INVESTIGATION OF BAY SSH 0860 FOR CHEAT CONTROL IN WHEAT

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CHAPTER I

INTRODUCTION

Oklahoma ranks fourth in total wheat production in the United States and is the second leading producer of hard red winter wheat (27). The most serious weed problem facing the Oklahoma wheat farmer today is control of the *Bromus* spp., particularly cheat (*Bromus secalinus* L.). Peeper (38) has reported that the *Bromus* spp. cost Oklahoma wheat farmers an estimated 44 million dollars in 1976 due to yield reductions, dockage, additional seed cleaning costs, and delaying of harvesting operations.

Cultural practices can reduce cheat populations although complete control may not be possible. Runyan (42) found that tillage systems in which the moldboard plow was used as the primary tillage tool gave good control of *Bromus* sp. However, tillage systems utilizing stubble mulch or minimum tillage tools gave no *Bromus* spp. control, except when used late in the fall, after rainfall has germinated the *Bromus sp*. Oklahoma farmers have tried to adopt reduced tillage and stubble mulch systems in an effort to conserve moisture, fuel, and reduce wind erosion. The availability of a herbicide for cheat control is required to prevent cheat problems from becoming so severe that the stubble mulch systems must be abandoned.

Currently metribuzin (common and chemical names of pesticides used herein are listed in Table I) is the only recommended herbicide for

TABLE I

COMMON AND CHEMICAL NAMES OF PESTICIDES

Common name	Chemical name
barban	4-chloro-2-butynyl 3 chlorophenylcarbamate
BAY SSH 0860	1-amino-3-(2,2 dimethylpropyl)-6-(ethylthio)-1,3,5 -triazine-2,4-(1H,3H)-dione
difenzoquat	1,2-dimethyl-3,5-diphenyl-1 H-pyrazolium
metribuzin	4-amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4 -triazin-5 (4H)-one
triadimefon	1-(4-chlorophenoxy)-3,3-dimethyl-1-(1H-1,2,4-trizol-1-yl)-2-butanone
triallate	S-(2,3,3-trichlror-2-propenyl) bis (1-methylethyl) carbamothioate

cheat control in Oklahoma (23). However, this herbicide has several edaphic and variety restrictions that limit its use. In addition, it may not perform satisfactorily due to lack of rainfall for activation or when it has been applied to saturated soil. Another limitation on the use of metribuzin is that it is less effective on wild oats (*Avena fatua* L.) than on cheat. Wild oats are occasionally a severe problem in southern and western Oklahoma (22). Other herbicides available in Oklahoma for wild oats control have restrictions which completely prevent use of the crop for forage. Thus, use of these products is limited because winter wheat is frequently used as both a forage and grain crop in Oklahoma (27,30).

BAY SSH 0860 is an experimental herbicide discovered by Mobay Chemical Corporation (3). The primary objective of this research was to evaluate BAY SSH 0860 for its ability to selectively control cheat and wild oats in winter wheat, both under controlled conditions and in the field. Other objectives included determining the effect of irrigation and application timing on the efficacy and phytotoxicity of BAY SSH 0860. Applications were made 60 days prior to planting to evaluate the persistence of BAY SSH 0860 and to ascertain whether herbicide application could be in conjunction with normal seedbed preparations. The effect of planting date on BAY SSH 0860 phytotoxicity to winter wheat was also evaluated.

CHAPTER II

LITERATURE REVIEW

Winter Wheat

Wheat is among the oldest of man's crops, the most extensively grown, and the one produced in greatest amount (14). Of the several species of wheat still cultivated, hard red winter wheat (*Triticum aestivum* L.) is by far the most abundant. Hard red winter wheat is a winter annual species which grows from 60 to 120 cm tall and is characterized by a terminal spike inflorescence containing two to five flowered, solitary sessile spikelets attached at each node of the rachis (4). Wheat is adapted throughout the state of Oklahoma and the approximately 3 million hectares planted annually are more than the area seeded to all the other cultivated crops combined (12). In addition hundreds of thousands of animal unit months of grazing are provided by wheat during the winter months (27). The optimum seeding date for grain production is between September 15 and October 15 (27). If moisture is adequate, a satisfactory grain yield can be obtained from seeding dates through December (27). The optimum seeding date for forage production is August 22, with every two week delay reducing forage yields from 672 to 1120 kg/ha (30). Nearly all of Oklahoma's wheatland is in continuous wheat production.

Many parameters are of interest to millers and bakers in judging the quality of wheat for their use. Thus, these measurements have become important to the wheat producer as well. Characters evaluated include test weight, 1000 seed weight, moisture content, protein content, and the presence of weed seeds and damaged kernels (47). Test weight is a measure of kernel density (49). The general rule is that the higher the test weight of the wheat, the more flour the wheat will produce (49). Many environmental factors can greatly affect test weight including low light intensity (53), temperature (55), water stress (35, 41, 54), and wetting and drying of the grain prior to harvest (16). Low light intensity and temperature affect test weight by affecting the length of the grain filling period. Water stress during the flowering period is the most critical factor in determining test weight (35). The weight of 1000 kernels is similar to test weight except that the 1000 kernel weight also takes into account kernel size as well as kernel density (49). The moisture content of harvested grain is important because of its effect on storage properties of the grain (46). Protein content of the grain is very important because all other milling and baking properties are a function of protein content (16). Any procedure for increasing yields, except nitrogen addition, tends to reduce grain protein due to a dilution of the available nitrogen over a greater quantity of grain (46).

Cheat

Cheat, *Bromus secalinus* L., is a weedy annual brome species introduced from Europe. Cheat has erect culms, 30 to 60 cm tall. Cheat will grow taller than 60 cm if in competition with a crop (25). The foliage is glabrous but the lower sheaths are sometimes puberulent. The inflorescence is a nodding panicle, pyramidal shaped, 7 to 12 cm long. Spikelets are ovoid-lanceolate, 1 to 2 cm long and 6 to 8 mm wide. Glumes are obtuse, the first 3 to 5-nerved, 4 to 6 mm long, the second 7-nerved, 6 to 7 mm long. Lemmas are 7-nerved, 6 to 8 mm long, elliptic, obtuse, and smooth. The margin is strongly involute at maturity and the undulate awns are usually 3 to 5 mm long, or sometimes very short or obsolete. The palea is about as long as the lemma (25). Cheat is found throughout temperate North America and was reported in Oklahoma as early as 1900 (8).

Rescuegrass (Bromus catharticus Vahl.), downy brome (Bromus tectorum L.), and Japanese brome (Bromus japonicus Thunb.) are also annual weeds frequently found in wheat fields in association with cheat. Wheat growers in the western United States proclaim that downy brome is their worst weed problem but, fortunately for the Oklahoma wheat farmer, dense populations of downy brome are not common in Oklahoma wheat fields (34). However, this problem was severe enough to merit a symposium at the 1983 Weed Science Society of America annual meeting (33). Wheat growers usually do not distinguish between these Bromus spp. and refer to them all as cheat or cheatgrass. Approximately 1.4 million hectares of Oklahoma wheat have been reported to be cheat infested (23). Losses were estimated at 44 million dollars in 1976 (38). The practice of stubble mulch or minimum tillage methods of land preparation have been identified as a major factor in the increase of the cheat problem (38,42). Fenster et al. (15) found that downy brome was a serious, difficult to control weed when stubble mulch farming was used in a wheat fallow rotation. Davidson and Santelmann (13) found cheat to be an increasing problem in chemical fallow plots.

Cultural Control of Cheat

In 1953 Phillips (39) reported that proper preseeding tillage, crop rotation, or fallowing were the only acceptable methods of control of annual grasses in wheat. Crop rotation can be an excellent method of cheat control except that government farm programs typically preclude this practice (23). In areas infested with cheat that can be rotated to a summer crop, cheat control is accomplished by tillage during fall, winter and early spring. Use of the moldboard plow has been shown to reduce *Bromus* spp. infestations by burying the seed to a depth from which emergence is impossible (43,45). Wicks et al. (56) reported that in a continuous winter wheat cropping system, the moldboard plow was the most effective tillage implement in reducing the downy brome problem. McNeil and Peeper (32) reported only 1% cheat seedling emergence from a depth of 10.2 cm and no emergence when the seed was buried 15.2 cm deep. It has been reported that cheat seed does not live long in the soil and so seed burial by moldboard plowing would seem to be a feasible method of control (2). However, it is recommended that deep moldboard plowing should not be done more than once every three years due to erosion and other problems.

Delayed planting is often recommended as a method of controlling cheat (23). This late planting could provide an extra tillage operation which could reduce the infestation of winter annual grasses if moisture is available to germinate the cheat seed (2). However, Runyan and Peeper (43) reported that delayed planting did not always eliminate cheat infestations.

Carter et al. (10) reported that soft red winter wheat and cheat had the same potential winter hardiness but under conditions of late planting the wheat had much more ability to survive. He stated that although wheat and cheat germinate at the same time, wheat seedlings started growth much more quickly than did cheat seedlings. Finnery et al. (17) investigated the phenology of downy brome, cheat, and japanese brome in Nebraska and found that considerable winterkill occurred in poorly established late fall plantings of these weeds. Winters in Oklahoma are less severe than those in Nebraska and this might explain why cheat is more of a problem in Oklahoma.

Chemical Control of Cheat

Currently, metribuzin is the only herbicide labeled for cheat control in Oklahoma (23). Many factors govern the effectiveness and safety of the use of metribuzin including soil organic matter, soil texture, soil pH, soil moisture and wheat variety. Parrish et al. (36) found that soil moisture increased with increasing crop residue and concluded that increased soil moisture is a major factor in determining the level of metribuzin activity. Ladlie et al. (26) reported that phytotoxicity of metribuzin increased with increasing pH. In his research corn (Zea mays L.) yield was reduced 35% when the pH was raised from the 4.5 range to the 6.5 range. In contrast, Ballerstadt and Banks (5) reported that the initial activity of metribuzin on oats (Avena sativa L.) did not appear to be affected by soil pH.

Cultivars of several crops, including soybean [Glycine max (L.) Merr.] (24,29), tomato (Lycopersicon esculentum Mill.) (50), and potato (Solanum tuberosum L.) (20) have been shown to differ in their response to metribuzin. Runyan et al. (44) reported that hard red winter wheat also exhibited differential cultivar response to metribuzin. They found TAM W 101 was one of the most tolerant varieties tested. Presently only four varieties are labeled for treatment with metribuzin in Oklahoma. These are TAM W 101, TAM 105, Hawk, and Newton (23). Fischer and Peeper (18) reported that metribuzin applied either in the fall or sping provided excellent cheat control with no yield reductions of TAM W 101, TAM 105 and Newton.

Wild oats

Wild oats (Avena fatua L.) can be a severe problem in winter wheat grown in the Rolling Plains and Northern Blacklands of Texas and in southern and western Oklahoma (28, 38). Wild oats grow as a winter annual in Oklahoma. The stems are generally 60-120 cm tall with distinct dark colored nodes. Leaves are flat, 10-60 cm long, 15 mm wide or wider, and tapered to a long thin point. The inflorescence is a large panicle with slender branches. The spikelets contain two to four florets varying from dull white through yellow or gray to brown or nearly black. The florets are usually hairy but sometimes nearly smooth with a sharp-pointed sucker mouth at the lower end and a long (3-4 cm) bent twisted awn (1).

Mechanical methods of wild oats control are not considered effective due to their early maturity, seed dormancy characteristics, and the extended viability of buried seed of this species (57). Banting found that some wild oat seeds were still viable after nearly seven years in the soil (6). He also reported that there were sufficient amounts of seed still viable to reinfest an area that had been fallow for five years. In contrast to cheat, cultural control of wild oat by plowing is not very effective since some seedlings have been reported to emerge from a depth of 15 cm (6,32,37,40). Banting (6) also reported that burial of seeds (below 5 cm) extended the period of persistence and for that reason should be avoided.

