Division of Marketing
Agricultural Development and Diversification (ADD) Program

1989 Grant Final Report

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FINAL REPORT

1990

EVALUATION OF AGRONOMIC ADAPTABILITY, WEED CONTROL OPTIONS AND ECONOMICS OF PRODUCING LUPINS IN WISCONSIN

PREPARED BY: THOMAS J. GALLENBERG

WOLF RIVER VALLEY SEEDS

Research supported by a grant from the Wisconsin Department of Agriculture, Trade, and Consumer Protection's ADD grant program

and

The University of Wisconsin, Department of Agronomy
Dr. E. S. Oplinger and Dr. R. G. Harvey

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OVERVIEW OF PROJECT

The research project, "Evaluation of Agronomic Adaptability, Weed Control Options and Economics of Producing Lupins in Wisconsin", for 1990 was completed in December.

The research methods used were of standard university procedure. It is anticipated that portions of this project may be eligible for publication in the National Scientific Journals, upon completion of next years research.

Research was conducted at Arlington, Antigo, Spooner and Sturgeon Bay University Extension stations and also at our White Lake facility. The only station reporting a problem was the Sturgeon Bay site, in which an infestation of leaf hoppers severly reduced plot yields. When various crops are being tested at a location, in which insecticides are used, insects may migrate from one crop that is sprayed to another that is not sprayed. This problem has been corrected for our 1991 research and the data deleted from our 1990 results.

The variety, seeding rate and date of planting trials all responded as anticipated.

In the weed control studies, the information learned was also as anticipated. That in itself is important, do to the fact that predictability of herbicide performance or lack of performance is a prerequisite to the labeling of herbicides.

Overall, the research project was very successful. Wolf River Valley Seeds gratefully acknowledges the WDATCP's ADD program for its financial support and its staff for its assistance in this project.

University of Wisconsin-Madison

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November 12, 1990

Thomas J. Gallenberg
Wolf River Valley Seeds
N2976 County M
White Lake, WI 54491

Dear Tom:

Attached are copies of five individual reports which describe results of my 1990 lupine weed control studies. Also attached is a list of herbicide common names and trade names. For academic reasons, only common names are included in the research reports. Our 1990 results were quite promising, however, they raise several key questions which require further attention.

"Weed management systems study in lupines" summarizes investigations of integrated weed management systems for lupines planted in 30, 15 or 7 inch spaced rows. As expected, lupin yields were generally highest in 7 inch rows. Pendimethalin (Prowl) plus imazethapyr (Pursuit) applied preplant-incorporated (PPI) or imazethapyr plus nonionic surfactant (NIS) applied early postemergence (EP) provided the best weed control. Combining these herbicide treatments with rotary hoeing or cultivation improved performance, particularly control of common ragweed.

"Weed control in lupines studies at Arlington, WI" summarizes results of primarily PPI and preemergence (PRE) treatments for lupine weed control. The heavy common ragweed pressure resulted in poor performance for many treatments. PPI treatments containing clomazone (Command) provided the best control. Clomazone did cause some temporary chlorosis of lupines. I think FMC could be convinced to register the herbicide for lupines if follow-up studies confirm that the early season injury does not result in crop yield reductions. Of the PRE treatments, linuron (Lorox) and imazethapyr provided the best results. Hopefully IR-4 will obtain a label for linuron. Imazethapyr will be discussed below.

Because imazethapyr treatments caused lupine injury in previous Minnesota but not Wisconsin studies, we conducted the "Imazethapyr rate, timing, additive and lupine variety weed control study". No differences were seen in the responses of the three lupine varieties to imazethapyr. Consequently, weed control and lupine yields are pooled for the three varieties. PPI and EP imazethapyr treatments provided the best weed control and highest lupine yields. EP imazethapyr caused greater lupine injury when applied with NIS and 10-34-0 fertilizer than when applied alone or with only NIS. Yields were not adversely affected, however. When applied postemergence (POST), yields were reduced. Most of this yield reduction probably was caused by early season weed competition.

However, addition of NIS plus 10-34-0 to POST imazethapyr substantially increased crop injury and further reduced lupine yields. American Cyanamid has suggested that using only the 0.047 rather than 0.063 lb/A imazethapyr rate would reduce lupine injury. Our results at Arlington do not support the need for lower rates.

"Annual weed control in lupines at White Lake" summarizes the study at your home location. Weed pressure was not as high at this location. Hand harvest resulted in high LSD's for lupine yields. Clomazone treatments again caused initial lupine chlorosis, and that herbicide did not totally control the weed species present. Lupine yields did not appear to be reduced by any treatments.

"Annual weed control in lupines at Spooner, WI" summarizes results of the Spooner study. Again hand harvest resulted in variable yield data. Injury ratings indicated that imazethapyr applied with NIS plus 10-34-0 caused substantial lupine injury. However, elimination of additives with imazethapyr did not result in higher lupine yields. It appeared that increased weed control counteracted the greater crop injury. Suspiciously low lupine yields with imazethapyr applied at 0.063 lb/A PPI and at both rates PRE suggest possible lupine injury. Visual ratings did not identify such injury.

Overall, our 1990 studies provided the information I expected. Performance of some treatments varied between sites. This is typical since herbicide performance is affected by environmental and soil conditions. Thus, these studies need to be repeated in 1991 to determine reproducibility. This will also allow results to be published in a scientific journal (a minimum of two years data is required). Sites other than Spooner and White Lake could be used. It would be good, however, to have at least one site with sandy soils similar to Spooner. An expanded clomazone tolerance study might be included in 1991. American Cyanamide would register imazethapyr for use in lupines as soon as they are satisfied with crop tolerance. We must continue imazethapyr tolerance studies and perhaps do a better job of documenting crop responses to that herbicide at all locations. Measurements of crop heights, etc. should be taken in addition to the visual injury ratings.

If you have questions about our 1990 results, let me know. As always, I am open to other suggestions for 1991. You , Ed Oplinger, and I probably need to sit down and discuss the future of our research programs sometime soon.

Sincerely,

Gordon Harvey

Robert Gordon Harvey
Professor of Weed Science

MAJOR CONCLUSIONS OF PROJECT

To fully understand the impact of this research project one could draw a correlation between the introduction of soybeans in the 1920's and the introduction of Lupin Beans today. An excerpt from the "Kernel & The Bean", a book on the history of the Staley company, describes several of the questions farmers asked about soybeans, when they were first introduced, such as:

> "Where will we get the beans to plant as seed?"
>
> "What implements should we use for planting and harvesting?"
>
> "How far apart should we plant our rows?"
>
> "Who'll buy our soybeans once they're harvested and for how much a bushel?"
>
> "Where will the purchasers come from?"
>
> "Should the soybean plants be used mainly for hay and forage or plowing under to serve as a nitrogin supplement for a subsequent crop of corn?"
>
> "To what end-uses will the beans be put by processors?"
>
> "Will the expirement be worth the time and trouble?"

Even though agricultural technology has advanced tremendously since the 1920's, many of these same questions are asked in the 1990's. Along with the advancement in technology, also comes the increased financial commitment by todays farmer. This in turn puts greater pressure on making sound crop and production decisions.

The 1990 research data obtained will be tremendous help in our overall Lupin program.

The information on yield potential is now being established by an unbiased enity, the University of Wisconsin, which is the key factor in determining the overall economics of the crop.

The basic cultural and genetic information obtained, will allow more precise decisions to be made on production and marketing.

Overall, the major conclusion of our research is that it provided an initial foundation for the production guidelines of Lupins in Wisconsin.

MARKET OVERVIEW, PAST - PRESENT - FUTURE

From the early 1980's, until 1983, Lupins were grown mainly as a protein source for on farm use. Acreage grew to approximately 4500 acres in 1986 with dairy producers consuming the majority of available product. In 1987, commercial acreage was being developed, with Lupin's value estimated at $3.00 per 60 lb. bushel. Acreage doubled over the next year with many farmers trying to grow Lupins for the first time. Unfortunately, 1988 brought an extreme drought with major crop failures throughout the Midwest. Lupin yields declined comparatively to other crops. However, for many first time producers, the crop still remained unproven. The years from 1988 through 1989 stimulated higher commodity prices, which in turn created higher feed costs to dairy producers. This provided an opportunity to introduce Lupins as an alternative protein supplement at a competitive price. Over this time period and into 1990, a limited group of dairy farmers, including some of the top herds in Wisconsin, began gaining experience feeding Lupins and realized it was an excellent source of protein and energy. These dairy producers, in essence, provided the demand for the first structured market of Lupins in Wisconsin. There were, however, several concerns that commercial producers had about growing Lupins.

"What kind of yields can we reasonably expect?" (Based on the yield experienced in 1988)

"What herbicides are cleared for use on Lupins?"

"What are the rotational effects of Lupins?"

"What guarantees do I have that there is a market for Lupins?"

"What is the value of Lupins?"

Do to the results of our 1990 reseach project, the first three questions are being addressed. As far as the market, we have contracted with producers in the past, guaranteeing that we will purchase their entire crop, no matter what the yields are. To establish the value of Lupins we used the value of soybean meal which Lupins compare closest to from a feed performance standpoint. Do to the fact that dairy producers need a consistent supply on a year round basis and the potential volatility of the feed ingredient markets, we've established a formula for effectively hedging Lupins against soybean meal on the Chicago Board of Trade. This will allow us to confidently move ahead by limiting the exposure of our positions with future inventories. The capability to hedge can also be an effective tool for our commercial producers by allowing them more options in determining the net value of their production.

The market value of Lupins has increased steadily over the past three years. This can be attributed to the freight savings over imported protein, the performance farmers are obtaining feeding Lupins, and feeding trials being performed in Michigan, Minnesota, and California. One of the more recent trials, as listed herein, shows the improvement in production by inclusion of Lupins.

Effects of substituting lupine seed protein for soybean meal in dairy cattle diets.

M.G. MAY*, D.G. JOHNSON, D.E. OTTERBY, and
J.G. LINN. UNIVERSITY of MINNESOTA, ST. PAUL.

Sweet white lupine seeds were evaluated as a replacement for soybean meal in diets of 30 multiparous and 24 primiparous lactating Holsteins. Cows were randomly assigned to treatments in blocks of five by calving order within parity. Treatments began 22 days post-partum (pp) and ended 140 days pp. Days 15 to 21 pp were used as a covariate. Diets were isonitrogenously balanced (CP 17%) using soybean meal as the control (SSSS), with lupine seed protein substituted at levels of 25 (SSSL), 50 (SSLL), 75 (SLLL), and 100% (LLLL) of the supplement protein source. Feed intake and milk production were recorded daily. Milk components (fat, protein), were recorded weekly. Substitution of lupine seed for soybean meal did not adversly affect milk production.

		SSSS	SSSL	SSLL	SLLL	LLLL	S.E
FCM 3.5%	kg/d	27.4	29.0	28.7	30.3	28.8	.676
Milk fat	kg/d	.96	1.02	1.01	1.08	1.02	.027
Milk protein	kg/d	.82	.86	.81	.86	.82	.020
DM intake	kg/d	19.9	20.8	20.6	21.0	20.4	.493

All means are covariately adjusted.

1 kg = 2.2 lbs.

In summary, we have developed the market for Lupins to the point where demand is currently exceeding supply.

The future of Lupins in Wisconsin looks very promising. There are some key benefits to Lupins other than the nutritional values previously stated.

