

Source	SS	DF	MS	F[a]
treatment	1.87	12	0.16	1.54
replication	0.09	3	0.03	
error	3.38	36	0.10	
total	5.62	51		

Duncan's LSD = 209

Appendix Table 29. Analysis of Variance for dry weight of corn leaves at harvest at Hyslop Farm.

Source	SS	DF	MS	F
treatment	0.57	12	0.05	1.94
replication	0.08	3	0.03	
error	0.88	36	0.02	
total	1.53	51		

Duncan's LSD = 100

Appendix Table 30. Analysis of Variance for Hyslop location dry weight of corn stems taken at harvest.

Source	SS	DF	MS	F
treatment	0.68	12	0.06	2.36
replication	0.05	3	0.02	
error	0.87	12	0.02	
total	1.60	51		

Duncan's LSD = 100

a * and ** indicate significance at the 5% and 1% levels respectively.

Appendix Table 31. Analysis of Variance for the percentage of white clover covering tne soil surface at Hyslop Farm on April 19, 1984.

Source	SS	DF	MS	F[a]
treatment	16836	11	1531	11.27**
replication	114	3	38	
error	4480	33	135	
total	21429	47		

Duncan's LSD = 17

Appendix Table 32. Analysis of Variance for percentage of weeds covering soil surface at Hyslop Farm on April 19, 1984.

Source	SS	DF	MS	F
treatment	6550	11	595	9.27**
replication	96	3	32	
error	2119	33	64	
total	8765	47		

Duncan's LSD = 12

Appendix Table 33. Analysis of Variance for fresh weight of unhusked Jubilee' sweet corn ears taken October 22, 1984 at the Horticulture Farm.

Source	SS	DF	MS	F
treatment	421	9	47	9.2**
replication	7	3	3	
error	138	27	5	
total	567	39		

Duncan's LSD = 3

a * and ** indicate significance at the 5% and 1% levels respectively.

Appendix Table 34. Analysis of Variance for average height of sweet corn plants taken at the Horticulture Farm on October 22, 1984.

Source	SS	DF	MS	F[a]
treatment	2739	9	305	12.0**
replication	38	3	13	
error	686	27	25	
total	3463	39		

LSD = 15

Appendix Table 35. Analysis of Variance for average height of sweet corn plants at the Horticulture Farm on September 20, 1984.

Source	SS	DF	MS	F
treatment	2880	9	320	12.7 **
replication	44	3	15	
error	680	27	25	
total	3604	39		

Duncan's LSD = 19

Appendix Table 36. Analysis of Variance for average height of sweet corn plants at the Horticulture Farm on September 7, 1984.

Source	SS	DF	MS	F
treatment	7367	9	819	11.8**
replication	175	3	58	
error	1881	27	70	
total	9424	39		

Duncan's LSD = 31

a * and ** indicate significance at the 5% and 1% levels respectively.

Appendix Table 37. Analysis of Variance for average height of sweet corn plants at the Horticulture Farm on August 27, 1984.

Source	SS	DF	MS	F[a]
treatment	7257	9	807	15.2**
replication	170	3	57	
error	1433	27	53	
total	8860	39		

Duncan's LSD = 27.4

Appendix Table 38. Analysis of Variance for average height of sweet corn plants at the Horticulture Farm on August 10, 1984.

Source	SS	DF	MS	F
treatment	374	9	42	6.1**
replication	33	3	11	
error	184	27	7	
total	591	39		

Duncan's LSD = 10

Appendix Table 39. Analysis of Variance for dry weight of sweet corn ears taken at the Horticulture Farm at harvest.

Source	SS	DF	MS	F
treatment	1.39	9	0.15	2.32*
replication	0.21	3	0.07	
error	1.79	27	0.07	
total	3.38	39		

Duncan's LSD = 172

a * and ** indicate significance at the 5% and 1% levels respectively.

Appendix Table 40. Analysis of Variance for dry weight of sweet corn leaves taken at the Horticulture Farm at harvest.

Source	SS	DF	MS	F[a]
treatment	0.06	9	0.06	3.9**
replication	0	3	0	
error	0.04	27	0	
total	0.10	39		

Duncan's LSD = 3

a * and ** indicate significance at the 5% and 1% levels respectively.