Early removal of wild oats from grain crops is essential if serious yield reductions due to competition for water and mineral nutrients are to be avoided (7,9,11,19,31). Bowden and Friessen (9) indicated that wild oats compete with spring wheat even before emergence. They concluded that almost all spring wheat yield reduction has been caused by the time the wild oats reached the 2 to 3 leaf stage. In contrast, Chancellor and Peters (11) reported that in Britain wild oat competition does not begin until the crop has reached the four leaf stage. A possible explanation for this discrepancy is that higher densities were required to reduce yield in the British study so wild oats may not be as competitive there as in Canada. McNamara (31) reported that wild oat competition with the crop occurs throughout the growing season and increases with increasing weed density.

Chemical Control of Wild Oat

Herbicides available for wild oat control in wheat in Oklahoma include barban, difenzoquat, and triallate. Metribuzin is considered to provide partial control (21).

BAY SSH 0860

BAY SSH 0860 is a symmetrical triazine herbicide under development for the control of wild oats and cheat in cereals (Figure 1). BAY SSH 0860 differs from other symmetrical triazines currently used as herbicides in that side chains are attached to two of the nitrogens in the triazine ring and not just to the carbons as is the case with the other triazines. BAY SSH 0860 is a photosynthetic inhibitor with predominate uptake via the roots (3). In areas of low rainfall, best results have been acheived with preplant or postplant incorporated treatments (3). Schumacher et al. (48) found that a preemergence application of 2.24 kg/ha effectively controlled ripgut brome (*Bromus diandrus* Roth.) with no crop injury. Vaculin (52) found that BAY SSH 0860 was less phytotoxic to wheat as soil moisture increased. He also reported that increased phytotoxicity from BAY SSH 0860 due to increases in soil pH should not be a problem.

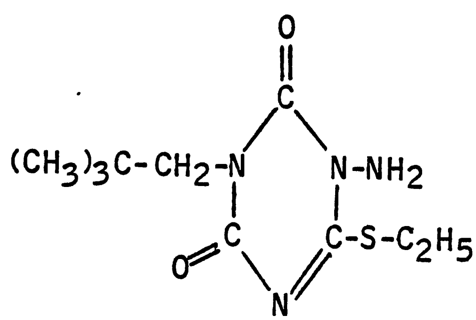

Figure 1. Chemical Structure of BAY SSH 0860

CHAPTER III

METHODS AND MATERIALS

Response of Wheat and Selected Weeds to BAY SSH 0860 in the Greenhouse

Experiments were established in the greenhouse to compare the response of winter wheat (TAM W 101), cheat, wild oats, and jointed goatgrass (*Aegilops cylindrica* Host)to BAY SSH 0860. BAY SSH 0860 at 0, 0.14, 0.28, 0.56, 1.12, 1.68, and 2.24 kg/ha was applied by a compressed air sprayer to 250 ml styrofoam pots which contained 250 g of air dried Teller loam soil (Udic Arguistolls) (Sa=47.5%, Si=32.5%, Cl=20.0%, pH=6.1, OM=0.7%). The herbicide was then incorporated by mixing the soil from each pot in a small plastic bag. Eight seeds of each species were then planted 1 cm deep and the pots sub-irrigated with tap water. The pots were placed on a bench in the greenhouse where they received approximately 12 h of sunlight daily. The daytime temperature was kept below 33 C and nighttime temperature was maintained at 20 C. After emergence, plants in each cup were thinned to a consistent number per species (four for wheat and jointed goatgrass, five for wild oats, and six for cheat). After emergence the pots were watered from the top as needed. After 28 days all above ground forage was harvested and green weights obtained. The experimental design was a randomized complete block with a factorial arrangement of treatments. Each experiment was replicated four times. The data was statistically analyzed.

Efficacy and Phytotoxicity to Wheat of PPI and Preemergence Applications of BAY SSH 0860, With and Without Sprinkler Irrigation After Seeding

Experiments were conducted during 1981-82 and in 1982-83 at the Agronomy Research Station, Stillwater, OK to evaluate the effect of sprinkler irrigation after planting on the efficacy of preplant incorporated (PPI) and preemergence (Pre) applications of BAY SSH 0860. These experiments will hereafter be referred to as S-1 and S-2, respectively. In both experiments BAY SSH 0860 was applied at 0.56, 1.12, 1.68, and 2.24 kg/ha both PPI and preemergence. Incorporation of the PPI treatments was accomplished by a single pass of a tandem disc operated at a depth of 10 cm. In both experiments metribuzin at 0.28 and 0.42 kg/ha was applied in December as a standard cheat control treatment. The experiments were designed as split plots with irrigation or no irrigation as the main plots and herbicide treatments as subplots. Treatment particulars, including the irrigation schedules, are in Table II. S-1 was established on an area with a natural cheat infestation. The cheat density in the fall in untreated areas was approximately 165 plants/meter^2. The S-2 location was overseeded with cheat seed which was tilled into the soil with a tandem disc immediately prior to herbicide application. The cheat density resulting was approximately 390 plants/meter^2. Cheat control and wheat injury were evaluated visually. The plots were harvested with a small plot combine on June 10, 1982 and June 24, 1983 respectively. Dockage was determined by cleaning the harvested grain with a Clipper M2B seed cleaner. Clean

TABLE II

CONDITIONS FOR ESTABLISHMENT OF THE SPRINKLER IRRIGATION EXPERIMENTS AT STILLWATER, (S-1, 1981-82 AND S-2, 1982-83)

Location:	Agronomy Research Station, Stillwater, Oklahoma
Soil:	Kirkland clay loam (Sa=45%, Si=23.5%, Cl=31.5%) OM=1.3%, pH=5.5 Udertic Paleustoll
Application equipment:	S-1: Compressed air bicycle sprayer S-2: Compressed air tractor sprayer
Carrier volume (l/ha):	280
Incorporation:	Single pass with a tandem disc operated 10 cm deep
Spray boom:	Four 11005 nozzle tips on 50 cm spacing
Planting date:	S-1: September 22, 1981 S-2: October 6, 1982
Planting method:	Disc drill with 17.7 cm row spacing
Wheat variety:	TAM W 101
Seeding rate (kg/ha):	73
Irrigation schedule:	S-1: Sept. 22, 7.5 cm; Sept. 27, 10 cm; Oct. 5, 7.5 cm; Oct. 8, 5.6 cm; Oct. 10, 2 cm S-2: Oct. 6, 8.5 cm; Oct. 9, 7.5 cm; Oct. 12, 8 cm; Oct. 16, 7.6 cm; Oct. 20, 6.5 cm

Treatment particulars:

Experiment no.:	S-1		S-2		
Application stage[1]:	PPI, Pre	Post	PPI, Pre	Post	Post II
Date:	September 22	December 10	October 6	December 22	April 26
Air temp (^{o}C):	28	10	23	11	21
Soil temp (^{o}C):	23	4	25	5	11
Soil moisture:	good	dry	dry	wet	good
Sun:	bright	cloudy	bright	bright	bright
Wind (km/h):	10-13	5-11	6-13	0-2	6-13

1. PPI= preplant incorporated, Pre= preemergence and Post= postemergence herbicide applications. The Post II treatment in S-2 was an application of Bayleton (0.28 kg/ha) for powdery mildew control.

grain yield and test weight were obtained. Grain protein was determined using the UDY system (51). Grain moisture data was obtained by analyzing a sample of the grain in a Dole Model 400 moisture meter as it was harvested in S-1, and after the grain had been cleaned in S-2 (less than 2 h after harvest).

Application Timing and Persistance Studies

Three field experiments were established in 1981 and again in 1982 to compare the efficacy of early preplant incorporated (PPI-1 and PPI-2), preplant incorporated (PPI-3) and preemergence applications of BAY SSH 0860 on cheat and wild oats and the effect of the treatments on winter wheat. Each year one experiment was located on a Teller loam soil at the Agronomy Research Station near Perkins, OK, on a Meno sand at the Sandyland Research Station near Magnum, OK, and at the Agronomy Research Station, Stillwater, OK on a Kirkland clay loam (1981-82) or a Norge loam soil (1982-83). These experiments will hereafter be referred to as P-1 and P-2, M-1 and M-2, and S-3 and S-4 respectively. The details of establishment for these experiments are in TABLES III, IV, and V.

BAY SSH 0860 at 1.68 and 3.36 kg/ha was applied and incorporated approximately 60 and 30 days prior to planting at all locations and on the day of planting at P-1, P-2, S-3 and S-4. Additional treatments consisted of an application of BAY SSH 0860 Pre at 1.68 kg/ha on plots that had received PPI treatments either 30 or 60 days previously. In P-1 and S-3 BAY SSH 0860 was also applied Pre at 1.68 and 3.36 kg/ha. Herbicide incorporation at Perkins and Stillwater was accomplished by a single pass of a tandem disc. At Mangum an incorporation variable was

TABLE III

CONDITIONS FOR ESTABLISHMENT OF THE APPLICATION TIMING EXPERIMENTS AT STILLWATER, (S-3, 1981-82 AND S-4, 1982-83)

Location:	Agronomy Research Station, Stillwater, Oklahoma
Soil:	S-3: Kirkland clay loam (Sa=45%, Si=23.5%, Cl=31.5%) OM=1.2%, pH=6.5 Udertic Paleustolls
	S-4: Norge loam (Sa=42%, Si=32%, Cl=26%) OM=1.2%, pH=5.3 Udic Paleustoll
Application equipment:	S-3: Compressed air bicycle sprayer
	S-4: Compressed air tractor spayer
Spray boom:	Four 11005 nozzle tips on 50 cm spacing
Carrier volume (l/ha):	280
Incorporation:	Single pass of a tandem disc operating 10 cm deep
Planting date:	S-3: September 29, 1981
	S-4: October 1, 1982
Planting method:	Hoe drill with 25 cm row spacing
Wheat variety:	S-3: Newton
	S-4: TAM W 101
Seeding rate (kg/ha):	S-3: 67
	S-4: 73
Treatment particulars:	

Experiment no.:	S-3			S-4		
Application stage[1]:	PPI-1	PPI-2	PPI-3, Pre	PPI-1	PPI-2	PPI-3, Pre
Date:	July 23	August 27	September 29	August 2	September 1	October 1
Air temp (°C):	42	25	28	36	37	17
Soil temp (°C):	31	26	24	31	33	21
Soil moisture:	dry	good	good	good	dry	dry
Sun:	bright	bright	bright	bright	bright	cloudy
Wind (km/h):	6-13	0-8	0-5	6-11	13-19	0-3

1. PPI= preplant incorporated, Pre= preemergence

TABLE IV

CONDITIONS FOR THE ESTABLISHMENT OF THE APPLICATION TIMING EXPERIMENTS AT PERKINS, (P-1, 1981-82 AND P-2, 1982-83)

Location:	Agronomy Research Station, Perkins, Oklahoma					
Soil:	Teller loam, (Sa=47%, Si=32.5%, Cl=18%) OM=0.7%, pH=6.1 Udic Agriustoll					
Application equipment:	P-1: PPI-1 and PPI-2 applied with a compressed air bicycle sprayer; PPI-3 and Pre applied with a compressed air tractor sprayer					
	P-2: PPI-1 applied with a compressed air bicycle sprayer; PPI-2, PPI-3 and Pre applied with a compressed air tractor sprayer					
Spray boom:	Four 11005 nozzle tips on 50 cm spacing					
Carrier volume (l/ha):	280					
Incorporation:	Single pass with a tandem disc operating 10 cm deep					
Planting date:	P-1: October 27, 1981					
	P-2: October 1, 1982					
Planting method:	Hoe drill with 25 cm row spacing					
Wheat variety:	TAM W 101					
Seeding rate (kg/ha):	67					
Treatment particulars:						
Experiment no.:						
Application stage[1]:	PPI-1	PPI-2	PPI-3, Pre	PPI-1	PPI-2	PPI-3, Pre
Date:	August 19	September 22	October 27	August 3	September 2	October 1
Air temp (°C):	28	36	14	34	27	29
Soil temp (°C):	25	28	12	32	27	24
Soil moisture:	good	good	good	good	wet	good
Sun:	bright	bright	bright	bright	bright	bright
Wind (km/h):	8	8-11	0-4	0-4	13-19	0-3