One of the most important benefits is its nitrogen fixing capability. With the current concerns over pesticides and groundwater contamination more farmers are looking at incorporating legumes into their rotations to reduce the need for chemical nitrogens. Lupins are one of the highest nitrogen fixing annual legumes.

As transportaion costs increase, it will become increasingly important to produce more of our feedstuffs, logistically closer.

Lupins could be a major factor to stimulate agriculture in northern Wisconsin, where crop options are limited, and useage of high protein feeds is substantial.

Our marketing plan for Lupins is two-fold.

#1 To develope and build a strong cash market, to support the Wisconsin commercial grain producers.

#2 To work with farmers who have the capability, land base, and the desire to produce Lupins for their own use.

Besides the current agronomic work being done, in the research project, there are other supporting roles we are pursuing.

Seed production is a vital role in building a solid commercial acreage. We contract with experienced, certified seed growers throughout the Midwest in regions that produce high quality seed stocks. We are working with researchers across North America who are working on the cultural, utilization, and marketing of Lupins.

In the area of genetics, we are assisting in the development of improved plant types, with a broader base of adaptability.

Our long term marketing plan involves several stages closely aligned with projected Lupin acreage growth. A general outline follows:

Phase I Commercial feed sales for 1991. We anticipate dairy feeds to be our primary market. Since every dairy operation is operated on an independent basis this allows market expansion to coincide precisley with product availability. Over the next ten years we anticipate the dairy producer to continue to be a primary consumer of Lupin beans.

Phase II As acreage and production increases, we intend to vertically integrate the Lupin market, by expanding into added value processing. We currently have the technology to fractionate the bean to remove the outer fiberous hull. This will allow us to penetrate specialty feed markets, (which we are currently testing product in), human consumption markets, (in which there is currently a pasta line utilizing Lupins), and other industrial uses. Long term these are the type of markets that will help us increase the value of Lupins. We anticipate entering into Phase II on a commercial scale by 1993.

Phase III The export potential of Lupins or processed Lupin products could be developed upon initiation of Phase II. We have already received several inquiries on the availability of feed, food, and seed grade supplies. This area of market development will probably be pursued once stable and mature markets are in place as outlined in Phase I and Phase II.

Based on cultural knowledge, anticipated research, the agricultural economy, market development, and anticipated financing, we will be pursuing the following commercial acreage growth.

YEAR	ACREAGE	TARGETED MARKET & MARKET SALES %
1991	4000 acres	Phase I - 90%, Phase II - 10%
1992	9000 acres	Phase I - 60%, Phase II - 40%
1993	16000 acres	Phase I - 40%, Phase II - 60%
1994	36000 acres	Phase I - 40%, Phase II - 55%, Phase III - 5%
1995	60000 acres	Phase I - 40%, Phase II - 45%, Phase III - 15%

As with any new crop, there are several limitations and problems to overcome to reach the desired end result, which is profitability throughout the system.

The current "Ag Development Initiative" program, administered through the ADD grant program and WHEDA, will help tremendously in solving many of the initial road blocks in our desire to develop Lupins in Wisconsin.

REVISED: PROPOSED ANNUAL BUDGET

FEBRUARY 21, 1990

	PROJECT I			PROJECT II			TOTAL		
	MATCHED FUNDS		REQUESTED FUNDS	MATCHED FUNDS		REQUESTED FUNDS			
	WRV	UW	WDATCP	WRV	UW	WDATCP	WRV	UW	WDATCP
Salaries (W R V)	$600		0	$300	0	0	$900	0	0
Salaries (U. W.)	0	$5,800	.0	0	$5,000	0	0	$10,800	0
Specialists (Martinka 30%)	0	0	$6,000	0	0	0	0	0	$6,000
(Kutil 30%)	0	0	0	0	0	$6,000	0	0	$6,000
Graduate Res. Asst.	0	0	0	0	0	0	0	0	0
Labor	0	$ 500	$2,500	0	$ 500	$2,500	0	$1,000	$5,000
Travel	$300	$ 500	$ 500	$200	$ 500	$ 500	$500	$1,000	$1,000
Computer Costs	0	$ 300	0	0	$ 300	0	0	$ 600	0
Supplies & Equipment Use	$200	$1,000	$ 500	$100	$1,000	$ 500	$300	$2,000	$1,000
Total Annual Funding	$1,100	$8,100	$9,500	$600	$7,300	$9,500	$1,700	$15,400	$19,000

(W R V) Wolf River Valley Seeds
(U W) University of Wisconsin

Total Funds Requested	$19,000.00
Total Matching Funds	$17,200.00
Total Research Project	$36,200.00

FIELD EXPERIMENT HISTORY FORM

Year: 1990

Exp. Nos.:9080, 9081, 9082, 9083
Title: 1990 LUPINE VARIETY TRIALS
Personnel: M.J. Martinka, E.S. Oplinger, R.E. Rand, R. W. Weidman, and F. Gilson
Location: Arlington, Antigo, Spooner, Sturgeon Bay
Supported by: Goldsmith Seeds and WDATCP Ag Diversification Fund

FIELD INFORMATION

Soil Types: Arl.--silt loam; Antigo-silt loam: Spoon.-loamy sand; Stur. Bay- silt loam

EXPERIMENTAL PROCEDURE

Experimental Design: Randomized Complete Block

Replicates: 4

Varieties: Ultra, Primorsky, Strain 21, 46-10, 47-5, L0125N, L0403N, L0728N, L0970N, L2011N, L2017N, L2019N, L2020N, L2082N, L2085N, L2090N, L2101N

Row spacing: Arl.- 7 in.; Antigo- 7 in.; Spoon.- 12 in.; Stur. Bay- 12 in.

Planting: Date: Arl.- 22 Apr.; Antigo-3 May; Spoon.- 23 Apr.; Stur. Bay- 20 Apr.

Harvesting: Date: Arl.-14 Aug.; Antigo-20 Sept.; Spoon.- 11 Sept.; Stur. Bay- 11 Sept.

Wisconsin Lupine Variety Trial Yield Results, 1989–90.

Variety	1990				1989–90				
	Arlington	Antigo	Spooner	1990 Mean	Arlington	Antigo	Spooner	Sturgeon Bay /1	7–Test Mean
	Yield (bu/ac)				Yield (bu/ac)				
ULTRA	66.9	52.8	47.3	55.7	48.1	47.8	35.4	51.5	44.8
PRIMORSKY	55.6	45.3	39.2	46.7	41.3	44.2	31.1	53.9	41.0
STRAIN 21	68.1	56.4	48.6	57.7	47.4	53.0	37.5	54.5	47.2
46–10	60.5	57.1	39.3	52.3	41.6	48.7	32.1	50.4	42.1
47–5	60.1	57.2	57.1	58.1	46.1	51.5	41.1	52.2	47.1
L0125N	64.8	60.8	38.7	54.8					
L0403N	69.9	59.5	50.0	59.8					
L0728N	64.2	58.0	32.1	51.4	44.4	49.2	26.8	43.2	40.6
L0970N	68.8	73.0	51.1	64.3	45.7	59.3	38.0	49.0	47.8
L2011N	60.0	60.1	39.7	53.3					
L2017N	61.1	72.5	45.4	59.7					
L2019N	68.9	67.4	50.5	62.3	46.7	52.7	37.9	50.3	46.4
L2020N	65.8	59.9	56.5	60.7	48.3	51.8	41.5	52.3	47.9
L2082N	67.1	65.7	46.4	59.7					
L2085N	66.3	52.8	41.0	53.4	47.2	49.9	33.0	52.4	44.6
L2090N	64.4	57.4	52.0	57.9	43.6	47.7	38.9	54.6	45.0
L2101N	63.3	49.0	45.0	52.4					
Mean	64.5	59.1	45.9	56.5	45.5	50.5	35.7	51.3	45.0
LSD (10%)	5.5	7.2	7.3	3.9	3.4	4.2	3.5	4.7	2.0

1/ Sturgeon Bay yield data from 1989 only.

1990 Lupine Variety Trial
Arlington, WI (Expt. 9080)

Entry	Yield	Plant Height	Plant Lodging	Population Emergence	Population Harvest	Survival	Seeds/ lb.	Maturity Days after Aug. 1
				--- plants/a-----				
	bu/a	in.	1-5	x 1000		%		
ULTRA	66.9	40	2.3	186	154	85	1424	28.0
PRIMORSKY	55.6	36	4.5	193	163	85	1557	25.3
STRAIN 21	68.1	40	3.0	199	180	90	1327	34.0
46-10	60.5	42	3.0	203	183	90	1352	31.5
47-5	60.1	47	2.5	199	172	87	1354	36.0
L0125N	64.8	42	2.8	184	161	87	1437	31.0
L0403N	69.9	42	2.3	195	173	90	1400	33.3
L0728N	64.2	38	3.3	171	173	102	1296	27.8
L0970N	68.8	37	2.3	180	181	101	1382	30.5
L2011N	60.0	40	2.3	178	175	98	1327	29.3
L2017N	61.1	37	2.0	178	168	95	1670	28.8
L2019N	68.9	40	2.3	184	184	101	1402	29.3
L2020N	65.8	43	2.5	194	188	97	1448	34.3
L2082N	67.1	39	2.5	187	155	84	1563	31.3
L2085N	66.3	37	2.8	200	176	88	1782	23.8
L2090N	64.4	44	1.8	179	158	88	1484	35.0
L2101N	63.3	37	3.5	180	175	98	1758	25.8
Mean	64.5	40	2.7	188	172	92	1468	30.3
LSD (10%)	5.5	3.1	0.9	26	25	15	57	1.8

1990 Lupine Variety Trial
Antigo, WI (Expt. 9081)

Entry	Yield	Plant Height	Plant Lodging	Seeds/ lb.
	bu/a	in.	(1-5)	
ULTRA	52.8	37	4.0	2081
PRIMORSKY	45.3	34	5.0	2144
STRAIN 21	56.4	41	4.3	1962
46-10	57.1	40	4.5	1928
47-5	57.2	41	4.0	1808
L0125N	60.8	37	3.8	2058
L0403N	59.5	40	4.3	2236
L0728N	58.0	33	3.8	1952
L0970N	73.0	38	4.3	1887
L2011N	60.1	38	3.8	1773
L2017N	72.5	35	3.3	1991
L2019N	67.4	40	4.0	1758
L2020N	59.9	41	4.5	2021
L2082N	65.7	37	3.3	2121
L2085N	52.8	36	5.0	2456
L2090N	57.4	40	4.5	1972
L2101N	49.0	36	4.8	2666
Mean	59.1	38	4.2	2048
LSD (10%)	7.2	3	0.8	246

1990 Lupine Variety Trial
Spooner, WI (Expt. 9082)

Entry	Yield	Plant Height	Plant Lodging	Population Emergence	Population Harvest	Seeds/ lb.
				--- plants/a-----		
	bu/a	in.	1-5	x 1000		
ULTRA	47.3	28	2.3	134	111	1249
PRIMORSKY	39.2	25	4.0	139	145	1277
STRAIN 21	48.6	29	1.3	156	154	1092
46-10	39.3	30	3.0	143	143	1219
47-5	57.1	34	1.3	136	133	1082
L0125N	38.7	29	3.8	121	129	1278
L0403N	50.0	31	3.0	141	159	1253
L0728N	32.1	27	3.5	121	121	1182
L0970N	51.1	26	1.8	182	144	1096
L2011N	39.7	32	2.8	156	158	1224
L2017N	45.4	28	2.8	148	167	1249
L2019N	50.5	30	3.5	153	122	1079
L2020N	56.5	35	1.0	161	151	1056
L2082N	46.4	29	1.8	144	130	1201
L2085N	41.0	27	2.3	143	173	1325
L2090N	52.0	35	1.5	124	119	1190
L2101N	45.0	31	2.5	159	176	1305
Mean	45.9	29	2.5	145	143	1197
LSD (10%)	7.3	2	1.1	43	42	115

1990 Lupine Variety Trial
Sturgeon Bay, WI (Expt. 9083)

Entry	Yield 1/	Plant Height	Plant Lodging	Population Emergence	Population Harvest	Seeds/ lb.
				--- plants/a-----		
	bu/a	in.	1-5	x 1000		
ULTRA	11.2	32.5	1.8	192	169	2289
PRIMORSKY	6.9	31.5	2.8	223	215	2338
STRAIN 21	10.5	31.3	2.0	203	190	2188
46-10	8.3	33.5	1.5	218	209	2050
47-5	9.3	34.3	1.0	219	201	2190
L0125N	11.2	34.5	1.0	178	169	1952
L0403N	9.8	34.5	1.8	237	216	2325
L0728N	4.0	29.5	1.8	168	152	2070
L0970N	11.2	32.5	2.0	207	187	2227
L2011N	7.9	32.3	1.5	248	228	1783
L2017N	3.0	30.3	1.0	211	199	2881
L2019N	5.1	31.0	2.0	249	225	2191
L2020N	9.4	32.3	1.5	211	182	2331
L2082N	7.1	31.5	1.5	264	245	2368
L2085N	6.6	30.8	1.8	233	218	2932
L2090N	12.2	36.3	1.0	208	201	2290
L2101N	10.6	35.5	1.3	229	210	2587
Mean	8.5	32.6	1.6	217	201	2293
LSD (10%)	4.6	3.6	1.0	43	38	211

1/ Due to severe leafhopper infestation the yields were adversely affected.

1990 Combined Lupine Variety Trials

Arlington, Antigo, and Spooner WI (Expt. 9080-82)

Entry	Yield	Plant Height	Plant Lodging	Seeds/ lb.
	bu/a	in.	(1-5)	
ULTRA	55.7	35	2.9	1585
PRIMORSKY	46.7	32	4.5	1659
STRAIN 21	57.7	37	2.9	1460
46-10	52.3	37	3.5	1500
47-5	58.1	40	2.6	1415
L0125N	54.8	36	3.5	1591
L0403N	59.8	38	3.2	1630
L0728N	51.4	32	3.5	1477
L0970N	64.3	34	2.8	1455
L2011N	53.3	37	3.0	1441
L2017N	59.7	33	2.7	1637
L2019N	62.3	36	3.3	1413
L2020N	60.7	39	2.7	1508
L2082N	59.7	35	2.5	1629
L2085N	53.4	33	3.4	1854
L2090N	57.9	40	2.6	1548
L2101N	52.4	34	3.6	1910
Mean	56.5	36	3.1	1571
LSD (10%)	3.9	1	0.5	80

1990 Lupine Variety Trial Yield Results

Variety	Arlington	Antigo	Spooner	Mean
	Yield (bu/ac)			Yield (bu/ac)
ULTRA	66.9	52.8	47.3	55.7
PRIMORSKY	55.6	45.3	39.2	46.7
STRAIN 21	68.1	56.4	48.6	57.7
46-10	60.5	57.1	39.3	52.3
47-5	60.1	57.2	57.1	58.1
L0125N	64.8	60.8	38.7	54.8
L0403N	69.9	59.5	50.0	59.8
L0728N	64.2	58.0	32.1	51.4
L0970N	68.8	73.0	51.1	64.3
L2011N	60.0	60.1	39.7	53.3
L2017N	61.1	72.5	45.4	59.7
L2019N	68.9	67.4	50.5	62.3
L2020N	65.8	59.9	56.5	60.7
L2082N	67.1	65.7	46.4	59.7
L2085N	66.3	52.8	41.0	53.4
L2090N	64.4	57.4	52.0	57.9
L2101N	63.3	49.0	45.0	52.4
Mean	64.5	59.1	45.9	56.5
LSD (10%)	5.5	7.2	7.3	3.9

FIELD EXPERIMENT HISTORY FORM

Exp. No. 9084-85 Year: 1990
Title: LUPINE DATE OF PLANTING STUDY AT TWO LOCATIONS
Personnel: M.J. Martinka, R.E. Rand, and E.S. Oplinger
Location: Arlington Research Station, Spooner Research Station, WI
Supported by: Hatch Project 1890 and WDATCP Ag Diversification Fund

FIELD INFORMATION

Arlington Location
Field No.: 369A Soil Type: Plano silt loam
Tillage Operations: Conventional (Fall plowed, field cultivator, cultimulcher)
Previous Crop: Soybeans
Irrigation: none

EXPERIMENTAL PROCEDURE

Experimental Design: RCB plot design Replicates: 4

Variables: Date of Planting (3)

Plot Size:
Arlington
Planted: 6' x 25'
Harvested: 4.4'x 75'
Row Spacing: 7"

Spooner
Planted: 4' x 25'
Harvested: 2' x 21'
Row Spacing: 12"

Planting:
Arlington
Date: April 22, May 7, and 22 Rate (seeds/a): 180000 Depth: 1
Equipment: Hefty G tractor with mounted cone type planter

Spooner
Date: April 23, May 9, and 21 Rate (seeds/a): 180000 Depth: 1'
Equipment: Hand Planted and Harvested

Harvesting:
Arlington
Date: Sept. 14 Equipment: Almaco plot combine #1

Spooner
Date: Sept. 11

Cultivar(s): Ultra

	Material	Rate	Method	Date
Herbicide(s):	Prowl	2 pts/ac	PPI	20 April
	Dual	2 pts/ac	PPI	
Insecticide(s):	Asana XL	2.5 oz/A	Tractor mounted Sprayer	

1990 Lupine Date of Planting Study
Arlington, Spooner, WI (Expt. 9084-85)

Location	Planting Date	Yield	Plant Height	Plant Lodging	Population Emergence	Population Harvest	Survival	Seeds/ lb.
					--- plants/a-----			
		bu/a	in.	(1-5)	(x1000)		%	
Arlington	April 22	52.2	36.9	3.0	176.0	121.5	70	1338
Arlington	May 7	49.2	34.0	3.5	145.0	140.5	100	1471
Arlington	May 22	45.1	34.1	4.5	127.7	111.4	89	1339
Mean		48.8	35.0	3.7	149.6	124.5	86	1383
Spooner	April 23	50.2	28.0	1.0	163.4	140.5	88	1127
Spooner	May 9	29.9	24.6	1.0	110.0	86.0	79	1297
Spooner	May 21	39.2	34.3	1.0	126.3	118.7	94	896
Mean		39.8	29.0	1.0	133.2	115.1	87	1107

Arlington

Probability (%) Planting Date	0.2	21.5	7.8	1.1	3.6	1	<.1
LSD (10%) Planting Date	8.4	ns	1.3	57.0	34.9	36	134
C.V. (%)	6.2	10.0	22.3	18.4	16.3	20	3

Spooner

Probability (%) Planting Date	<.1	<.1		4.7	0.3	30	0
LSD (10%) Planting Date	2.1	6.1		32.3	32.4	ns	238
C.V. (%)	8.9	3.4		17.9	14.4	14	8

FIELD EXPERIMENT HISTORY FORM

Exp. No. 9087 Year: 1990
Title: LUPINE ROW SPACING BY SEEDING RATE STUDY
Personnel: M.J. Martinka, and E.S. Oplinger
Location: Arlington Research Station Arlington, WI
Supported by: Hatch Project 1890 and WDATCP Ag. Diversification Fund

FIELD INFORMATION

Field No.: 450 W Soil Type: Plano silt loam
Soil Test Results: Date: 9/89 pH: 6.1 P(#/A): 118 K(lb/A):310 OM(T/A): 34
Tillage Operations: Conventional (summer plowed, field cultivator, cultimulcher)
Previous Crop: Small Grains

EXPERIMENTAL PROCEDURE

Experimental Design: RCB Split-split plot design Replicates: 4

Variables: Row Spacing (3), Varieties (3), Seeding Rates (3)

Plot Size: Planted: 25' x 6' (7" rows), 25' x 7.5' (15" rows), 25' x 10' (30" rows)
Harvested: 21' x 53" (7-7" rows), 21' x 5' (4-15" rows), 21' x 5' (2-30" rows)
Row Spacing: 7, 15 and 30"

Planting: Date: 23 April, 1990 Rate (seeds/sq ft): Var. Depth: 1"
Equipment: Hefty plot planter

Harvesting: Date: 11 Sept. 1990 Equipment: Almaco plot combine #1

Cultivar(s): Ultra, Primorsky, and 46-10

	Material	Rate	Method	Date
Herbicide(s):	Prowl	2 pts/ac	PPI	20 April
	Dual	2 pts/ac	PPI	
Insecticide(s):	Asana XL	2.5 oz/ac	Tractor mounted Sprayer	

1990 Lupine Row Spacing and Seeding Rate Study
Arlington, WI (Expt. 9087)

Row Spacing	Variety	Seeding Rate	Yield	Plant Height	Plant Lodging	Population Emerged	Population Harvest	Survival	Seeds/ lb
in.		Seeds/a (x 1000)	bu/a	in.	(1-5)	--- plants/a--- (x 1000)		%	
7	Ultra	120	66.0	41.0	2.5	114	118	97	1426
7	Ultra	180	67.6	38.5	2.5	163	164	100	1420
7	Ultra	240	69.8	37.5	2.3	216	203	94	1366
7	Primorsky	120	62.5	36.8	2.8	133	112	85	1510
7	Primorsky	180	65.2	39.5	3.5	188	180	96	1522
7	Primorsky	240	65.9	40.5	4.0	256	244	96	1457
7	46-10	120	68.7	43.0	2.0	134	122	92	1378
7	46-10	180	64.3	41.5	3.0	173	141	82	1372
7	46-10	240	71.3	41.0	2.5	235	227	97	1324
15	Ultra	120	62.4	39.5	2.3	142	135	96	1407
15	Ultra	180	64.6	39.8	2.0	198	161	84	1425
15	Ultra	240	62.4	37.8	2.5	249	212	85	1356
15	Primorsky	120	62.9	38.5	2.8	146	140	96	1494
15	Primorsky	180	60.8	39.0	3.5	217	201	93	1473
15	Primorsky	240	61.8	39.0	3.5	265	222	87	1439
15	46-10	120	63.9	42.5	2.3	129	125	96	1281
15	46-10	180	58.8	39.8	2.3	216	198	97	1318
15	46-10	240	63.3	41.3	2.0	237	236	101	1307
30	Ultra	120	59.2	38.8	1.5	123	114	92	1315
30	Ultra	180	57.4	37.0	1.8	187	173	94	1320
30	Ultra	240	57.5	37.3	2.0	229	199	90	1279
30	Primorsky	120	54.4	36.8	2.0	173	150	89	1467
30	Primorsky	180	55.6	37.8	3.3	182	158	88	1424
30	Primorsky	240	57.8	36.5	3.8	269	204	76	1429
30	46-10	120	53.3	39.5	1.8	128	134	105	1314
30	46-10	180	57.0	40.3	2.5	200	172	87	1239
30	46-10	240	59.8	39.0	2.5	242	214	90	1236
7	Ultra		67.8	39.0	2.4	164	162	97	1404
7	Primorsky		64.5	38.9	3.4	192	178	92	1496
7	46-10		68.1	41.8	2.5	181	163	90	1358
15	Ultra		63.1	39.0	2.3	196	169	89	1396
15	Primorsky		61.8	38.8	3.3	209	188	92	1468
15	46-10		62.0	41.2	2.2	194	186	98	1302
30	Ultra		58.0	37.7	1.8	180	162	92	1305
30	Primorsky		55.9	37.0	3.0	208	171	84	1440
30	46-10		56.7	39.6	2.3	190	174	94	1263
7		120	65.7	40.3	2.4	127	117	91	1438
7		180	65.7	39.8	3.0	174	161	93	1438
7		240	69.0	39.7	2.9	235	225	96	1383
15		120	63.1	40.2	2.4	139	133	96	1394
15		180	61.4	39.5	2.6	210	187	91	1405
15		240	62.5	39.3	2.7	250	223	91	1367
30		120	55.6	38.3	1.8	141	133	95	1365
30		180	56.7	38.3	2.5	190	168	89	1328
30		240	58.4	37.6	2.8	247	206	85	1315

(Cont.)