1. PPI= preplant incorporated, Pre= preemergence

TABLE V

CONDITIONS FOR ESTABLISHMENT OF THE APPLICATION TIMING EXPERIMENTS AT MANGUM, (M-1, 1981-82 AND M-2, 1982-83)

Location:	Sandyland Research Station, Mangum, Oklahoma
Soil:	Meno sand (Sa=97%, Si=2%, Cl=1%) OM=0.7%, pH=5.7 Arenic Haplustalf
Application equipment:	Compressed air tractor sprayer
Spray boom:	Six 11005 nozzle tips on 50 cm spacing
Carrier volume (l/ha):	280
Incorporation:	Single pass with either a tandem disc or a 3 m sweep operating 10 cm deep
Planting date:	M-1: September 10, 1981 M-2: September 23, 1982
Planting method:	Disc drill with 20 cm spacing
Wheat variety:	M-1: TAM W 101 M-2: Wings
Seeding rate (kg/ha):	73

Treatment particulars:

Experiment no.:	M-1			M-2		
Application stage[1]:	PPI-1	PPI-2	Pre	PPI-1	PPI-2	Pre
Date:	July 2	August 11	September 10	July 8	August 10	September 23
Air temp (^{o}C):	30	25	31	34	31	32
Soil temp (^{o}C):	27	33	31	31	26	25
Soil moisture:	good	dry	good	good	good	good
Sun:	bright	cloudy	bright	bright	bright	bright
Wind (km/h):	5	0	0-6	0-8	0-1	0-11

1. PPI= Preplant incorporated, Pre= preemergence

included with incorporation by either a single pass of a tandem disc or a 3 m sweep. All incorporation tools were operated approximately 10 cm deep at 7 km/h at each location. The entire experimental area was tilled each time PPI treatments were applied. The experimental design at Perkins and Stillwater was a randomized complete block with four replications. At Mangum a split plot design was employed with incorporation method as the main plot and herbicide treatments as the subplots.

Weed control and crop injury were evaluated visually at all locations, except that M-1 had insufficient weed pressure for herbicide performance evaluation. P-1 and S-3 were established on natural weed infestations while P-2 and S-4 were overseeded with weed seed which was disced in prior to applying the PPI treatments on the day of planting. P-1, P-2, and S-4 all had cheat populations in the range of 400 to 550 plants/meter^2. The cheat population of S-1 varied from 50 to 390 plants/meter^2.

All plots were harvested with a small plot grain combine. In 1982 the experiments at Stillwater, Perkins, and Mangum were harvested on June 10, June 17, and June 16, respectively. In 1983 harvest dates were June 23, June 21, and June 15, respectively. Dockage was determined from the Perkins and Stillwater locations by cleaning the harvested grain with a Clipper M2B seed cleaner. Yield and test weight were de ter mined after cleaning. Grain protein was determined using the UDY system (50). Wild oat control was also evaluated from P-1 and P-2 by counting the number of wild oat seed present in 100 g of wheat after removal of cheat seed and chaff with the Clipper seed cleaner.

Grain moisture content was determined in all experiments. On June 4, 1982 ten wheat heads were hand-picked from each plot in S-3 and P-1, weighed and oven-dried to obtain percent moisture. Harvest moisture data was obtained from S-3, P-1, M-1, and M-2 by analyzing a sample of the uncleaned grain with a Dole moisture meter as it was harvested. Grain moisture data from S-4 and P-2 was obtained by analyzing a sample of grain after it had been cleaned (within 2 h after harvest).

Effect of Planting Date on BAY SSH 0860 Phytotoxicity

Two experiments were established at weed free locations in the fall of 1982 to determine whether delaying the planting date of wheat could increase the potential for crop injury from preplant incorporated treatments of BAY SSH 0860. The experiments were located at the Agronomy Research Station, Stillwater (S-5) on a Port sandy clay loam and at the Agronomy Research Station, Perkins (P-3) on a Teller loam. In both experiments BAY SSH 0860 was applied PPI at 0, 1.12, 1.68, and 2.24 kg/ha on four dates immediately before seeding. Incorporation of the herbicide was accomplished with a single pass of either a Danish S-tine harrow (S-5) or a springtooth harrow (P-3) operated 7.5 or 10 cm deep respectively. Wheat was seeded to a depth of approximately 2.5 cm at both locations with a single disc drill. All planting dates at both locations, except the October 14 planting in S-5, were seeded into adequate moisture for crop emergence. A delay of fourteen days occurred before significant rainfall was received on the October 14 planted plots. For the four planting dates average minimum air temperatures for the ten days following seeding, in chronological order, were 14.4, 3.8, 3.4, and 0.5 C at P-3 and 11.7, 3.8, 2.5, and 1.5 C at S-5. A factorial arrangement of treatments with four replications was employed at both locations with seeding dates and herbicide rates as factors. Treatment particulars for these experiments are in Tables VI and VII, respectively.

Triadimefon at 0.14kg/ha was applied to S-5 on April 26, 1983 for powdery mildew control. Wheat injury was evaluated at both locations on May 20, 1983. Both experiments were harvested with a small plot combine on June 24 (S-5) and 30 (P-3), 1983. Yield, test weight, and thousand seed weight were obtained after cleaning the grain to remove the remaining chaff from the samples.

TABLE VI

CONDITIONS FOR ESTABLISHMENT OF THE PLANTING DATE EXPERIMENT AT STILLWATER (S-5)

Location:	Agronomy Research Station, Stillwater, Oklahoma			
Soil:	Port sandy clay loam (Sa=54%, Si=22%, Cl=24%) OM=1.1%, pH=5.4 Cumulic Haplustoll			
Application equipment:	Compressed air tractor sprayer			
Spray boom:	Six 11005 nozzle tips on 50 cm spacing			
Carrier volume (l/ha):	280			
Incorporation:	Single pass with a Danish s-tine harrow operated 7.5 cm deep			
Planting method:	Disc drill with 17.7 cm row spacing			
Wheat variety:	TAM W 101			
Seeding rate (kg/ha):	73			
Application conditions[1]:				
Planting date:	September 21	October 14	November 14	November 24
Air temp (°C):	22	23	10	4
Soil temp (°C):	26	23	15	5
Soil moisture:	wet	dry	good	good
Sun:	bright	bright	bright	partly cloudy
Wind (km/h):	0-6	0-5	0-5	5-8

1. On each date herbicide treatments were applied just prior to seeding.

TABLE VII

CONDITIONS FOR ESTABLISHMENT OF THE PLANTING DATE EXPERIMENT
AT PERKINS (P-3)

Location:	Agronomy Research Station, Perkins, Oklahoma			
Soil:	Teller loam (Sa=58%, Si=27%, Cl=16%) OM=0.9%, pH=6.4 Udic Argiustoll			
Application equipment:	Compressed air tractor sprayer			
Spray boom:	Six 11005 nozzle tips on 50 cm spacing			
Carrier volume (l/ha):	280			
Incorporation:	Single pass with a springtooth harrow operated 10 cm deep			
Planting method:	Disc drill with 17.7 cm row spacing			
Wheat vareity:	TAM W 101			
Seeding rate (kg/ha):	73			
Application conditions[1]:				
Planting date:	September 30	October 21	November 10	December 20
Air temp (^{o}C):	21	21	21	16
Soil temp (^{o}C):	20	18	19	5
Soil moisture:	good	good	good	good
Sun:	bright	bright	cloudy	bright
Wind (km/h):	5-8	0-5	8-14	8-16

1. On each date herbicide treatments were applied just prior to seeding.

CHAPTER IV

RESULTS AND DISCUSSION

Response of Wheat and Selected Weeds to BAY SSH 0860 in the Greenhouse

Preplant incorporated treatments of BAY SSH 0860 at rates of 0.14 to 2.24 kg/ha did not reduce the fresh weight of TAM W 101 wheat or jointed goatgrass (Figure 2). The fresh weights of both cheat and wild oat were significantly reduced by BAY SSH 0860 at 0.14 kg/ha. Complete control of wild oats was obtained with 0.56 kg/ha whereas 1.12 kg/ha was required to completely control cheat. Thus, BAY SSH 0860 appeared very selective under greenhouse conditions.

Efficacy and Phytotoxicity to Wheat of PPI and Preemergence Applications of BAY SSH 0860, With and Without Sprinkler Irrigation After Seeding

S-1

Over 70% cheat control was obtained in December by application of BAY SSH 0860 at all rates and by either application method in S-1 (Table VIII). A significant irrigation by treatment interaction was present in the final cheat control rating. Better cheat control was obtained with 1.12 kg/ha PPI and 0.56 kg/ha Pre in the non-irrigated plots than in the

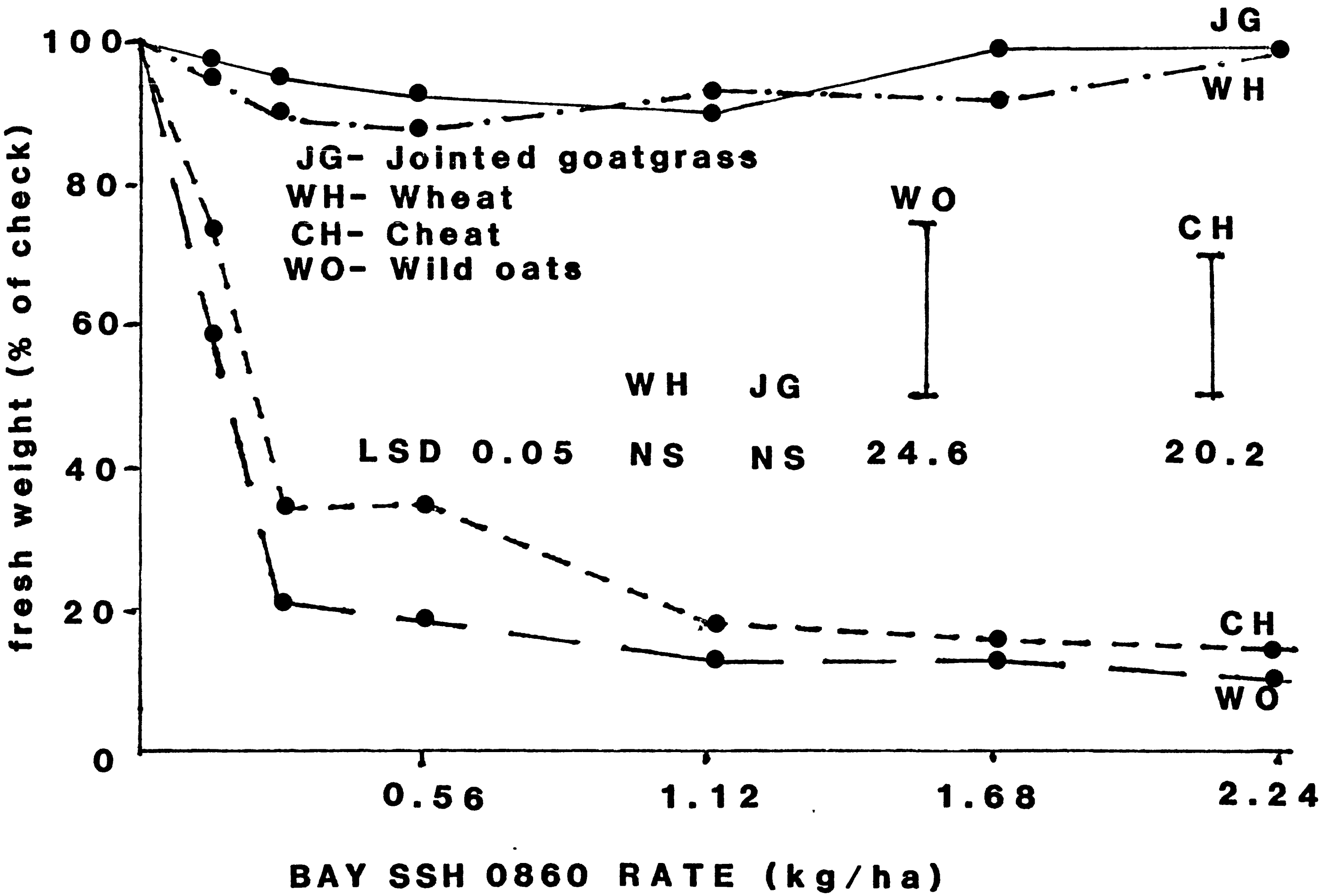

Figure 2. Fresh foliage weight of Wheat, Cheat, Wild Oats and Jointed Goatgrass 28 days after seeding into soil treated with BAY SSH 0860.