1990 Lupine Row Spacing and Seeding Rate Study

Arlington, WI (Expt. 9087)

Row Spacing in.	Variety	Seeding Rate Seeds/a (x 1000)	Yield bu/a	Plant Height in.	Plant Lodging (1-5)	Population Emerged --- plants/a--- (x 1000)	Population Harvest	Survival %	Seeds/lb
	Ultra	120	62.5	39.8	2.1	126	122	95	1382
	Ultra	180	63.2	38.4	2.1	183	166	93	1388
	Ultra	240	63.2	37.5	2.3	231	204	90	1334
	Primorsky	120	59.9	37.3	2.5	151	134	90	1490
	Primorsky	180	60.5	38.8	3.4	195	180	92	1473
	Primorsky	240	61.8	38.7	3.8	263	223	86	1442
	46-10	120	62.0	41.7	2.0	131	127	98	1324
	46-10	180	60.1	40.5	2.6	196	170	89	1309
	46-10	240	64.8	40.4	2.3	238	226	96	1289
7			66.8	39.9	2.8	179	168	93	1419
15			62.3	39.7	2.6	200	181	93	1389
30			56.9	38.1	2.3	193	169	90	1336
	Ultra		63.0	38.6	2.1	180	164	93	1368
	Primorsky		60.8	38.3	3.2	203	179	89	1468
	46-10		62.3	40.9	2.3	188	174	94	1308
		120	61.5	39.6	2.2	136	128	94	1399
		180	61.3	39.2	2.7	191	172	91	1390
		240	63.3	38.9	2.8	244	218	91	1355
Mean			62.0	39.2	2.6	190	172	92	1381
Probabilty (%)									
Row Spacing (R)			<.1	3.7	5.7	14.4	23.1	>50	6.9
Variety (V)			28.3	<.1	<.1	1.5	8.8	26.2	<.1
R x V			>50	>50	>50	>50	>50	16.3	>50
Seeding Rate (SR)			14.8	>50	<.1	<.1	<.1	>50	<.1
R x SR			>50	>50	22.3	>50	8.1	31.7	11.1
V x SR			>50	16.9	1.1	>50	>50	31.1	>50
R x V x SR			>50	>50	>50	>50	4.9	>50	28.9
LSD (10%)									
Row Spacing (R)			0.4	0.2	0.1	ns	ns	ns	49
Variety (V)			ns	0.9	0.1	12.0	10.9	ns	28
Seeding Rate (SR)			ns	ns	0.1	11.7	9.4	ns	15
C.V. (%)			7.7	6.8	23.4	15.4	13.7	12.9	2.7

FIELD EXPERIMENT HISTORY FORM

Exp. No. 9088 Year: 1990
Title: LUPINE ROW SPACING BY SEEDING RATE STUDY
Personnel: M.J. Martinka, and E.S. Oplinger
Location: Antigo (Langlade Co.), WI
Supported by: Hatch Project 1890 and WDATCP Ag. Diversification Fund

FIELD INFORMATION

Soil Type: Antigo silt loam
Tillage Operations: Conventional (Fall plowed, field cultivator, cultimulcher)
Previous Crop: Potatoes

EXPERIMENTAL PROCEDURE

Experimental Design: RCB Split-split plot design Replicates: 4

Variables: Row Spacing (3), Varieties (3), Seeding Rates (3)

Plot Size: Planted: 25' x 6' (7" rows), 25' x 7.5' (15" rows), 25' x 10' (30" rows)
Harvested: 21' x 53" (7-7" rows), 21' x 5' (4-15" rows), 21' x 5' (2-30" rows)
Row Spacing: 7, 15 and 30"

Planting: Date: 3, May 1990 Rate (seeds/sq ft): Var. Depth: 1"
Equipment: Hefty plot planter

Harvesting: Date: 20, Sept. 1990 Equipment: Almaco plot combine #1

Cultivar(s): Ultra, Primorsky, and 46-10

	Material	Rate	Method	Date
Herbicide(s):	Lorox	2 pts/ac	Pre-emergence	12, April

1990 Lupine Row Spacing and Seeding Rate Study

Antigo, WI (Expt. 9088)

Row Spacing in.	Variety	Seeding Rate Seeds/a (x 1000)	Yield bu/a	Plant Height in.	Plant Lodging (1-5)	Population Emerged --- plants/a--- (x 1000)	Population Harvest	Survival %	Seeds/ lb
7	Ultra	120	63.0	35.8	3.0	134	120	90	1948
7	Ultra	180	61.9	38.0	4.0	152	130	87	2054
7	Ultra	240	60.1	35.0	3.3	202	150	74	1916
7	Primorsky	120	54.6	34.8	3.8	145	142	99	2139
7	Primorsky	180	43.5	36.0	4.8	176	158	90	1814
7	Primorsky	240	47.2	37.0	4.5	205	180	89	1624
7	46-10	120	69.6	39.0	3.0	131	135	105	1728
7	46-10	180	57.4	38.3	3.5	185	160	86	1913
7	46-10	240	57.5	37.8	3.3	237	214	90	1859
15	Ultra	120	59.5	35.8	2.8	108	87	81	2051
15	Ultra	180	51.0	35.5	3.5	129	130	101	2073
15	Ultra	240	56.7	35.0	4.0	190	160	84	2053
15	Primorsky	120	49.1	35.0	3.3	106	97	94	2212
15	Primorsky	180	44.4	35.8	4.3	156	142	91	2081
15	Primorsky	240	44.7	33.0	4.3	214	194	91	2223
15	46-10	120	70.3	34.8	2.5	122	112	95	1692
15	46-10	180	61.3	37.3	3.3	155	135	87	1805
15	46-10	240	60.1	37.8	3.5	215	186	87	1606
30	Ultra	120	50.2	34.0	3.8	101	96	96	1996
30	Ultra	180	47.1	35.5	3.3	132	122	92	2054
30	Ultra	240	45.3	32.3	3.3	171	151	89	2079
30	Primorsky	120	40.9	32.8	3.8	119	105	88	2146
30	Primorsky	180	36.3	39.8	4.3	171	153	90	2292
30	Primorsky	240	37.4	35.5	4.8	196	186	95	2392
30	46-10	120	57.8	36.3	2.8	124	113	92	1751
30	46-10	180	49.9	34.5	3.8	159	148	94	1853
30	46-10	240	48.2	38.8	3.5	212	199	94	1856
7	Ultra		61.7	36.3	3.4	162	133	84	1973
7	Primorsky		48.5	35.9	4.3	176	160	92	1859
7	46-10		61.5	38.3	3.3	184	170	94	1833
15	Ultra		55.7	35.4	3.4	142	126	88	2059
15	Primorsky		46.1	34.6	3.9	159	145	92	2172
15	46-10		63.9	36.6	3.1	164	144	90	1701
30	Ultra		47.5	33.9	3.4	135	123	92	2043
30	Primorsky		38.2	36.0	4.3	162	148	91	2276
30	46-10		52.0	36.5	3.3	165	153	93	1820
7		120	62.4	36.5	3.3	136	132	98	1938
7		180	54.3	37.4	4.1	171	149	88	1927
7		240	54.9	36.6	3.7	215	181	84	1799
15		120	59.6	35.2	2.8	112	99	90	1985
15		180	52.3	36.2	3.7	147	136	93	1986
15		240	53.8	35.3	3.9	207	180	87	1961
30		120	49.6	34.3	3.4	114	105	92	1964
30		180	44.4	36.6	3.8	154	141	92	2066
30		240	43.6	35.5	3.8	193	179	92	2109

(Cont.)

1990 Lupine Row Spacing and Seeding Rate Study

Antigo, WI (Expt. 9088)

Row Spacing in.	Variety	Seeding Rate Seeds/a (x 1000)	Yield bu/a	Plant Height in.	Plant Lodging (1-5)	Population Emerged --- plants/a--- (x 1000)	Population Harvest	Survival %	Seeds/ lb
	Ultra	120	57.5	35.2	3.2	114	101	89	1998
	Ultra	180	53.3	36.3	3.6	138	127	93	2060
	Ultra	240	54.0	34.1	3.5	188	153	82	2016
	Primorsky	120	48.2	34.2	3.6	123	115	94	2165
	Primorsky	180	41.4	37.2	4.4	168	151	90	2062
	Primorsky	240	43.1	35.2	4.5	205	187	91	2080
	46-10	120	65.9	36.7	2.8	125	120	97	1723
	46-10	180	56.2	36.7	3.5	166	148	89	1857
	46-10	240	55.2	38.1	3.4	221	200	90	1773
7			57.2	36.8	3.7	174	154	90	1888
15			55.2	35.5	3.5	155	138	90	1977
30			45.9	35.5	3.7	154	141	92	2046
	Ultra		55.0	35.2	3.4	146	127	88	2025
	Primorsky		44.2	35.5	4.2	165	151	92	2102
	46-10		59.1	37.1	3.2	171	156	92	1784
		120	57.2	35.3	3.2	121	112	93	1962
		180	50.3	36.7	3.8	157	142	91	1993
		240	50.8	35.8	3.8	205	180	88	1956
Mean			52.8	36.0	3.6	161	145	91	1971
Probabilty (%)									
Row Spacing (R)			1.9	>50	>50	<.1	27.9	>50	>50
Variety (V)			<.1	<.1	<.1	<.1	<.1	7.6	<.1
R x V			10.9	24.1	>50	>50	>50	18.7	31.3
Seeding Rate (SR)			<.1	14.8	<.1	<.1	<.1	20.2	>50
R x SR			>50	>50	38.3	>50	15.7	21.3	>50
V x SR			9.6	14.1	>50	30.3	22.1	27.2	>50
R x V x SR			>50	14.4	>50	>50	>50	>50	>50
LSD (10%)									
Row Spacing (R)			5.1	ns	0.3	5.8	ns	ns	ns
Variety (V)			2.0	0.9	0.3	9.2	9.7	3.1	163
Seeding Rate (SR)			ns	ns	ns	9.3	9.2	ns	ns
C.V. (%)			8.9	8.4	9.5	14.5	15.9	13.6	13.2

Title: 1990 Weed Management Systems Study in Lupines (LUPN 1 90)

Personnel: R.G. Harvey, E.D. Birschbach and J.W. Albright

Location: Arlington Exp. Stn. Department: Agronomy

Plot information:

A. Field no.: 361
B. Soil type: Plano silt loam
C. % OM: 3.2
D. pH: 6.9
E. Variety: 'Ultra'
F. Date planted: Apr 18
G. Planting pop.: 155 lb/A
H. Planting depth: 1-1.5 inches
I. Row spacing: 7, 15 and 30 inches
J. Date harvested: Aug 21
K. Plot size: 10 x 30 Ft.
L. No. reps/design: 3 / RCB

Herbicide application data:

A. Application equipment: Tractor-mounted compressed air sprayer, GPA = 20 PSI = 25, MPH = 3, Tips = 8002, Nozzle spacing = 15 in., Height = 14 in.
B. Incorporation equipment: Mulch treader, 2 passes.