TABLE VIII

INTERACTION OF EARLY POSTSEEDING SPRINKLER IRRIGATION AND BAY SSH 0860 ON CHEAT CONTROL AND WHEAT HARVEST DATA (S-3, 1981-82)

			Cheat Control[2]				Harvest Data (June 10, 1982)															
			Dec 21		April 20		Grain Moisture		Yield			Dockage			Test Weight			1000 Seed Weight		Grain Protein	
Treatment	Rate	Stage[1]	0	IR	0	IR	0	IR	0	IR	Mean	0	IR	Mean	0	IR	Mean	0	IR	0	IR
			(%)				(%)		(kg/ha)			(%)			(kg/hl)			(g)		(%)	
1. SSH 0860	0.56	PPI	73	85	45	48	20.8	16.0	2177	2567	2372	19.7	6.0	12.9	61.7	68.9	65.3	40.2	39.8	13.0	12.7
2.	1.12		99	83	88	30	21.8	16.1	2177	2345	2218	7.6	4.2	5.9	63.8	70.8	67.3	39.2	39.4	13.0	12.1
3.	1.68		100	93	98	68	21.4	15.1	2251	2669	2459	6.5	4.3	5.4	66.0	70.2	68.1	38.6	40.1	14.2	11.2
4.	2.24		100	100	95	93	21.3	16.7	2312	2601	2460	7.4	4.4	5.9	66.3	71.8	69.1	39.9	39.4	13.0	12.6
5.	0.56	Pre	98	90	85	38	20.4	19.0	2601	2819	2722	6.0	4.3	5.2	68.0	68.6	68.3	39.8	40.2	12.6	12.5
6.	1.12		99	94	100	45	21.3	17.0	2365	2688	2527	5.0	4.1	5.6	66.2	70.5	68.3	40.0	39.9	13.2	12.3
7.	1.68		100	99	98	78	20.8	16.4	2352	2552	2460	5.7	3.9	4.8	67.4	71.8	69.6	41.2	39.2	12.7	12.3
8.	2.24		100	100	100	95	22.4	16.9	2325	2392	2359	6.6	4.2	5.4	66.8	70.8	68.9	40.0	39.9	13.1	12.0
9. Metribuzin	0.28	Post	--	--	30	58	20.1	14.6	2493	2547	2520	7.1	7.1	7.1	65.0	68.0	66.5	40.8	39.8	12.2	12.1
10.	0.42		--	--	80	70	21.0	14.9	2332	2621	2480	5.1	5.6	5.4	67.3	66.5	66.9	41.4	40.4	13.7	12.9
11. Untreated	----	---	0	0	0	0	16.6	18.1	1956	2594	2278	23.9	14.7	19.3	53.5	59.3	56.5	39.0	39.7	12.1	12.3
Mean									(2305)	(2587)		(9.2)	(5.7)		(64.6)	(68.9)					
LSD 0.05			[20][3]		[28][3]		[5.6][3]		(NS)[4]		249	(2.7)		4.8	(1.7)		3.5	NS		NS	

(1) PPI, Pre, and Post refer to preplant incorporated, premergence, and postemergence herbicide applications.

(2) 0 and IR refer to non-irrigated and irrigated treatments, respectively

(3) The LSD 0.05 in[ ] is comparing any two values.

(4) LSD's 0.05 in ( ) are for comparing irrigated vs. non-irrigated means.

irrigated plots. This could be due to leaching of the BAY SSH 0860 in the irrigated plots but since the unirrigated PPI treatments were more effective than the irrigated, there may have been other factors involved.

A significant irrigation by treatment interaction was found in the grain moisture data at harvest. The non-irrigated Pre application of 2.24 kg/ha BAY SSH 0860 had higher grain moisture than the non-irrigated check. This indicates a slight herbicide-induced delay in maturity. However, this rate is above that required for weed control. No differences were found between any other treatment and its respective check. There were, however, differences between irrigated and non-irrigated applications of BAY SSH 0860 at 1.12 and 1.68 kg/ha PPI and 2.24 kg/ha applied Pre as well as both rates of metribuzin. This could be a result of the effect higher dockage in these plots had on the moisture data as the capacitance method of moisture testing is inaccurate when the bulk density of the sample is modified.

No irrigation by herbicide treatment interaction was present in the clean grain yield data (Table VIII). Therefore the data is averaged across irrigation treatments. Pre applications of BAY SSH 0860 at 0.56 and 1.12 kg/ha were the only treatments that increased wheat yield. Other treatments which controlled the cheat failed to increase wheat yield. This was due to the relatively low cheat density at this location.

No irrigation by treatment interaction was present in the dockage data. All herbicide treatments contained less dockage than the check. The non-irrigated plots contained more dockage than the irrigated plots. This could be due to more uniform cheat emergence, better crop emergence and competition, or possibly a dilution effect because the irrigated treatments produced more wheat to dilute the cheat seed present (although irrigation made no significant difference in yield, a definite trend did exist). A more plausible explanation is that wheat from the non-irrigated plots contained more small wheat kernels that were lost in the cleaning process.

No interaction was present in the test weight data. However, averaged over herbicide treatments, the test weight of the irrigated wheat was higher than the non-irrigated wheat. All herbicide treatments significantly increased test weight compared to the check. This could be related to moisture since all herbicide treatments did reduce at least some of the competition for available moisture from the cheat. The test weights of grain from the treatments with BAY SSH 0860 applied PRE at 1.68 amd 2.24 kg/ha and PPI at 2.24 kg/ha were higher than the test weight of grain from the 0.56 kg/ha PPI application. This was attributed to better cheat control. No differences were present in the 1000 seed weight data.

The non-irrigated wheat contained more protein than the irrigated wheat. Whether this difference (12.98% vs. 12.26%) is a herbicide induced effect or a dilution effect of applied nitrogen spread over more grain produced is unclear. However, no herbicide treatment had an effect on grain protein.

S-2

In S-2 cheat control was lower than that of S-1 in December but had improved to the point that by February BAY SSH 0860 at 1.68 kg/ha applied either PPI or Pre was providing almost 100% cheat control (Table

IX). However, in February, wheat in plots treated with BAY SSH 0860 at 2.24 kg/ha PPI was somewhat stunted compared to the check. In S-2, an irrigation by treatment interaction was again present in the final cheat control rating. The interaction occurred because the 0.56 kg/ha rate of BAY SSH 0860 applied either PPI or Pre and the 1.12 kg/ha Pre application provided better cheat control in the irrigated plots than in the non-irrigated plots. This was attributed to the absence of significant rainfall until three weeks after herbicide application (see rainfall data in Appendix Table XXI).

No irrigation by treatment interaction was indicated in the grain moisture data. A herbicide treatment main effect did exist. Treatments in which BAY SSH 0860 was applied at 1.12 or 1.68 kg/ha were higher in grain moisture than the untreated plots. The 2.24 kg/ha PPI application of BAY SSH 0860 was also higher in grain moisture as was the 0.28 kg/ha application of metribuzin. Whether this delay is due to direct effects of the herbicide or due indirectly to cheat control is not known. Increased competition for moisture could have hastened maturity of the cheat infested check, or nutrient competition could have affected maturity.

In contrast to S-1, an irrigation by treatment interaction was present in the S-2 yield data (Table X). Wheat yields in S-2 were quite low due to a severe infestation of powdery mildew (Erysiphe graminis DC.). An application of Bayleton (triadimefon) was too late to prevent crop damage and severe yield reduction across the entire experimental area. The greater severity of the disease in the irrigation plots than in the non-irrigated plots is evident in the yield data wherein the non-irrigated check had a significantly higher yield than did the

TABLE IX

EFFECT OF EARLY POSTSEEDING SPRINKLER IRRIGATION ON EFFICACY AND PHYTOTOXICITY OF BAY SSH 0860 (S-2, 1982-83)

			Visual Ratings[2]												
			Cheat Control								Henbit Control		Wheat Injury	
			December 21			February 18			May 20		December 21	February 18	February 18	
Treatment	Rate	Stage[1]	0	IR	Mean	0	IR	Mean	0	IR	IR	IR	0	IR
	(kg/ha)		(%)											
1. SSH 0860	0.56	PPI	15	53	34	13	53	33	13	30	58	3	0	0
2.	1.12		69	79	74	90	85	88	55	53	74	50	0	0
3.	1.68		86	91	89	100	95	98	81	86	89	70	0	1
4.	2.24		78	86	82	100	98	99	86	88	89	85	3	20
5.	0.56	Pre	31	25	28	23	40	31	1	28	50	28	0	0
6.	1.12		71	63	67	78	80	79	51	78	83	60	3	0
7.	1.68		90	73	81	100	95	98	75	86	95	80	0	0
8.	2.24		79	86	83	100	100	100	88	90	98	98	0	3
9. Metribuzin	0.28	Post I	0	0	0	0	0	0	0	0	--	0	0	0
10.	0.42		13	0	7	25	0	13	25	0	--	0	0	0
11. Untreated	----	---	0	0	0	0	0	0	0	0	0	0	0	0
LSD 0.05=					8.7			8.8	[21.8][3]		24	31	[6.5]	

(1) PPI, Pre, and Post refer to herbicide application method, preplant incorporated, preemergence or postemergence.

(2) O, IR, and Mean refer to not irrigated, irrigated and the treatment mean averaged over irrigation.

(3) LSD 0.05 for significant treatment by irrigation interaction is in [ ].

TABLE X

EFFECT OF EARLY POSTSEEDING SPRINKLER IRRIGATION AND BAY SSH 0860 APPLICATIONS ON HARVEST DATA (S-2, 1982-83)

Treatment	Rate	Stage[1]	Grain Moisture[2]			Yield		Dockage			Test Weight			1000 Seed Weight			Grain Protein	
			0	IR	Mean	0	IR	0	IR	Mean	0	IR	Mean	0	IR	Mean	0	IR
	(kg/ha)		-------(%)------			--(kg/ha)-		-------(%)------			-----(kg/hl)----			-------(g)------			----(%)---	
1. SSH 0860	0.56	PPI	12.3	12.8	12.5	921	948	40.3	38.7	39.5	70.9	72.2	71.6	31.9	28.8	30.4	11.6	11.4
2.	1.12		12.0	14.0	13.0	1270	1136	21.3	26.2	23.7	73.8	73.5	73.6	32.3	29.5	30.9	11.3	11.6
3.	1.68		13.2	13.6	13.4	1122	1364	16.8	15.9	16.4	74.0	75.2	74.5	32.2	31.0	31.6	11.5	11.8
4.	2.24		14.3	13.3	13.8	1331	1331	10.9	19.4	15.1	75.3	75.0	75.2	32.8	30.7	31.8	11.7	11.2
5.	0.56	Pre	12.3	12.5	12.4	894	739	43.1	47.6	45.4	73.4	70.8	72.1	32.1	27.5	29.8	11.7	11.7
6.	1.12		12.6	13.8	13.2	1210	1344	23.7	18.7	21.2	73.8	74.5	74.1	32.0	29.8	31.4	10.8	11.5
7.	1.68		13.0	13.2	13.1	1250	1404	11.3	11.9	11.6	73.8	76.4	75.0	32.5	30.8	31.6	11.3	10.7
8.	2.24		12.4	12.8	12.6	1189	1277	14.6	15.2	14.9	74.1	75.8	75.0	32.2	31.1	31.6	11.9	12.6
9. Metribuzin	0.28	Post I	11.6	12.9	12.7	833	833	43.2	27.3	35.2	71.2	68.2	69.6	31.8	27.7	29.7	11.1	12.0
10.	0.42		11.9	13.5	12.3	1129	1129	33.4	64.5	48.9	73.3	69.9	71.6	32.5	27.5	30.0	11.8	11.8
11. Untreated	----	----	12.1	12.2	12.2	605	181	50.0	73.0	61.4	69.9	51.9	60.9	31.4	25.1	28.2	11.8	11.9
LSD 0.05=					0.45[3]	[415][4]				8.94[3]			3.61[3]			0.91[3]	NS	

(1) PPI, Pre, and Post I refer to preplant incorporated, preemergence, or postemergence application of the herbicides.

(2) 0 and IR refer to non-irrigated and irrigated treatments, respectively.

(3) LSD's 0.05 for the herbicide treatment means averaged over irrigation treatment.

(4) The LSD 0.05 in [ ] is for comparing any two yield values.

irrigated check. In all other irrigated and non-irrigated pairs no differences exist. This then is where the interaction lies. All irrigated treatments produced higher yields than the irrigated check. In the non-irrigated plots, only the PPI and Pre applications of BAY SSH 0860 at 0.56 kg/ha, and metribuzin at 0.28 kg/ha did not control enough cheat to increase yield.

Dockage values were higher in S-2 than in S-1 due to the high amount of shriveled grain present because of the powdery mildew infestation. All herbicide treatments reduced dockage compared to the check. BAY SSH 0860 at rates of 1.12 kg/ha or above applied either PPI or Pre reduced grain dockage compared to the metribuzin treatments. Pre applications were equal to PPI applications in dockage reduction.

A herbicide treatment main effect was found in the test weight data and as in S-1 all herbicide treatments had higher test weights than the check. Also, grain from plots which had BAY SSH 0860 applied at 1.12, 1.68 and 2.24 kg.ha either PPI or Pre was higher in test weight than that obtained with metribuzin at 0.24 kg/ha. These differences were attributed to increases in cheat control.

All herbicide treated plots had heavier seed than the check. In addition, treatments in which BAY SSH 0860 was applied at 1.68 or 2.24 kg/ha as well as the 1.12 Pre application had heavier seed than the treatment with the high rate of metribuzin. These differences were attributed to the control of cheat removing competition for moisture.

As was the case in S-1, no differences in grain protein were detected, indicating that BAY SSH 0860 applications had no detrimental effect upon grain protein.

Application Timing and Persistance Studies

S-3

Visual ratings revealed that 82 to 100% cheat control was obtained in S-3 when BAY SSH 0860 was incorporated either 33 (PPI-2) or 0 (PPI-3) days before planting or applied preemergence (Table XI). However, the PPI-1 treatments, applied 68 days before planting, provided only poor cheat control.

Observation of S-3 as the wheat began to mature indicated that the highest rates of BAY SSH 0860 were delaying maturity. However, both oven drying of wheat heads collected on June 4 and grain moisture readings taken in the field before cleaning failed to show any significant differences in grain moisture.

No significant differences were found in dockage, yield, grain protein, test weight or 1000 seed weight of the harvested grain although trends could be seen in dockage and wheat yield. The failure to detect differences in these harvest parameters was attributed to the variable weed infestation at this location.

S-4

In contrast to S-3, in S-4 only BAY SSH 0860 applied on the day of planting provided substantial visual cheat control (Table XII). This difference in performance could be related to the difference in rainfall to germinate the cheat relatively early in the fall. S-3 received much 8.2 cm of rainfall in the 21 days immediately following seeding. S-4 received 0.6 cm of rainfall in the same time frame. Wheat injury, though not statistically significant, was noted in S-4 (Table XII). The

TABLE XI

RESPONSE OF CHEAT AND WHEAT TO PREPLANT INCORPORATED AND PREEMERGENCE TREATMENTS OF BAY SSH 0860 (S-3, 1981-82)

	BAY SSH 0860 Application Timing and Rate[1]				Cheat Control		Wheat Moisture[2]		Harvest Data (June 10, 1982)				
	PPI-1	PPI-2	PPI-3	Pre	Dec 21	Mar 30	Head	Grain	Yield	Dockage	Grain Protein	Test Weight	1000 Seed Wt
	(kg/ha)				(%)				(kg/ha)	(%)		(kg/hl)	(g)
1.	1.68	0	0	0	5	10	38.3	12.3	1492	16.8	12.6	73.4	28.2
2.	3.36	0	0	0	36	30	37.0	11.4	1552	18.5	11.5	75.9	30.6
3.	0	1.68	0	0	93	82	37.2	12.0	1640	11.1	11.5	77.2	30.6
4.	0	3.36	0	0	100	100	39.7	12.9	1687	10.7	12.5	75.9	29.1
5.	0	0	1.68	0	100	100	40.1	12.2	1714	10.3	12.1	75.9	28.7
6.	0	0	3.36	0	100	100	41.0	13.4	1344	16.1	13.3	74.6	28.0
7.	1.68	0	0	1.68	100	100	38.8	11.7	1653	13.5	12.5	75.9	28.8
8.	3.36	0	0	1.68	100	100	38.3	12.6	1620	11.2	12.1	75.9	30.4
9.	0	1.68	0	1.68	100	100	40.5	12.6	1566	11.5	13.0	75.9	29.1
10.	0	3.36	0	1.68	100	100	38.9	12.7	1599	12.1	12.1	74.6	29.1
11.	0	0	0	1.68	100	100	40.6	13.5	1525	11.5	12.7	75.9	29.7
12.	0	0	0	3.36	100	100	39.6	12.7	1606	12.3	12.6	74.6	29.2
13.	0	0	0	0	0	0	35.4	10.8	1331	24.7	11.5	74.6	29.0
				LSD 0.05=	32	35	NS	NS	NS	NS	NS	NS	NS

(1) PPI-1, PPI-2, and PPI-3 refer to incorporation of the herbicide 69, 33, and 0 days before seeding. Pre refers to premergence applications.

(2) Head refers to moisture obtained by oven drying entire heads collected June 4, 1982. Grain refers to grain moisture obtained in the field at harvest.

injury noted (less than 16%) was stand reduction. This injury, which was more evident in the sprayer tracks, could have been a result of soil compaction, less effective incorporation in the sprayer tracks, or a combination of these factors.

In S-4 the wheat from each plot was cleaned the same day as harvested and moisture data obtained after cleaning to overcome any effect that the dockage might have had on moisture determination. This grain moisture data revealed that the high rate of BAY SSH 0860 applied on the day of planting as well as treatments which had received a Pre application sequential to a previous PPI application had significantly higher grain moisture than the untreated plots. This indicates a herbicide- induced delay in maturity did occur. However, this delay only occurred at rates in excess of those required for cheat control as indicated by the dockage data.

No significant differences were found in 1000 seed weight and grain protein data, however, marked differences were observed in the dockage, clean grain yield, and the test weight data. All treatments except treatment 1 (1.68 kg/ha BAY SSH 0860 60 days before planting) significantly increased wheat yield compared to the untreated check. Moreover, the yield of some treatments was well over twice that of the check. However, the yield of treatment 12, which received 3.36 kg/ha PPI on the day of planting and 1.68 kg/ha Pre, was lower than the highest yielding treatment, indicating that the visual injury recorded in March was not overcome adequately to prevent yield loss even though this injury did not reduce yield nearly as much as cheat competition.

Only BAY SSH 0860 at 1.68 kg/ha applied 60 days before planting failed to significantly reduce dockage. Grain from treatments which had

TABLE XII

RESPONSE OF CHEAT AND WHEAT TO PREPLANT INCORPORATED AND PREEMERGENCE TREATMENT OF BAY SSH 0860 (S-4, 1982-83)

	BAY SSH 0860 Application Timing and Rate[1]				Cheat Control			Wheat Injury	Harvest Data (June 23, 1983)					
	PPI-1	PPI-2	PPI-3	Pre	Dec 21	Mar 8	May 20	Mar 8	Grain Moisture	Yield	Dockage	Grain Protein	Test Weight	1000 SdWt
	(kg/ha)				(%)					(kg/ha)	(%)		(kg/hl)	(g)
1.	1.68	0	0	0	10	3	5	0	12.0	1189	32.7	11.9	76.2	34.0
2.	3.36	0	0	0	34	13	10	0	12.4	1532	22.3	11.1	77.5	35.0
3.	0	1.68	0	0	38	10	3	3	12.4	1647	21.6	11.2	77.5	36.2
4.	0	3.36	0	0	56	40	35	0	12.4	1949	9.7	11.1	78.3	36.7
5.	0	0	1.68	0	85	80	70	5	12.4	1848	7.9	12.0	77.9	36.2
6.	0	0	3.36	0	90	90	90	16	14.3	1626	5.4	12.1	76.9	37.1
7.	1.68	0	0	1.68	80	88	96	9	13.0	2003	4.5	11.2	77.9	37.0
8.	3.36	0	0	1.68	90	89	95	5	13.7	1841	5.0	11.7	77.5	37.7
9.	0	1.68	0	1.68	53	79	94	0	12.9	2124	3.5	11.6	79.2	37.1
10.	0	3.36	0	1.68	84	86	93	3	13.4	1868	4.4	11.0	78.2	36.8
11.	0	0	1.68	1.68	89	90	97	15	14.4	1687	4.2	11.5	76.4	34.9
12.	0	0	3.36	1.68	89	94	98	10	13.3	1465	4.3	11.5	76.6	33.1
13	0	0	0	0	0	0	0	0	11.5	786	42.5	12.1	71.7	33.8
	LSD 0.05=				29	17	20	NS	1.6	538	14.3	0.8	1.8	NS

(1) PPI-1, PPI-2, and PPI-3 refer to incorporation of the herbicide 60, 30, and 0 days before seeding. Pre refers to preemergence applications.

been applied on the day of planting as well as all sequential treatments and the 3.36 kg/ha PPI-2 application contained significantly less dockage than that from 3.36 kg/ha applied 60 days before planting or the low rate applied at PPI-2. However, the dockage data does indicate that visual ratings of some treatments were too low because plots which were rated as having 35% control had over 75% reduction of dockage. Even plots with little or no cheat present had approximately 7% dockage because the air flow from the separator fan on the combine was restricted to insure that most of the cheat was collected in the grain bin rather than being blown out over the sieves. Thus, considerable chaff was also collected.

Grain from all herbicide treatments was significantly higher in test weight than that from the untreated check. In addition, treatment 10, which received 3.36 kg/ha PPI 30 days before planting and a sequential application of 1.68 kg/ha Pre, was higher in test weight than were the 1.68 kg/ha application 60 days before planting and treatments which received PPI and sequential treatments both on the day of planting. With the lower rate of BAY SSH 0860 applied 60 days before planting this difference was attributed to the lack of weed control obtained. With the PPI and sequential applications this reduction in test weight could have been due to wheat injury.

At Stillwater, BAY SSH 0860 applied on the day of planting provided excellent cheat control. In contrast, if application was made 60 days prior to seeding cheat control was inadequate. BAY SSH 0860 applications 30 days before seeding were variable and therefore, could not be recommended to the producer. However, the 3.36 kg/ha rate provided good cheat control as measured by dockage and yield response in S-2. The control this treatment provided was equivalent to the 1.68 kg/ha application on the day of planting indicating a half-life of approximately 30 days.

P-1

Over 95% cheat and wild oat control were obtained from all treatments except treatments 1 and 2, which were applied 69 days before planting (Table XIII). This indicates that the limit to BAY SSH 0860 residual activity had been reached or exceeded.

Wild oat control was also evaluated by counting the number of wild oat seeds present in a 100 g sample of grain that had been cleaned to remove the chaff and cheat seed. All treatments significantly reduced the number of wild oat seeds present. As in the visual ratings, the treatments applied 69 days before seeding were inferior in control of wild oats compared to applications made either 33 days prior to or on the day of seeding. However, due to the untreated borders between plots and the failure of the small plot combine to completely clean itself out between plots, low numbers of seed could be found in samples from plots in which no wild oat plants were seen.