C. Date treated:	Apr 18	May 8	Jun 4
D. Treatment:	PPI	EP	PDIR
E. Soil surface:	Dry	Dry	Moist
F. Soil temp.(2 in) (F):	44	75	69
G. Air temperature (F):	55	72	61
H. Wind/direction (mph):	7-15 SW	10-16 S	3-6 NW
I. Relative humidity(%):	31	57	43
J. Sky description:	Clear	Clear	Clear
K. Crop - height (in):	0	2-3	7-9
- stage(pent):	0	2-3	6-8
L. Colq - height (in):	0	0.5-1	3-5
- stage (lf):	0	1-2	6-8
Corw - height (in):	0	0.5-1	3-6
- stage (lf):	0	1	6-7
Lath - height (in):	0	0.5	0-1
- stage (lf):	0	Cotyl	0-2
Gift - height (in):	0	0.5	1-3
- stage (lf):	0	1-3	2-3

Previous Cropping and Tillage: Soybeans; plowed (fall 89), digger and harrow used, and cultimulched (spring 90).

Fertilization: None.

Other Pesticides Used: Permethrin was applied at 0.1 lb/A on July 6 and esfenvalerate was applied at 0.03 lb/A on July 11.

Principle Weeds Present: Common lambsquarters (Colq), common ragweed (Corw), ladysthumb (Lath) and giant foxtail (Gift).

(continued)

1990 WISCONSIN LUPINE VARIETY TRIALS

Experimental Procedure Information

Research Conducted by: E. S. Oplinger and M. J. Martinka
Department of Agronomy
University of Wisconsin
Madison, WI 53706

	Locations			
	Arlington	Antigo	Spooner	Sturgeon Bay[1/]
Soil Type :	Silt loam	Silt loam	Loamy sand	Silt loam
Row Spacing (in.) :	7	7	12	12
Planting Date :	22 April	3 May	23 April	20 April
Harvest Date :	14 Sept.	20 Sept.	11 Sept.	11 Sept.
Cooperator :	S. Kraak	F. Gilson	R. Rand	R. Weidman

[1/]Data are not included in trial summary due to low yields caused by leaf hopper infestations.

Experimental design : Randomized complete block with 4 replications.

Variety entries :	Company	Entries
	Wolf River Valley Seeds N2976 Cty M White Lake, WI 54991	Ultra, Primorsky, Strain 21, 46-10, 47-5
	Goldsmith Seeds, Inc. 6744 Avenue 304 Visalia, CA 93291	L0125N, L0403N, L0728N, L0970N, L2011N, L2017N, L2019N, L2020N, L2082N, L2085N, L2090N, L2101N

Research support provided by: Wolf River Valley Seeds, Goldsmith Seeds, Inc. and the Wisconsin Agricultural Diversification Program (WDATCP).

Results: See accompanying table for summary of yield results.

SUMMARY OF 1990 RESULTS

Project I, Evaluation of the Agronomic Adaptability of Lupins in Wisconsin.

Lupin yields in 1990 returned to the levels we were experiencing prior to the drought year of 1988.

In the variety trials the overall state average was 56.5 bushel per acre. A suprising statistic is that the Arlington research station, in southern Wisconsin, had the highest average of 64.5 bushel per acre. Lupins are generally associated with producing a higher yielding crop in the northern regions of the state. However, this shows that in cooler years it has excellent yield potential even farther south.

Statistically, most of the varieties tested showed excellent yield potential. Variety trials over a period of several years will help to determine cultivars that, on an average, will produce consistently acceptable yields with the desired traits.

In the date of planting trial the results were as anticipated, however, the difference's were not as significant as prior years. This particular study is important to further identify the ideal date to plant Lupins in different regions of Wisconsin.

The row spacing and seeding rate study also performed as anticipated. The optimum seeding rate and row spacing continues to be seven inch rows and 150 to 180 thousand plants per acre.

Yield response due to soil type was not as significant a factor this past year do to adequate precipitation in most areas. Silt Loam soil types continue to be the most preferred type, over sandy soils, do to their increased moisture holding capacity.

Project II, Weed Control in Lupins.

Currently there are three herbicides registered for use on Lupins, Dual, Prowl, and Poast. Dual and Poast are mainly grass herbicides and Prowl is a broadleaf herbicide. We are experiencing some limitations on growing Lupins in certain parts of Wisconsin do to the weed species that are incurred, and the limited spectrum of control that the labeled herbicides provide.

The purpose of this project is to identify potential products that can control these weeds and to establish an intergrated weed management system for Lupins.

Another important aspect of this research is the interaction of the university and the chemical companies. They rely heavily on the professors who are doing the research work for input on the need, application guidelines, and effectiveness of there products.

Weed control studies were conducted at three locations Arlington, Spooner, and White Lake. From this research, three herbicides, Linuron, Pursuit, and Command show good promise for potential use on Lupins. These three compounds would dramatically expand our broadleaf weed control spectrum. The potential labeling of one, two or all three of these products could expand the production potential of Lupins substantially in other regions of the state.

As with Project I, weed control studies need to be repeated over a period of years to fully understand the plants interaction with the cultural factors surrounding it. We are, however, starting to answer many of the questions with the results of these two research projects.

University of Wisconsin-Madison

Department of Agronomy
1575 Linden Drive
Madison, Wisconsin 53706
608-262-1390

November 7, 1990

To: 1990 Lupine Research Cooperators
Gene Aksland - Goldsmith Seeds
Tom Gallenberg - Wolf River Seeds
Richard Weidman - Sturgeon Bay Research Station
Robert Rand - Spooner Research Station
Francis Gilson - Langlade Co. Extension

From: E. S. Oplinger and M. J. Martinka
Ed Oplinger Mark Martinka

Re: 1990 Research Results

Enclosed are results from the 1990 Lupine Research Studies conducted in Wisconsin. They include Variety Trial results from Arlington, Antigo, Spooner and Sturgeon Bay; Date of Planting results from Arlington and Spooner; and Row Spacing x Seeding Rate Studies from Arlington and Antigo.

Severe leaf hopper infestations at Sturgeon Bay severely lowered yields, thus the results from the management studies at this location are not included. In addition, I have elected not to include results from this location in the overall variety trial summary which will be released to county extension agents, growers and the media since it does not reflect the lupine yield potential in this area of the state.

In general, yields were considerably higher than in 1988 or 1989, especially at Arlington. We did see considerable lodging in all experiments at Antigo. Lodging has not been a problem in previous experiments, at least in Wisconsin to my knowledge.

We are in the process of summarizing this data over the last 2-3 years, and will be distributing it to agents, media, etc. Your interest in the lupine research is appreciated. Our current plan is to continue these trials in 1991.

cj

Title: 1990 Weed Management Systems Study in Lupines (LUPN 1 90) (continued)

Results and Comments: Rotary hoeing and cultivation did not provide adequate weed control in lupines without a supplemental herbicide treatment. In the absence of mechanical practices, pendimethalin plus imazethapyr, and imazethapyr plus nonionic surfactant provided the best weed control. Planting lupines in rows spaced 7 or 15 rather than 30 inches apart improved weed control from the above mentioned herbicide treatments. Postemergence-directed imazethapyr plus methylated sunflower oil and 10-34-0 fertilizer or linuron plus crop oil concentrate improved late-season weed control but did not significantly increase lupine yields.

Table. Weed management systems study in lupines (R.G. Harvey, E.D. Birschbach and J.W. Albright).

Treatments[a]	Time of application	Rate of application	Crop vigor reduction[b] May 31	Crop vigor reduction[b] Jun 11	Weed control[c] Jun 29 Colq	Jun 29 Corw	Jun 29 Lath	Jun 29 Gift	Aug 2 Colq	Aug 2 Corw	Aug 2 Lath	Aug 2 Gift	Yield[d]
		(lb/A)	---- (%) ----		---------- (%) ----------								(Bu/A)
Lupines planted in 30-inch rows:													
No Mechanical Weed Control													
No herbicide	---	---	0	0	0	0	0	0	0	0	0	0	19
Pendimethalin	PPI	1.0	0	0	96	58	95	96	99	0	93	96	19
Pendimethalin + imazethapyr	PPI	1.0+0.047	0	2	99	94	99	99	98	38	95	91	33
Imazethapyr + NIS	EP	0.047+0.25%	13	2	99	94	99	99	98	7	99	95	20
Imazethapyr + MSO + 10-34-0	PDIR	0.063+ 4qt+1qt	0	9	0	0	0	0	67	75	96	98	28
Linuron + COC	PDIR	1.0+1qt	0	22	0	0	0	0	99	99	96	13	17
Rotary hoe													
No herbicide	---	---	0	0	85	91	88	78	0	0	0	0	16
Pendimethalin	PPI	1.0	0	2	98	91	99	99	93	12	94	96	21
Pendimethalin + imazethapyr	PPI	1.0+0.047	3	2	99	98	99	99	99	83	98	96	35
Imazethapyr + NIS	EP	0.047+0.25%	13	0	99	98	99	99	99	62	99	87	44
Cultivation													
No herbicide	---	---	0	0	89	84	88	86	0	0	0	0	18
Pendimethalin	PPI	1.0	0	0	99	96	99	99	99	0	81	99	16
Pendimethalin + imazethapyr	PPI	1.0+0.047	2	0	98	99	98	98	63	76	93	79	38
Imazethapyr + NIS	EP	0.047+0.25%	5	1	99	99	99	99	98	85	99	88	43
Lupines planted in 15-inch rows:													
No Mechanical Weed Control													
No herbicide	---	---	0	0	0	0	0	0	0	0	0	0	19
Pendimethalin	PPI	1.0	0	0	99	65	96	99	93	13	94	96	17
Pendimethalin + imazethapyr	PPI	1.0+0.047	5	2	99	96	99	99	99	65	99	98	33
Imazethapyr + NIS	EP	0.047+0.25%	13	2	99	96	99	99	95	37	99	98	41
Imazethapyr + MSO + 10-34-0	PDIR	0.063+ 4qt+1qt	0	22	0	0	0	0	77	87	93	98	15
Linuron + COC	PDIR	1.0+1qt	0	32	0	0	0	0	98	97	97	27	14
Rotary hoe													
No herbicide	---	---	0	0	78	73	65	76	0	0	0	0	23
Pendimethalin	PPI	1.0	2	0	99	92	98	99	99	28	91	96	28
Pendimethalin + imazethapyr	PPI	1.0+0.047	12	4	99	99	99	99	99	93	98	98	51
Imazethapyr + NIS	EP	0.047+0.25%	13	2	99	98	99	99	99	63	99	98	51
Lupines planted in 7-inch rows:													
No Mechanical Weed Control													
No herbicide	---	---	0	0	0	0	0	0	0	0	0	0	21
Pendimethalin	PPI	1.0	0	0	98	59	86	99	96	10	99	96	23
Pendimethalin + imazethapyr	PPI	1.0+0.047	5	5	99	98	99	99	99	58	97	97	49
Imazethapyr + NIS	EP	0.047+0.25%	13	3	98	97	99	99	94	67	99	97	50
Rotary hoe													
No herbicide	---	---	0	0	81	91	74	79	0	0	0	0	24
Pendimethalin	PPI	1.0	5	2	99	90	98	99	99	17	98	97	30
Pendimethalin + imazethapyr	PPI	1.0+0.047	12	4	99	98	99	99	99	89	99	98	54
Imazethapyr + NIS	EP	0.047+0.25%	13	3	99	98	99	99	99	72	99	93	43
		LSD (0.10) =	4	4	3	16	17	3	14	27	7	12	14

[a] NIS was X-77, a nonionic surfactant by Valent U.S.A.; COC is Prime Oil by Riverside/Terra; MSO was methylated sunflower oil, a surfactant by AGSCO, Inc.