No significant wheat injury was observed in any treatment. All herbicide treatments had more grain moisture than the untreated check. However, since this moisture reading was taken in the field prior to removing the dockage and the capacitance testing method can be somewhat inaccurate when the bulk density of the sample is modified by the presence of dockage, the actual differences in grain moisture may not have been as large as indicated.

Wheat yields were significantly increased by all treatments. Yield

TABLE XIII

RESPONSE OF CHEAT, WILD OATS, AND WHEAT TO PREPLANT INCORPORATED AND PREEMERGENCE TREATMENTS OF BAY SSH 0860 IN EXPERIMENT P-1, 1981-82

	BAY SSH 0860 Application Timing and Rate[1]				Cheat Control			Moisture[2]		Harvest Data- June 17, 1982			
												Test	Wild[3]
	PPI-1	PPI-2	PPI-3	Pre	Oct. 17	Dec. 21	Mar. 30	Head	Grain	Yield	Dockage	Weight	Oats
	(kg/ha)				(%)			(%)		(kg/ha)	(%)	(kg/hl)	
1.	1.68	0	0	0	45	35	40	49.0	13.7	1163	24.8	70.2	28.8
2.	3.36	0	0	0	88	80	78	51.1	15.0	1257	20.9	70.2	12.8
3.	0	1.68	0	0	94	96	100	49.5	14.4	1384	20.1	70.2	2.0
4.	0	3.36	0	0	98	98	100	48.9	16.2	1015	18.1	68.1	0.3
5.	0	0	1.68	0	--	99	100	50.9	15.5	1183	17.3	69.7	0.5
6.	0	0	3.36	0	--	100	100	51.4	16.6	840	21.0	67.4	0.0
7.	1.68	0	0	1.68	68	100	100	50.5	15.5	1337	17.2	69.7	0.8
8.	0	0	0	1.68	--	99	100	49.2	15.3	1331	16.4	70.1	0.0
9.	0	1.68	0	1.68	96	100	100	44.4	16.5	1001	20.4	69.0	0.0
10.	0	0	0	1.68	--	100	100	51.8	15.0	1250	16.8	70.1	0.8
11.	0	0	0	3.36	--	100	100	53.2	16.8	780	20.8	67.5	0.8
12.	----	Untreated		----	0	0	0	48.2	9.7	739	43.0	69.7	98.3
				LSD 0.05=	12	9	8	NS	1.9	262	8.2	2.1	28.8

(1) PPI-1, PPI-2, and PPI-3 refer to incorporation of the herbicide 69, 35, and 0 days before seeding. Pre refers to preemergence applications.

(2) Head refers to moisture obtained by oven drying entire heads collected June 4, 1982. Grain refers to grain moisture obtained in the field.

(3) Wild oats refers to the number of wild oats seed present in 100 g of wheat.

increases were not as dramatic in 1981 as in 1982. However, this could be due to a rather poor quality harvest at this location (see test weight data).

Dockage was significantly reduced by all treatments. The dockage data at this location were all relatively high. For example plots with 100% cheat and wild oat control had 15-20% dockage in the harvested grain. This could have been due to loss of small wheat grains in the cleaning process.

No herbicide treatment significantly increased the test weight of the clean grain. Low test weights in this experiment could have been the result 3.4 cm of rainfall in the week preceeding harvest and the subsequent wetting and drying of the kernels.

P-2

As was the case with S-3 and S-4, weed control was somewhat lower in P-2 than in P-1. However, over 90% cheat control was obtained from 3.36 kg/ha of BAY SSH 0860 applied on the day of planting as well as all sequential treatments, except treatment 7. All sequential treatments and kg/ha applied either PPI-2 or PPI-3 provided over 90% wild oat control (Table XIV). As was the case in P-1, PPI-1 treatments provided significantly less weed control which indicates the limit of BAY SSH 0860 residual activity had been reached.

All treatments except BAY SSH 0860 at 1.68 kg/ha applied 52 days before seeding contained far less wild oat seed than the untreated check. As in P-1, applications of BAY SSH 0860 either 30 days prior to or on the day of planting essentially eliminated wild oat seed from the harvested grain. Here again, the PPI-1 treatments controlled less wild

TABLE XIV

RESPONSE OF CHEAT, WILD OATS, AND WHEAT TO PREPLANT INCORPORATED AND PREEMERGENCE TREATMENTS OF BAY SSH 0860 (P-2, 1982-83)

	BAY SSH 0860 Application Timing and Rate[1]				Cheat Control			Wild Oats Control	Wheat Injury	Harvest Data (June 21, 1983)					
	PPI-1	PPI-2	PPI-3	Pre	Jan 6	April 27	May 20	May 20	April 27	Grain Moisture	Yield	Dockage	Test Weight	1000 Seed Wt	W.O.[2]
	(kg/ha)				(%)					(%)	(kg/ha)	(%)	(kg/hl)	(g)	
1.	1.68	0	0	0	5	0	0	0	0	13.5	1230	29.7	75.7	31.9	43.8
2.	3.36	0	0	0	35	30	30	38	0	13.3	1761	11.9	77.9	33.4	15.8
3.	0	1.68	0	0	50	23	50	50	0	14.1	1727	12.8	78.0	34.5	7.3
4.	0	3.36	0	0	66	59	83	93	0	14.3	2023	8.0	78.0	34.5	3.8
5.	0	0	1.68	0	68	44	76	81	0	13.8	2177	8.5	78.4	34.5	2.0
6.	0	0	3.36	0	70	70	91	97	0	13.8	2150	6.9	77.9	35.1	1.8
7.	1.68	0	0	1.68	75	68	89	92	5	13.9	1956	7.7	77.8	33.8	4.8
8.	3.36	0	0	1.68	85	86	96	97	3	14.5	2090	6.4	78.0	34.6	2.3
9.	0	1.68	0	1.68	78	83	95	100	3	14.5	2150	7.3	78.9	35.8	1.8
10.	0	3.36	0	1.68	89	90	99	100	8	14.5	2171	6.7	78.3	35.7	2.0
11.	0	0	1.68	1.68	86	95	97	100	20	14.6	2009	5.7	77.9	36.6	1.8
12.	0	0	3.36	1.68	89	98	100	100	32	14.7	2063	6.8	78.4	37.5	3.3
13.	0	0	0	0	0	0	0	0	0	13.9	813	48.5	76.1	33.3	37.8
				LSD 0.05=	19	28	15	17	6	0.8	329	12.4	1.2	1.4	15.3

(1) PPI-1, PPI-2, and PPI-3 refer to incorporation of the herbicide 52, 29, and 0 days before seeding. Pre refers to preemergence applications.

(2) W.O. refers to the number of wild oats seed present in 100 g of wheat.

oats than either the PPI-2 or PPI-3 treatments.

Treatments that consisted of both a sequential Pre treatment plus a PPI treatment on the day of planting or the treatment with 3.36 kg/ha PPI applied 30 days prior to planting plus 1.68 kg/ha Pre had significant wheat injury. The treatment which had received 3.36 kg/ha PPI-3 plus 1.68 kg/ha Pre had 32% injury. The injury was a combination of stunting and stand reduction, both of which were more evident in the wheel tracks left by the spray tractor. Other treatments caused no wheat injury. Treatments which injured the wheat contained at least twice the amount of BAY SSH 0860 required for weed control. Treatments which included application of BAY SSH 0860 both PPI and Pre applications all on the day of planting were not included in P-1.

Only treatment 12 (3.36 kg/ha PPI on the date of planting plus 1.68 kg/ha Pre) had higher grain moisture than the untreated check. Thus, it appeared that only treatments in excess of the rate required for excellent cheat control affected the wheat enough to delay maturity.

As was the case in S-4, all treatments significantly increased wheat yields. Over twofold yield increases were observed as a result of cheat control provided by many of the treatments. Treatments in which BAY SSH 0860 was applied on the day of planting resulted in higher yields than those with the herbicide applied 60 days prior to planting. Treatments 11 and 12, produced over twice the yield as the check, but less than the highest yielding treatment. This indicates that wheat injury noted in April was not totally overcome although it was far less detrimental than was competition from cheat and wild oats.

The data with dockage of 6-8% is typical of that obtained from weed-free plots harvested with the small plot combine adjusted to collect most of the cheat seed. All herbicide treatments significantly reduced the dockage compared to the untreated plots. Dockage was lower in the PPI-3 and all sequential treatments than treatment 1 (1.68 kg/ha applied PPI-1). BAY SSH 0860 at 3.36 kg/ha applied 60 or 30 days before planting reduced dockage as much as treatments applied on the day of planting.

All herbicide treatments except 1.68 kg/ha BAY SSH 0860 60 days prior to planting resulted in higher clean grain test weight than that of the untreated check. This could be a direct result of weed control and reflects the less than adequate control observed when BAY SSH 0860 was applied 60 days prior to planting.

Significant increases in the weight of 1000 seeds were observed in P-2. Treatments receiving sequential Pre applications on top of PPI applications on the day of planting or 30 days previous were significantly higher in seed weight than was the check.

BAY SSH 0860 appeared to be more active in the Teller loam at Perkins than in the Kirkland clay loam or Norge loam at Stillwater, as evidenced by the better performance of the PPI-1 and PPI-2 treatments in the Teller loam. However, as was the case at Stillwater, the performance of the PPI-1 treatments was unsatisfactory. PPI-2 treatments were, for most parameters, equal to the 1.68 kg/ha applied on the day of planting and resulted in higher yields than the 3.36 kg/ha PPI-3 treatment in P-1. At this location both persistence and initial activity appeared to be higher than that observed at Stillwater.

M-1

No visual injury was seen at any time throughout the growing season. No differences in wheat yield or grain moisture were observed (Table XV) which indicated that crop safety was very good, even in the extremely active environment of the agricultural sand soil at Mangum. However, since no cheat was present to indicate the presence of BAY SSH 0860, it was not possible to evaluate persistence at this location.

A significant tillage by herbicide treatment by Pre application interaction was present in the test weight data. The 1.68 kg/ha rate of BAY SSH 0860 which had been disc incorporated 60 days before planting and had not received a Pre application of BAY SSH 0860 was higher in test weight than was its sweep incorporated counterpart. The 1.68 kg/ha application which had been disc incorporated 30 days before seeding and had received a Pre application was higher in test weight than was its sweep incorporated counterpart. The reason for these differences is unclear, but could be moisture related due to some summer weed control provided by the disc incorporated treatments. No differences between treatment combinations existed.

M-2

As was the case in M-1, no visual wheat injury was observed throughout the growing season. No application timing by incorporation method by premergence application interaction was detected in the harvest data (Table XVI). A treatment by tillage interaction was present in the percent moisture of the harvested grain (Table XVII). The treatment consisting of BAY SSH 0860 at 1.68 kg/ha applied 60 days

TABLE XV

EFFECT OF BAY SSH 0860 INCORPORATION METHOD AND SEQUENTIAL PREEMERGENCE APPLICATIONS OF BAY SSH 0860 ON WHEAT, EXPERIMENT M-1 (1981-82)

BAY SSH 0860 Application Timing and Rate[1]				Incorp	Harvest Data (June 16, 1982)		
					Grain		Test
	PPI-1	PPI-2	Pre	Method	Moisture	Yield	Weight
	(kg/ha)				(%)	(kg/ha)	(kg/hl)
1.	1.68	0	0	DISC	11.7	1381	71.6
2.	1.68	0	1.68	DISC	11.3	1365	71.2
3.	1.68	0	0	SWEEP	11.5	987	68.2
4.	1.68	0	1.68	SWEEP	11.1	968	71.8
5.	3.36	0	0	DISC	11.2	921	70.8
6.	3.36	0	1.68	DISC	11.1	923	71.4
7.	3.36	0	0	SWEEP	11.2	806	70.9
8.	3.36	0	1.68	SWEEP	11.3	766	70.8
9.	0	1.68	0	DISC	11.5	1185	71.2
10.	0	1.68	1.68	DISC	11.2	1215	71.6
11.	0	1.68	0	SWEEP	11.5	864	70.5
12.	0	1.68	1.68	SWEEP	11.1	816	69.4
13.	0	3.36	0	DISC	11.1	1348	71.2
14.	0	3.36	1.68	DISC	11.2	1144	70.7
15.	0	3.36	0	SWEEP	11.3	831	70.9
16.	0	3.36	1.68	SWEEP	11.1	771	70.1
17.	0	0	0	DISC	11.7	1167	70.8
18.	0	0	1.68	DISC	11.4	1248	71.3
19.	0	0	0	SWEEP	11.7	757	70.7
20.	0	0	1.68	SWEEP	11.2	982	70.2
		LSD 0.05=			NS	NS	1.74

(1) PPI-1 and PPI-2 refer to herbicide incorporation 70 and 30 days before seeding. Pre refers to premergence applications.