[b] Vigor reduction is a visual ratings of 0 to 100, where 100 is total crop destruction.

[c] Weed control is a visual rating of weed biomass reduction ranging from 0 to 100, where 100 is complete weed control.

[d] Yields are adjusted to 13% moisture at 60 lb/bu.

Title: 1990 Weed Control in Lupines Studies at Arlington, WI (LUPN 2,3 90)

Personnel: R.G. Harvey, E.D. Birschbach and J.W. Albright

Location: Arlington Exp. Stn. Department: Agronomy

Plot information:

A. Field no.: 361
B. Soil type: Plano silt loam
C. % OM: 3.2
D. pH: 6.9
E. Variety: 'Ultra'
F. Date planted: Apr 18
G. Planting pop.: 155 lb/A
H. Planting depth: 1-1.5 inches
I. Row spacing: 15 inches
J. Date harvested: Aug 21
K. Plot size: 10 x 30 Ft.
L. No. reps/design: 3 / RCB

Herbicide application data:

A. Application equipment: Tractor-mounted compressed air sprayer, GPA = 20 PSI = 25, MPH = 3, Tips = 8002, Nozzle spacing = 15 in., Height = 14 in.
B. Incorporation equipment: Mulch treader, 2 passes.

C. Date treated:	Apr 18	Apr 23	May 8
D. Treatment:	PPI	PRE	EP
E. Soil surface:	Dry	Dry	Dry
F. Soil temp.(2 in) (F):	44	53	75
G. Air temperature (F):	55	79	72
H. Wind/direction (mph):	7-15 SW	6-11 S	10-16 S
I. Relative humidity(%):	31	54	57
J. Sky description:	Clear	P.Cloudy	Clear
K. Crop - height (in):	0	0	2-3
- stage(pent):	0	0	2-3
L. Colq - height (in):	0	0	0.5-1
- stage (lf):	0	0	1-2
Corw - height (in):	0	0	0.5-1
- stage (lf):	0	0	1
Lath - height (in):	0	0	0.5
- stage (lf):	0	0	Cotyl
Gift - height (in):	0	0	0.5
- stage (lf):	0	0	2-3

Previous Cropping and Tillage: Soybeans; plowed (fall 89), digger and harrow used, and cultimulched (spring 90).

Fertilization: None.

Other Pesticides Used: Permethrin was applied at 0.1 lb/A on July 6 and esfenvalerate was applied at 0.03 lb/A on July 11.

Principle Weeds Present: Common lambsquarters (Colq), redroot pigweed (Rrpw), velvetleaf (Vele), common ragweed (Corw) and giant foxtail (Gift).

(continued)

Title: 1990 Weed Control in Lupines Studies at Arlington, WI (LUPN 2,3 90) (continued)

Results and Comments: Lupine yields were excellent in 1990, probably as a result of cool weather. Most herbicide treatments controlled common lambsquarters, ladysthumb smartweed and giant foxtail. Common ragweed was more difficult to control. Of the preplant-incorporated treatments, only those which included clomazone provided greater than 90% late-season ragweed control. Preemergence treatments containing linuron or imazethapyr provided the most promising ragweed control.

Table. Weed control in lupines study at Arlington, WI (R.G. Harvey, E.D. Birschbach and J.W. Albright).

Treatments[a]	Time of application	Rate of application	Crop vigor[b] reduction		Weed control[c]								Yield[d]
					Jun 29				Aug 2				
			May 31	Jun 11	Colq	Corw	Lath	Gift	Colq	Corw	Lath	Gift	
		(lb/A)	---- (%) ----		---------------- (%) ----------------								(Bu/A)
Section A: Preplant incorporated treatments.													
Weedy check	---	---	0	0	0	0	0	0	0	0	0	0	24
Handweeded	---	---	0	3	99	86	99	98	99	69	99	98	44
Clomazone	PPI	0.5	7	5	98	98	99	98	93	95	99	98	57
Clomazone	PPI	0.75	10	11	99	98	99	99	99	95	99	98	58
EPTC	PPI	2.0	4	0	94	89	89	97	62	50	83	93	46
EPTC	PPI	3.0	5	1	96	76	98	96	92	54	94	96	41
Alachlor	PPI	2.0	3	1	91	64	98	90	94	43	99	88	40
Alachlor	PPI	4.0	3	0	97	87	92	99	91	57	90	98	51
Metolachlor	PPI	2.0	2	0	71	55	81	98	75	53	96	99	41
Metolachlor	PPI	4.0	3	2	95	65	98	98	93	27	94	99	35
Imazethapyr	PPI	0.047	2	0	98	92	99	80	95	74	99	95	44
Imazethapyr	PPI	0.063	5	0	99	97	98	88	99	86	98	93	66
Pendimethalin	PPI	0.75	0	0	98	44	92	95	99	43	91	97	42
Pendimethalin	PPI	1.0	2	0	99	56	98	96	99	35	97	97	40
Pendimethalin	PPI	1.5	3	0	98	80	98	89	99	46	97	96	49
Trifluralin	PPI	0.75	2	0	95	70	78	90	96	35	99	94	48
Trifluralin	PPI	1.0	3	2	98	68	99	98	97	43	99	98	37
Trifluralin	PPI	1.5	3	1	99	70	97	98	99	52	94	97	37
Trifluralin + clomazone	PPI	0.75+0.5	7	3	97	96	99	94	97	91	99	96	51
Trifluralin + clomazone	PPI	0.75+0.75	11	7	95	97	99	98	94	96	99	98	61
Pendimethalin + clomazone	PPI	1.0+0.5	10	5	93	95	99	98	94	91	99	96	53
Pendimethalin + clomazone	PPI	1.0+0.75	12	11	98	99	99	98	96	97	99	98	51
Pendimethalin + EPTC	PPI	1.0+2.0	3	1	99	67	95	98	96	33	94	98	41
Pendimethalin + EPTC	PPI	1.0+3.0	7	1	99	89	91	98	99	40	96	97	43
Pendimethalin + alachlor	PPI	1.0+2.5	2	0	95	86	97	97	99	35	96	99	54
Pendimethalin + metolachlor	PPI	1.0+2.0	3	0	99	75	97	98	97	71	95	99	49
Pendimethalin + metolachlor	PPI	1.0+3.0	2	0	86	55	98	97	99	29	99	98	38
Pendimethalin + metolachlor	PPI	1.5+2.0	2	0	98	51	98	99	95	36	99	97	35
Pendimethalin + imazethapyr	PPI	1.0+0.047	6	1	99	95	99	98	99	81	99	95	59
Pendimethalin + imazethapyr	PPI	1.0+0.063	3	2	99	97	99	98	99	89	99	99	53
Pendimethalin / imazethapyr + X-77	PPI/ EP	1.0/ 0.047+0.25%	7	1	99	83	99	98	99	63	99	98	59
Pendimethalin / imazethapyr + X-77	PPI/ EP	1.0/ 0.063+0.25%	5	2	99	92	99	99	99	73	99	99	65
		LSD (0.10) =	3	3	12	30	11	5	17	37	5	5	14

(continued)

Table. Weed control in lupines study at Arlington, WI (R.G. Harvey, E.D. Birschbach and J.W. Albright) (continued).

Treatments[a]	Time of application	Rate of application	Crop vigor[b] reduction		Weed control[c]								Yield[d]
					Jun 29				Aug 2				
			May 31	Jun 11	Colq	Corw	Lath	Gift	Colq	Corw	Lath	Gift	
		(lb/A)	---- (%) ----		---------------- (%) ----------------								(Bu/A)
Section B: Preemergence treatments.													
Weedy check	---	---	0	0	0	0	0	0	0	0	0	0	22
Alachlor	PRE	2.0	8	1	87	95	99	99	89	82	95	99	41
Alachlor	PRE	4.0	12	2	96	97	99	99	93	71	99	99	50
Metolachlor	PRE	2.0	0	0	89	70	98	99	90	47	99	99	39
Metolachlor	PRE	4.0	2	0	83	96	97	99	91	62	98	99	51
Linuron	PRE	0.5	3	1	98	97	90	97	97	82	90	97	49
Linuron	PRE	0.75	3	0	99	96	98	99	99	75	99	93	54
Linuron	PRE	1.0	2	1	99	98	99	99	99	91	96	97	61
Imazethapyr	PRE	0.047	12	5	97	98	99	99	96	94	99	98	51
Imazethapyr	PRE	0.063	16	2	99	99	99	99	99	95	99	97	58
Pendimethalin	PRE	0.75	0	0	96	83	98	99	99	50	99	99	34
Pendimethalin	PRE	1.0	3	0	99	64	99	99	99	32	99	98	41
Pendimethalin	PRE	1.5	2	0	99	91	99	99	99	48	99	99	53
Alachlor + linuron	PRE	2.0+0.75	8	0	93	96	98	99	91	88	98	99	50
Alachlor + linuron	PRE	2.0+1.0	12	0	97	98	97	99	83	85	96	99	56
Pendimethalin + imazethapyr	PRE	1.0+0.047	8	2	99	98	99	99	99	79	97	98	51
Pendimethalin + imazethapyr	PRE	1.0+0.063	13	1	99	95	99	99	99	90	99	99	57
Metolachlor + linuron	PRE	2.0+0.75	3	2	87	69	98	99	93	58	96	99	36
Metolachlor + linuron	PRE	2.0+1.0	5	0	86	66	86	99	99	48	99	97	38
Metolachlor + imazethapyr	PRE	2.0+0.047	13	3	99	97	99	99	99	88	99	98	61
Metolachlor + imazethapyr	PRE	2.0+0.063	13	2	99	99	99	99	99	91	99	99	55
Sethoxydim + COC	PRE	0.15+1qt	13	3	47	70	85	93	59	48	79	96	24
		LSD (0.10) =	6	2	15	32	6	1	11	33	6	4	15

[a] NIS was X-77, a nonionic surfactant by Valent U.S.A.
[b] Vigor reduction is a visual ratings of 0 to 100, where 100 is total crop destruction.
[c] Weed control is a visual rating of weed biomass reduction ranging from 0 to 100, where 100 is complete weed control.
[d] Yields are adjusted to 13% moisture at 60 lb/bu.

Title: 1990 Imazethapyr Rate, Timing, Additive and Lupine Variety Weed Control Study (LUPN 4 90)

Personnel: R.G. Harvey, E.D. Birschbach and J.W. Albright

Location: Arlington Exp. Stn. Department: Agronomy

Plot information:
A. Field no.: 361
B. Soil type: Plano silt loam
C. % OM: 3.2
D. pH: 6.9
E. Varieties: See below
F. Date planted: Apr 18
G. Planting pop.: 155 lb/A
H. Planting depth: 1-1.5 inches
I. Row spacing: 15 inches
J. Date harvested: Aug 21
K. Plot size: 10 x 30 Ft.
L. No. reps/design: 3 / RCB

Herbicide application data:
A. Application equipment: Tractor-mounted compressed air sprayer, GPA = 20 PSI = 25, MPH = 3, Tips = 8002, Nozzle spacing = 15 in., Height = 14 in.
B. Incorporation equipment: Mulch treader, 2 passes.

C. Date treated:	Apr 18	May 8	May 29
D. Treatment:	PPI	EP	POST
E. Soil surface:	Dry	Dry	Dry
F. Soil temp.(2 in) (F):	44	75	60
G. Air temperature (F):	55	72	65
H. Wind/direction (mph):	7-15 SW	10-16 S	8-10 NE
I. Relative humidity(%):	31	57	60
J. Sky description:	Clear	Clear	Clear
K. Crop - height (in):	0	2-3	3-5
- stage(pent):	0	2-3	5-7
L. Colq - height (in):	0	0.5-1	1.5-2
- stage (lf):	0	1-2	4-6
Corw - height (in):	0	0.5-1	2-3
- stage (lf):	0	1	3-4
Lath - height (in):	0	0.5	0.5-1
- stage (lf):	0	Cotyl	1
Gift - height (in):	0	0.5	1.5-2
- stage (lf):	0	2-3	2-3

Previous Cropping and Tillage: Soybeans; plowed (fall 89), digger and harrow used, and cultimulched (spring 90).

Crop Information: Varieties: 'Ultra', 'Primorsky' and '46-10'.

Fertilization: None.

Other Pesticides Used: Permethrin was applied at 0.1 lb/A on July 6 and esfenvalerate was applied at 0.03 lb/A on July 11.

(continued)

Title: 1990 Imazethapyr Rate, Timing, Additive and Lupine Variety Weed Control Study (LUPN 4 90) (continued)

Principle Weeds Present: Common lambsquarters (Colq), common ragweed (Corw), ladysthumb (Lath) and giant foxtail (Gift).

Results and Comments: Concern has been expressed about lupine tolerance to imazethapyr. This study confirms previous Wisconsin trials which indicate that preplant-incorporated treatments provide excellent weed control without significant lupine injury, early postemergence treatments are less injurious to lupines than postemergence treatments, and addition of adjuvants, particularly nonionic surfactant (NIS) plus 10-34-0 fertilizer, increases lupine injury. The most injury occurred when imazethapyr was applied postmergence with NIS and 10-34-0. Significant differences were not observed between responses of the three varieties to the imazethapyr treatments.

Table. Imazethapyr rate, timing, additive and lupine variety weed control study (R.G. Harvey, E.D. Birschbach and J.W. Albright).

Treatments[a]	Time of application	Rate of application	Crop vigor[b] reduction May 31	Crop vigor[b] reduction Jun 11	Weed control[c] Jun 29 Colq	Jun 29 Corw	Jun 29 Lath	Jun 29 Gift	Aug 2 Colq	Aug 2 Corw	Aug 2 Lath	Aug 2 Gift	Yield[d]
		(lb/A)	---- (%)	----	----	----	----	(%)	----	----	----	----	(Bu/A)
Herbicide treatments[e]													
Weedy check	---	---	0	0	0	0	0	0	0	0	0	0	24
Imazethapyr	PPI	0.047	1	0	98	91	98	91	98	89	99	96	57
Imazethapyr	PPI	0.063	3	0	97	90	99	89	98	91	98	97	51
Imazethapyr	EP	0.047	6	0	76	61	86	84	95	57	99	98	53
Imazethapyr	EP	0.063	8	2	96	87	99	88	97	65	99	99	51
Imazethapyr + NIS	EP	0.047+0.25%	5	0	90	66	96	75	98	66	99	97	48
Imazethapyr + NIS	EP	0.063+0.25%	7	0	90	87	95	93	98	73	99	98	58
Imazethapyr + NIS + 10-34-0	EP	0.047+ 0.25%+1qt	12	2	94	94	99	93	99	83	99	99	55
Imazethapyr + NIS + 10-34-0	EP	0.063+ 0.25%+1qt	16	7	97	96	99	99	99	94	99	98	59
Imazethapyr	POST	0.047	3	1	14	38	88	36	36	77	99	99	37
Imazethapyr	POST	0.063	9	2	70	77	90	87	49	98	99	99	40
Imazethapyr + NIS	POST	0.047+0.25%	7	2	45	61	93	89	64	95	99	98	43
Imazethapyr + NIS	POST	0.063+0.25%	9	2	65	86	89	86	77	97	99	99	45
Imazethapyr + NIS + 10-34-0	POST	0.047+ 0.25%+1qt	22	14	75	87	93	91	62	91	99	99	27
Imazethapyr + NIS + 10-34-0	POST	0.063+ 0.25%+1qt	24	15	82	85	96	89	87	92	98	99	30
		LSD (0.10) =	3	3	12	13	6	12	10	16	1	1	8
Lupine hybrids													
'Ultra'			9	3	73	74	88	79	78	77	92	92	48
'Primorsky'			9	3	73	74	88	79	76	77	92	92	46
'46-10'			9	3	73	74	88	79	78	80	92	92	42

[a] NIS was X-77, a nonionic surfactant by Valent U.S.A.
[b] Vigor reduction is a visual ratings of 0 to 100, where 100 is total crop destruction.
[c] Weed control is a visual rating of weed biomass reduction ranging from 0 to 100, where 100 is complete weed control.
[d] Yields are adjusted to 13% moisture at 60 lb/bu.
[e] No difference in variety was realized so data was averaged for all three.

Title: 1990 Annual Weed Control in Lupines at White Lake, WI (LUPNWL 90)

Personnel: R.G. Harvey, T.J. Gallenberg and J.W. Albright

Location: White Lake, Wis

Department: Agronomy

Plot information:

A. Field no.: ---
B. Soil type: Antigo silt loam
C. % OM: 3.2
D. pH: 6.1
E. Variety: 'Ultra'
F. Date planted: Apr 26
G. Planting pop.: 175 lb/A
H. Planting depth: 1-1.5 inches
I. Row spacing: 8 inches
J. Date harvested: Sep 14
K. Plot size: 10 x 30 Ft
L. No. reps/design: 3 / RCB

Herbicide application data:

A. Application equipment: Tractor-mounted compressed air sprayer, GPA = 20 PSI = 25, MPH = 3, Tips = 8002, Nozzle spacing = 15 in., Height = 14 in.
B. Incorporation equipment: Mulch treader, 2 passes.

C. Date treated:	Apr 26	May 22
D. Treatment:	PPI/PRE	EP
E. Soil surface:	Dry	Wet
F. Soil temp.(2 in) (F):	78	58
G. Air temperature (F):	78	63
H. Wind/direction (mph):	10-14 SW	4-6 SW
I. Relative humidity(%):	40	46
J. Sky description:	P.Clear	Cloudy
K. Crop - height (in):	0	0-2.5
- stage (lf):	0	0-2
Lath - height (in):	0	0-0.5
- stage (lf):	0	0-2
Yeft - height (in):	0	0-1
- stage (lf):	0	0-2

Previous Cropping and Tillage: Winter triticale; disked twice (Spring).

Fertilization: 9-23-23 at 400 lb/A (Fall 89).

Other Pesticides Used: None.

Principle Weeds Present: Ladysthumb (Lath) and yellow foxtail (Yeft).

Results and Comments: Slight lupine chlorosis occurred from all clomazone treatments. Clomazone treatments provided poor ladysthumb smartweed and yellow foxtail control, and alachlor treatments provided poor ladysthumb smartweed control. All other treatments provided excellent weed control. Lupine yields were estimated from small, hand-harvested samples. Thus yield data are quite variable and do not always reflect differences in crop injury or weed control.

Table. Annual weed control in lupines study at White Lake, WI (R.G. Harvey, T.J.Gallenberg and J.W. Albright).

Treatments[a]	Time of application	Rate of application	Crop vigor[b] Reduction May 23	Weed control[c] Jun 15 Lath	Yeft	Yield[d]
		(lb/A)	(%)	---- (%) ----		(Bu/A)
Weedy check	---	---	0	0	0	34
Handweeded	---	---	0	98	99	50
Clomazone	PPI	0.5	8	66	66	65
Clomazone	PPI	0.75	8	60	66	37
EPTC	PPI	3.0	0	99	98	42
Pendimethalin	PPI	1.5	0	99	99	50
Pendimethalin + clomazone	PPI	1.0+0.5	5	99	99	44
Pendimethalin + clomazone	PPI	1.0+0.75	10	96	98	43
Pendimethalin + metolachlor	PPI	1.0+2.0	0	99	99	40
Linuron	PRE	0.75	0	94	99	49
Metolachlor	PRE	2.0	0	98	99	62
Metolachlor + linuron	PRE	2.0+0.75	0	97	98	57
Alachlor	PRE	2.0	0	65	99	43
Alachlor + linuron	PRE	2.0+0.75	0	66	99	60
Imazethapyr	PPI	0.047	0	98	98	48
Imazethapyr	PPI	0.063	0	99	99	51
Imazethapyr	PRE	0.047	0	99	99	48
Imazethapyr	PRE	0.063	0	98	99	40
Imazethapyr	EP	0.047	0	99	99	51
Imazethapyr	EP	0.063	0	99	99	33
Imazethapyr + NIS	EP	0.047+0.25%	0	99	99	53
Imazethapyr + NIS	EP	0.063+0.25%	0	99	99	52
Imazethapyr + NIS + 10-34-0	EP	0.047+0.25%+1qt	0	99	98	43
Imazethapyr + NIS + 10-34-0	EP	0.063+0.25%+1qt	0	99	99	46
		LSD (0.10) =	3	31	23	19

[a] Additive: NIS is X-77, a nonionic surfactant by Valent U.S.A.
[b] Injury is a visual rating of 0 to 100, where 100 is total crop destruction.
[c] Weed control is a visual rating of weed biomass reduction ranging from 0 to 100, where 100 is complete weed control.
[d] Yields adjusted to 13% moisture at 60 lb/bu.

Title: 1990 Annual Weed Control in Lupines at Spooner, WI (LUPNSP 90)

Personnel: R.G. Harvey, R.E. Rand and J.W. Albright

Location: Spooner Exp. Stn.

Department: Agronomy

Plot information:
- A. Field no.: 'L'
- B. Soil type: Pence loamy sand
- C. % OM: 1.8
- D. pH: 6.6
- E. Variety: 'Ultra'
- F. Date planted: Apr 25
- G. Planting pop.: 175 lb/A
- H. Planting depth: 1.5-2.0 inches
- I. Row spacing: 8 inches
- J. Date harvested: Sep 11
- K. Plot size: 10 x 30 Ft
- L. No. reps/design: 3 / RCB

Herbicide application data:
- A. Application equipment: Tractor-mounted compressed air sprayer, GPA = 20 PSI = 25, MPH = 3, Tips = 8002, Nozzle spacing = 15 in., Height = 14 in.
- B. Incorporation equipment: Mulch treader, 2 passes.