TABLE XVI

EFFECT OF BAY SSH 0860 INCORPORATION METHOD AND SEQUENTIAL PREMERGENCE APPLICATIONS OF BAY SSH 0860 ON WHEAT, EXPERIMENT M-2 (1982-83)

BAY SSH 0860 Application Timing and Rate[1]				Incorp	Harvest Data (June 16, 1983)		
					Grain		Test
	PPI-1	PPI-2	Pre	Method	Moisture	Yield	Weight
	(kg/ha)				(%)	(kg/ha)	(kg/hl)
1.	1.68	0	0	DISC	9.9	2055	74.1
2.	1.68	0	1.68	DISC	10.5	1816	74.0
3.	1.68	0	0	SWEEP	10.8	1343	76.2
4.	1.68	0	1.68	SWEEP	12.3	1449	75.9
5.	3.36	0	0	DISC	9.7	2144	74.9
6.	3.36	0	1.68	DISC	9.8	2137	74.9
7.	3.36	0	0	SWEEP	11.0	1559	76.5
8.	3.36	0	1.68	SWEEP	10.8	1594	74.9
9.	0	1.68	0	DISC	8.9	1051	74.6
10.	0	1.68	1.68	DISC	10.6	1320	74.3
11.	0	1.68	0	SWEEP	13.2	886	75.6
12.	0	1.68	1.68	SWEEP	13.7	893	75.6
13.	0	3.36	0	DISC	10.6	1433	74.0
14.	0	3.36	1.68	DISC	10.4	1567	73.6
15.	0	3.36	0	SWEEP	12.9	787	73.6
16.	0	3.36	1.68	SWEEP	12.8	1132	71.7
17.	0	0	0	DISC	10.0	1459	73.3
18.	0	0	1.68	DISC	10.8	1391	74.0
19.	0	0	0	SWEEP	12.6	838	75.9
20.	0	0	1.68	SWEEP	14.5	922	74.6
		LSD 0.05=			NS	NS	NS

(1) PPI-1 and PPI-2 refer to herbicide incorporation 77 and 44 days before seeding. Pre refers to premergence applications.

TABLE XVII

EFFECT OF BAY SSH 0860 PREPLANT INCORPORATED TREATMENTS (AVERAGED OVER PREEMERGENCE APPLICATIONS) ON WHEAT, EXPERIMENT M-2 (1982-82)

BAY SSH 0860 Application Timing and Rate[1]			Incorp Method	Harvest Data (June 16,1983)		
	PPI-1	PPI-2		Grain Moisture[2]	Yield[3]	Test Weight[3]
	------(kg/ha)------			(%)	(kg/ha)	(kg/hl)
1.	1.68	0	DISC	10.2	1666	75.0
	1.68	0	SWEEP	11.5		
2.	3.36	0	DISC	9.7	1859	75.3
	3.36	0	SWEEP	10.8		
3.	0	1.68	DISC	9.7	1037	75.0
	0	1.68	SWEEP	13.4		
4.	0	3.36	DISC	10.5	1230	73.2
	0	3.36	SWEEP	12.9		
5.	0	0	DISC	10.3	1153	74.5
	0	0	SWEEP	13.5		
LSD 0.05 for incorp method by PPI treatment=				3.04	----	----
LSD 0.05 for PPI treatment main effect =				----	284	1.58

(1) PPI-1 and PPI-2 refer to herbicide incorporation 77 and 44 days before seeding.

(2) Data averaged over premergence application.

(3) Data averaged over both preemrgence application and incorporation method.

prior to planting with disc incorporation had significantly lower grain moisture than the untreated plots which had received sweep tillage. Within herbicide treatments the disc incorporation of both the 1.68 kg/ha applicatin of BAY SSH 0860 30 days before seeding and the untreated plots was lower in grain moisture than were the untreated sweep incorporation. Whether this difference is a result of herbicide application or moisture availability due to the tillage is unclear.

A significant difference in grain yield due to a treatment main effect did exist (Table XVII). Treatments which received PPI treatments 60 days prior to planting, (averaged over tillage and PRE treatments), were signifcantly higher in grain yield than were treatments applied 30 days prior to planting or the check. The usefulness of this effect is questionable as it averages over the PRE application of BAY SSH 8060. However, it could have been related to summer weed control provided by the 60 days preplant incorporated treatments. There were no reductions in yield from that of the untreated check again pointing to excellent crop safety.

Compared to other herbicide treated plots BAY SSH 0860 at 3.36 kg/ha applied 30 days prior to planting reduced test weight. It was not different from the untreated check, indicating once again that excellent crop safety was present.

At Mangum no wheat injury was observed, which indicates that crop safety was excellent even in the agricultural sand. Since there was no cheat pressure, herbicide activity and persistence in the sand is not discernable.

Effect of Planting Date on BAY SSH 0860 Phytotoxicity

P-3

No wheat injury from any PPI treatment of BAY SSH 0860 was observed on wheat seeded September 30 or October 21. However, BAY SSH 0860 at both 1.68 and 2.24 kg/ha caused significant stand reduction of wheat planted on November 11 and December 20 (Table XVIII). Injury from these higher rates was worse on Dec. 20 seeded wheat than on wheat seeded Nov. 11.

Averaged over seeding dates all rates of BAY SSH 0860 significantly reduced the grain yield compared to the untreated check (Table XIX). However, the effect on yield was actually due to reduced yields with the later planting dates. The planting date main effect was much more pronounced (Table XVIII). The yields of September 30 and October 21 seeded wheat were almost identical. Delaying seeding until November 11 reduced yield over 800 kg/ha and further delaying seeding until December 20 resulted in more yield reduction.

A planting date main effect was also present in the test weight data (Table XVIII). Averaged over herbicide treatment the test weight of grain harvested from plots seeded on November 11 averaged 2.0 kg/hl less than the test weight of grain seeded on October 21. Another 1.6 kg/hl drop in test weight was noted when the seeding date was further delayed until December 20. Although a seeding date by herbicide rate interaction was not found, it should be noted that wheat from plots with no herbicide treatment seeded on September 30, October 21 and November 11 had identical test weight. Test weight of wheat from the untreated check, seeded on December 20, was lower than the test weight of wheat

TABLE XVIII

INTERACTION OF BAY SSH 0860 RATE AND PLANTING DATE ON WHEAT YIELD, TEST WEIGHT AND 1000 SEED WEIGHT (EXPERIMENT P-3)

Planting Date	Rate SSH 0860	Wheat Injury (May 20)	Harvest Data (June 30, 1983) Yield	Test Weight	1000 Seed Weight
	(kg/ha)	(%)	(kg/ha)	(kg/hl)	(g)
September 30	----	0	3138	69.5	33.2
	1.12	0	2943	69.5	33.7
	1.68	0	3132	70.8	34.2
	2.24	0	2930	70.8	34.2
	(mean)	-[1]	(3037)	(69.9)	----
October 21	----	0	3064	69.5	34.4
	1.12	0	3078	70.8	34.4
	1.68	0	2997	70.8	35.7
	2.24	0	2964	70.8	35.6
	(mean)	-	(3024)	(70.2)	----
November 11	----	0	2513	69.5	35.7
	1.12	1	2177	68.2	34.1
	1.68	5	2090	68.2	33.8
	2.24	9	2016	66.9	33.7
	(mean)	-	(2197)	(68.2)	----
December 20	----	0	1700	66.9	30.6
	1.12	3	1458	66.9	31.1
	1.68	10	1391	65.6	28.8
	2.24	15	1398	66.9	29.7
	(mean)	-	(1485)	(66.6)	----
Interaction LSD 0.05=		5	----	----	1.81
Date effect LSD 0.05=		-	(168)	(1.0)	-----

(1) Planting date means not shown when significant date by rate interaction exists.

TABLE XIX

EFFECT OF BAY SSH 0860 RATE AVERAGED OVER PLANTING DATES ON WHEAT YIELD, TEST WEIGHT AND 1000 SEED WEIGHT (P-3 and S-5)

SSH 0860 Rate	P-3 Data		S-5 Data		
	Yield	Test Weight	Wheat Injury	Test Weight	1000 Seed Weight
(kg/ha)	(kg/ha)	(kg/hl)	(%)	(kg/hl)	(g)
0	2601	68.2	0	69.5	30.9
1.12	2413	68.2	2	70.8	32.0
1.68	2399	68.2	3	70.8	32.1
2.24	2318	68.2	4	70.8	31.9
LSD 0.05=	168	NS	2.4	NS	NS

seeded earlier. This indicates that herbicide treatments could have been responsible for the decline in test weight observed in the November 11 seeded plots.

BAY SSH 0860 at 1.68 and 2.24 kg/ha reduced seed weight of the wheat planted on November 11 (Table XVIII). This data also indicates the increased possibility of wheat injury from BAY SSH 0860 when seeding is delayed until November when the lower temperatures delay wheat emergence and decrease seedling growth rate.

S-5

A significant date of planting by rate of BAY SSH 0860 interaction was not detected in the visual ratings although a definite trend towards existance of an interaction could be seen (Table XX). However, both a date main effect and a rate main effect were present. Wheat seeded November 24 was injured more by BAY SSH 0860 than wheat planted earlier. This indicates that there is more potential for BAY SSH 0860 phytotoxicity with later seedings. Plots which received the two highest rates, 1.68 and 2.24 kg/ha, were higher in wheat injury than was the untreated plots (Table XIX). In contrast to P-3, in S-5 there was no significant interaction in the wheat injury data. This was attributed to the absence of a December planting date in S-5.

Planting date by herbicide rate interaction was detected in the yield data. Applications of BAY SSH 0860 at 1.68 and 2.24 kg/ha to wheat seeded November 24 significantly reduced wheat yields compared to their respective check. Low yields from the plots seeded September 21 were due to a powdery mildew infestation that, although treated with a fungicide, severely reduced wheat yields in these early seeded plots.

TABLE XX

INTERACTION OF BAY SSH 0860 RATE AND PLANTING DATE ON WHEAT YIELD, TEST WEIGHT AND 1000 SEED WEIGHT (EXPERIMENT S-5)

Planting Date	Rate SSH 0860	Wheat Injury (May 20)	Harvest Data (June 24, 1983) Yield	Test Weight	1000 Seed Weight
	(kg/ha)	(%)	(kg/ha)	(kg/hl)	(g)
September 21	----	0	1270	70.8	28.1
	1.12	0	1216	73.3	30.2
	1.68	0	1263	72.0	29.7
	2.24	0	1371	70.8	31.0
	(mean)	(0.0)	----[1]	(71.4)	(29.8)
October 14	----	0	1693	72.0	32.6
	1.12	0	1606	72.0	33.7
	1.68	0	2043	73.3	34.9
	2.24	0	1841	74.6	34.9
	(mean)	(0.0)	----	(72.8)	(33.8)
November 4	----	0	1687	69.5	31.5
	1.12	0	1680	72.6	33.8
	1.68	3	1431	74.6	34.3
	2.24	3	1767	72.6	32.9
	(mean)	(1.2)	----	(72.2)	(33.1)
November 24	----	0	1418	68.2	31.4
	1.12	6	1136	68.2	30.4
	1.68	8	847	65.6	30.7
	2.24	13	1042	65.6	28.8
	(mean)	(7.0)	----	(66.9)	(30.3)
Interaction LSD 0.05=		----	296	----	----
Date effect LSD 0.05=		(2.5)	----	(NS)	(NS)

(1) Planting date means not shown when significant date by rate interaction exists.

This yield data suggests that wheat injury is more possible with late seeded wheat as did the trend in P-3.

A planting date main effect was detected in the test weight data. Averaged over herbicide treatments, test weight of November 4 planted wheat was higher than the test weight of wheat seeded November 24. There was no herbicide effect on test weight although a trend could be seen in the November 24 planting date. The powdery mildew infestation, which more severly affected the earlier seeding dates, could be responsible for statistical inability to detect this difference.

No date by rate interaction or rate main effect was detected in the 1000 seed weight data. The weight of 1000 seeds of wheat seeded on both September 21 and November 24 was less than the seed weight of the October 14 and November 4 planting dates. In all probability the seed weight of the wheat seeded on September 21 was reduced by the disease. The seed weight reduction noted with the November 24 planted wheat, compared to the earlier seeding dates, was similar to results from P-3.

CHAPTER V

SUMMARY

In the greenhouse twice the rate of BAY SSH 0860 required to completely control cheat and four times the rate required to completely control wild oats caused no reduction in the fresh weight of TAM W 101 wheat. BAY SSH 0860 had no effect on jointed goatgrass. Thus, the herbicide appeared to be very selective for cheat and wild oat control in wheat.

Excellent cheat control was obtained in the field by PPI or PRE applications of BAY SSH 0860 at rates of 1.12 kg/ha or higher if applied on the day of planting. Treatments which had been applied over 30 days prior to planting, even if the high rate of 3.36 kg/ha, provided less cheat control and thus, wheat yields were generally less than those with the most effective treatments. This indicated that the residual activity of BAY SSH 0860 when applied in late summer was too short to obtain cheat control with applications 30 days prior to planting. Performance of the herbicide was generally consistent across location, although rainfall did have an effect. PPI applications of the lower rates of BAY SSH 0860 were more effective than preemergence applications if irrigation or rainfall for herbicide activation was not received in a timely manner. All BAY SSH 0860 applications which provided adequate weed control significantly increased wheat yields compared to the weedy check. In many instances the yield of treated plots was twofold that of the untreated plots.

All treatments of BAY SSH 0860 which provided weed control significantly reduced dockage. Some treatments that received visual ratings less than 40% still reduced dockage by over 75%. Increases in test weight and 1000 seed weight due to removal of the cheat by herbicide treatments were found. Slight delays in maturity, measured by grain moisture, were observed in some cases. Some maturity delay was detected at the 2.24 kg/ha rate of BAY SSH 0860 for a single application and when combined total rates for a sequential application went above 3.36 kg/ha applied within 30 days of seeding. Rates of BAY SSH 0860 which caused a maturity delay were above that required for excellent weed control.

No differences in grain protein due to herbicide application were observed.

BAY SSH 0860 appeared to be very selective in winter wheat when applied at normal usage rates and planting dates. However, when planting dates were delayed to late November or December the potential for injury from PPI applications of BAY SSH 8060 was increased with yield and seed weight decreases exhibited.

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TABLE XXI

RAINFALL AND IRRIGATION DATA (QUANTITIES OVER 0.1 cm) AND DATES OF INITIATION OF EXPERIMENTS -AGRONOMY RESEARCH STATION, STILLWATER, OKLAHOMA (JULY 1, 1981 - JUNE 30, 1983)

Date	Centimeters[1]	Date	Centimeters
July 4, 1981	.9	February 5	.4
July 9	3.9	February 12	.7
July 23 -Initiation of S-3	----	February 14	2.2
July 28	3.4	February 27	.8
July 29	2.8	March 14	2.2
July 30	2.9	March 27	.8
August 1	1.3	April 25	.9
August 2	.6	April 26	.6
August 7	4.8	April 29	2.1
August 13	.4	April 30	2.6
August 16	1.1	May 1	.2
September 1	.8	May 6	4.5
September 7	.4	May 12	11.4
September 12	2.7	May 13	1.8
September 13	2.1	May 17	6.1
September 14	.2	May 20	2.4
September 22 -Initiation of S-1		May 21	2.0
*September 22	7.5	May 24	1.2
*September 27	10.0	May 25	4.3
*October 5	7.5	May 27	.4
*October 8	5.6	May 28	2.0
October 8	.5	May 31	.7
*October 10	2.0	June 2	.5
October 12	3.7	June 4	.3
October 13	.4	June 11	1.1
October 14	.2	June 12	.6
October 16	2.4	June 15	1.5
October 17	.5	June 16	.2
October 26	1.5	June 19	1.7
October 31	1.3	June 21	.4
November 1	2.4	June 25	4.5
November 2	.2	July 7	.5
November 4	.5	July 10	.7
November 9	4.1	July 29	2.8
November 29	.2	July 30	.8
November 30	1.5	August 2 -Initiation of S-4	-----
December 14	.2	August 8	3.1
December 23	.2	August 30	.3
January 3, 1982	.9	September 13	.6
January 22	.4	September 14	1.1
January 30	4.9	September 15	3.8
January 31	.4	September 20	.2
February 3	5.0	September 21 -Initiation of S-5 -	

TABLE XXI (Continued)

Date	Centimeters[1]	Date	Centimeters
October 2	.2	March 4	1.6
October 6 -Initiation of S-2	--	March 5	.4
*October 6	8.5	March 20	.4
*October 9	7.5	March 23	.3
*October 12	8.0	March 24	.2
October 12	.3	March 26	3.0
*October 16	7.6	March 27	.5
*October 20	6.5	March 30	.8
October 28	1.6	April 2	.4
October 29	.2	April 4	.7
November 11	.7	April 9	.5
November 12	1.2	April 10	.7
November 22	.2	April 13	.2
November 26	2.2	April 20	.5
November 27	1.9	April 22	.2
November 28	.5	May 11	.7
December 1	.5	May 13	3.4
December 5	.8	May 14	3.3
December 10	.8	May 18	2.6
December 24	1.9	May 21	2.9
December 27	1.1	May 28	1.6
December 28	.3	May 29	2.6
January 19, 1983	.3	May 31	1.3
January 22	.4	June 11	2.9
February 1	4.0	June 14	.6
February 5	.2	June 25	.3
February 9	.7	June 26	.5
February 10	.7	June 27	1.5
February 20	1.8	June 29	2.9
February 21	.7		
February 22	.5		

1. * refers to sprinkler irrigation.

TABLE XXII

RAINFALL DATA (QUANTITIES OVER 0.1 cm) AND DATES OF INITIATION OF EXPERIMENTS -AGRONOMY RESEARCH STATION, PERKINS, OKLAHOMA (JULY 1, 1981 - JUNE 30, 1983)

Date	Centimeters	Date	Centimeters
July 1, 1981	.7	March 4	.2
July 4	2.0	March 9	.4
July 28	6.3	March 12	1.4
July 30	3.1	March 26	.2
July 31	.3	April 8	.3
August 1	4.4	April 15	.2
August 7	3.4	April 19	.2
August 13	.3	April 24	.5
August 16	1.8	April 26	.5
August 19 -Initiation of P-1 -		April 28	1.8
August 26	.9	April 29	2.5
August 27	1.8	May 1	.4
September 1	.9	May 6	3.4
September 2	.2	May 11	10.2
September 8	.6	May 12	2.3
September 13	1.9	May 13	.3
September 14	1.1	May 16	4.8
September 15	.7	May 18	.7
October 3	.7	May 19	1.6
October 6	.5	May 20	.7
October 8	.3	May 23	2.4
October 12	2.7	May 24	5.5
October 13	.6	May 26	1.7
October 16	2.2	May 27	1.7
October 17	.6	May 31	2.5
October 22	.7	June 2	.3
October 26	.3	June 3	.4
October 31	1.6	June 4	2.3
November 1	3.4	June 11	.7
November 4	.2	June 12	.7
November 9	.2	June 15	1.0
November 28	4.0	June 16	.8
November 30	1.7	June 19	.8
December 13	.2	June 21	.5
December 20	.7	June 22	.4
January 3, 1982	.5	June 25	3.4
January 22	.4	July 10	.2
January 30	5.2	July 20	.7
February 3	2.4	July 28	1.9
February 9	.4	July 29	1.9
Febraury 12	1.4	July 30	1.0
Febraury 26	.2	August 3 -Initiation of P-2 -----	

TABLE XXII (Continued)

Date	Centimeters	Date	Centimeters
August 8	.7	March 4	2.1
August 30	.7	March 5	.3
September 2	.2	March 6	.2
September 13	1.3	March 20	.5
September 18	.2	March 23	.3
September 20	.3	March 24	.2
September 30 -Initiation of P-3		March 26	3.5
October 2	.4	March 27	.3
October 2	.2	March 30	.7
October 28	.2	April 2	.4
October 29	1.2	April 4	.3
November 11	.8	April 5	2.5
November 12	1.1	April 8	.2
November 27	2.8	April 13	.3
November 28	.4	April 20	.7
December 2	2.4	April 22	.3
December 4	.6	April 23	.8
December 5	.3	May 11	.9
December 10	.8	May 13	3.1
December 11	.7	May 18	.9
December 24	3.5	May 21	2.1
December 27	1.1	May 28	2.3
December 28	8.2	May 29	1.2
January 19, 1983	.3	May 30	.4
January 22	.5	May 31	1.7
January 26	.7	June 11	3.7
February 1	4.9	June 15	1.7
February 2	.7	June 25	1.1
February 10	.3	June 26	2.1
February 20	1.6	June 27	1.9
February 21	1.3	June 28	1.1
February 22	.7	June 29	1.9

TABLE XXIII

RAINFALL DATA (QUANTITIES OVER 0.1 cm) AND DATES OF INITIATION OF EXPERIMENTS -SANDYLAND RESEARCH STATION, MANGUM, OKLAHOMA (JULY 1, 1981 - JUNE 30, 1983)

Date	Centimeters	Date	Centimeters
July 1, 1981	1.2	May 24	2.4
July 2 -Initiation of M-1	----	May 26	.5
July 9	.5	May 27	.5
July 29	2.1	May 28	4.2
July 30	.6	May 31	1.3
August 12	1.5	June 11	3.2
August 13	2.4	June 12	5.9
August 15	.3	June 18	4.3
August 16	1.3	June 19	4.4
August 27	1.2	June 21	1.4
September 6	1.0	June 24	6.9
September 24	.7	June 26	.8
September 25	.2	June 27	.4
October 4	1.2	July 3	.3
October 7	.3	July 5	.5
October 11	2.4	July 8 -Initiation of M-2	-------
October 12	1.7	July 12	.7
October 13	.2	July 28	.2
October 17	.5	July 30	3.4
October 22	.2	August 9	.2
October 25	.2	September 14	1.0
November 1	.8	September 15	5.1
November 3	.3	September 16	.2
November 8	.6	September 29	.7
November 9	.2	October 12	.5
November 29	.5	November 11	.6
November 30	2.1	November 12	.7
December 14	.3	November 25	.2
December 22	.2	November 26	1.5
January 22. 1982	.2	November 27	1.8
January 30	2.7	November 28	.2
January 31	.7	January 2, 1983	1.0
February 9	.2	January 19	1.2
February 18	.3	February 1	2.9
March 14	3.2	February 5	.8
April 10	.5	February 22	1.2
April 30	.6	March 16	2.2
May 1	.5	March 23	.2
May 12	2.2	March 26	3.6
May 13	.4	April 5	1.8
May 14	.3	April 13	.2
May 16	.4	April 21	.6
May 17	2.1	May 13	.8

TABLE XXIII (Continued)

Date	Centimeters	Date	Centimeters
May 14	1.0	May 31	.6
May 21	.7	June 6	.6
May 23	2.1	June 10	1.4
May 26	.6	June 11	2.6
May 28	.2	June 26	2.3
May 30	.3	June 28	.2

VITA 2

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