C. Date treated:		Apr 25	May 22
D. Treatment:		PPI/PRE	EP
E. Soil surface:		Dry	Moist
F. Soil temp.(2 in) (F):		72	64
G. Air temperature (F):		78	67
H. Wind/direction (mph):		10-15 S	3-11 SW
I. Relative humidity(%):		45	42
J. Sky description:		Clear	Clear
K. Crop	- height (in):	0	2-3.5
	- stage (lf):	0	2-4
Colq	- height (in):	0	0-1
	- stage (lf):	0	0-2
Howe	- height (in):	0	0-1.5
	- stage (lf):	0	0-4
Yeft	- height (in):	0	0-0.5
	- stage (lf):	0	0-2

Previous Cropping and Tillage: Sorghum-sudan grass; chisel plowed and disked one time (Spring).

Fertilization: None.

Other Pesticides Used: Chlorpyrifos at 1 pt/A applied three times to control leafhoppers.

Principle Weeds Present: Common lambsquarters (Colq), horseweed (Howe) and yellow foxtail (Yeft).

(continued)

Title: 1990 Annual Weed Control in Lupines at Spooner, WI (LUPNSP 90) (continued)

Results and Comments: Hand harvest of only small portions of each plot resulted in variable yield data. Consequently, lupine yields do not always correspond with observed weed control. Pendimethalin plus clomazone, pendimethalin plus metolachlor, metolachlor plus linuron, and alachlor plus linuron were particularly effective. Trends suggest that yields of lupines on this light soil were higher when imazethapyr was applied at 0.047 than 0.063 lb/A. Severe lupine injury occurred when imazethapyr was applied early postemergence with nonionic surfactant and 10-34-0 fertilizer.

Table. Annual weed control in lupines study at Spooner, WI (R.G. Harvey, R.E. Rand and J.W. Albright).

Treatments[a]	Time of application	Rate of application	Crop vigor[b] Reduction Jun 1	Weed control[c] Jun 15 Colq	Howe	Yeft	Yield[d]
		(lb/A)	(%)	------	(%)	-----	(Bu/A)
Weedy check	---	---	0	0	0	0	38
Handweeded	---	---	0	94	86	97	37
Clomazone	PPI	0.5	0	61	92	36	40
Clomazone	PPI	0.75	0	87	88	83	45
EPTC	PPI	3.0	3	78	81	67	38
Pendimethalin	PPI	1.5	0	92	85	94	35
Pendimethalin + clomazone	PPI	1.0+0.5	0	90	90	95	36
Pendimethalin + clomazone	PPI	1.0+0.75	7	87	92	94	47
Pendimethalin + metolachlor	PPI	1.0+2.0	0	85	86	98	50
Linuron	PRE	0.75	0	79	93	90	44
Metolachlor	PRE	2.0	0	2	98	98	40
Metolachlor + linuron	PRE	2.0+0.75	0	88	94	98	47
Alachlor	PRE	2.0	0	81	72	92	45
Alachlor + linuron	PRE	2.0+0.75	0	95	94	95	44
Imazethapyr	PPI	0.047	5	98	95	93	41
Imazethapyr	PPI	0.063	7	99	94	94	25
Imazethapyr	PRE	0.047	7	98	89	87	31
Imazethapyr	PRE	0.063	3	99	88	95	28
Imazethapyr	EP	0.047	10	88	87	98	42
Imazethapyr	EP	0.063	10	90	90	93	39
Imazethapyr + NIS	EP	0.047+0.25%	3	61	96	67	31
Imazethapyr + NIS	EP	0.063+0.25%	11	93	88	94	34
Imazethapyr + NIS + 10-34-0	EP	0.047+0.25%+1qt	40	96	91	99	34
Imazethapyr + NIS + 10-34-0	EP	0.063+0.25%+1qt	40	97	92	99	30
		LSD (0.10) =	10	21	14	25	15

[a] Additive: NIS is X-77, a nonionic surfactant by Valent U.S.A.
[b] Injury is a visual rating of 0 to 100, where 100 is total crop destruction.
[c] Weed control is a visual rating of weed biomass reduction ranging from 0 to 100, where 100 is complete weed control.
[d] Yields adjusted to 13% moisture at 60 lb/bu.

Pesticide Index

Common Name	Trade Name	Manufacturer
2,4-D amine [4 L]	Weedar 64	Rhone-Poulenc
2,4-D ester [4 L]		Rhone-Poulenc
2,4-DB [2 L]	Butyrac 200	Rhone-Poulenc
2,4-DB Low Volume [3.8 L] [5.7 L]	Weedone LV4, LV6	Rhone-Poulenc
AC 263,499 (see Imazethapyr)		
AC 310,448 [3 L]	None	Cyanamid
AC 513,655 [4.8 L]	None	Cyanamid
AC 513,851 [2.7 L]	None	Cyanamid
Acetochlor [8 L]	Harness	Monsanto
Acifluorfen [2 L]	Blazer	Rohm & Haas
Alachlor [4 L] [67 WDG]	Lasso	Monsanto
Alachlor (MT) [4 L]	Lasso Micro-Tech	Monsanto
Ametryn [80 D]	Evik	CIBA-Geigy
Atrazine [4 L] [90 DF]	AAtrex	CIBA-Geigy
BAS-51702 [1.67 L]	None	BASF
Benefin [1.5 L] [2 L]	Balan	Dow/Elanco
Bensulide [4 L]	Prefar	ICI
Bentazon [4 L]	Basagran	BASF
Bromoxynil [2 L]	Buctril	Rhone-Poulenc
Butylate+ [6.7 L]	Sutan+	ICI
CGA-136,872 (see Primasulfuron)		
CGA-180,937 [7.8 L]	None	CIBA-Geigy
Chloramben [75 D]	Amiben	Rhone-Poulenc
Chlorimuron [25 DF]	Classic	DuPont
Cinmethylin [7 L]	Cinch	DuPont
CL-23601 [3.75 L]	None	Agrolinz
CL-23747 [3.75 L]	None	Agrolinz
Clethodim [0.94 L]	Select	Valent USA
Clomazone [4.0 L]	Command	FMC
Clopyralid [3 L]	Lontrel	Dow/Elanco
Cyanazine [4 L] [90 DF]	Bladex	DuPont
Cycloate+ [6 L]	Marathon	ICI
DCPA [75 WP]	Dacthal W-75	Fermenta
Desmedipham [1.3 L]	Betanex	Nor-Am
Dicamba [4 L]	Banvel	Sandoz
Dichlobenil	Norosac	PBI-Gordon
Dichlofop [3 L]	Hoelon, Hoegrass	Hoechst
Diethatyl [4 ES]	Antor	Nor-Am
Diphenamid	Enide	Upjohn
Diquat [2 L]	Diquat	Valent
Diuron [80 WP]	Karmex	DuPont
DPX-79376-25 [0.8 L]	Assure II	DuPont
DPX-79406 [25 DF]	None	DuPont
DPX-E9636 [25 DF]	None	DuPont
DPX-JL193 [50 WP]	None	DuPont
DPX-M6316 [75 DF]	Harmony	DuPont
DPX-V9360 (see Nicosulfuron)		
DPX-Y6202-38 [0.75 L]	None	DuPont
EL-177 [80 D]	None	Dow/Elanco

Pesticide Index

Common Name	Trade Name	Manufacturer
EPTC [7 L]	EPTC	ICI
EPTC+ [6.7 L]	Eradicane	ICI
EPTC+/Dietholate [6 L]	Eradicane Extra	ICI
Ethalfluralin [3 L]	Sonalan	Dow/Elanco
EXP 200,991 [1.5 L]	None	Cyanamid
EXP 300,900 [1.5 L]	None	Cyanamid
EXP 324 [75 DF]	None	Nisson
F6285 [0.417 L]	None	FMC
Fenoxaprop [1 L]	Whip	Hoechst
Fluazifop-P [1 L]	Fusilade 2000	ICI
Fluroxypyr [1.67 L]	Starane	Dow/Elanco
Fomesafen [2 L]	Reflex	ICI
Glyphosate [3 L]	Roundup	Monsanto
Hexazinone [2 L]	Velpar L	DuPont
HOE-46360 [0.63 L]	None	Hoechst
ICIA-5676 [6.4 L]	None	ICI
Imazaquin [1.5 L]	Scepter	Cyanamid
Imazethapyr [2 L]	Pursuit	Cyanamid
KIH-2665 [50 D]	None	Dow/Elanco/Kumei
Lactofen [2 L]	Cobra	Valent
Linuron [4 L] [50 DF]	Lorox	DuPont
MBR-12325 (see Mefluidide)		
MCPA Amine [4 L]	Rhomene	Rhone-Poulenc
MCPB [2 L]	Thistrol	Rhone-Poulenc
Mefluidide [2 L]	Embark	3-M
Metolachlor [8 L]	Dual	CIBA-Geigy
Metribuzin [4 L] [75 DF]	Sencor, Lexone	Mobay,DuPont
MON 8422 [4 L]	None	Monsanto
MON 8435 [7.5 L]	None	Monsanto
MON 9897 [3.5 L]	None	Monsanto
Napronamide [50 WP]	Devrinol	ICI
Naptalam [2 L]	Alanap	Uniroyal
Nicosulfuron [75 DF]	Accent	DuPont
Oryzalin [4 L]	Surflan	Dow/Elanco
Oxadiazon [2 G] [50%WP]	Ronstar	Phone-Poulenc
Oxyfluorfen [1.6 L]	Goal	Rohm & Haas
Paraquat-CL [2.5 L]	Gramoxone Extra	ICI
Pendimethalin [4 L]	Prowl	Cyanamid
Primasulfuron [75 WDG]	Beacon	CIBA-Geigy
Prodiamine [65 WDG]	Rydex	Sandoz
Pronamide [50 W]	Kerb	Rohm & Haas
Pyrazon	Pyramin	BASF
Pyridate [3.75 L]	Tough	Agrolinz
Quizalofop [0.8 L]	Assure II	DuPont
R-25788 [6 E]	Dichlormid	ICI
R-29148 [2 E]	None	ICI
R-33865 [6 E]	Dietholate	ICI
RE-40885 [50 WP]	Benchmark	Various
SAN-582 [8 L]	None	Sandoz

Pesticide Index

Common Name	Trade Name	Manufacturer
SC-0058 [6 L]	None	ICI
Sethoxydim [1.5 L]	Poast	BASF
Sethoxydim + Dash [1 L]	Poast Plus	BASF
Simazine [90 DF]	Princep	CIBA-Geigy
Tridiphane [4 L]	Tandem	Dow/Elanco
Trifluralin [4 L]	Treflan	Dow/Elanco
Tryclopyr	Garlon	Dow/Elanco
UBI-A1237 [0.8 L]	None	Uniroyal
UBI-C4874 [1 L]	None	Uniroyal
V-165087 [1 L]	None	Valent USA
V-23031 [0.88 L]	None	Valent USA
V-40885 [50 WP]	None	Valent USA
V-53482 [50 WP]	None	Valent USA
V-63596 [0.89 L]	None	Valent USA

Additives

Crop Oil Conc (COC)	Prime Oil	Riverside/Terra
	Meth Sun Oil	Cyanamid
	UAP 903	United Agri Prod.
Non-ionic Surfactants (NIS)	Activate Plus	Riverside/Terra
	Activator 90	Loveland Ind.
	X-77	Valent USA
Liquid Fertilizers	10-34-0	
	28% N	
Adjuvants / additives	Agri-Dex	CIBA-Geigy
	BCH-815 ('Dash')	BASF
	Complex	Sum
	Herbimax	Loveland Ind.
	Inhance	MCA Lab
	LI-700	Loveland Ind.
	Sun-It	CIBA-Geigy
	Sun-It II	AGSCO, Inc.
	Surfactant WK	DuPont
	Tween-20	Valent USA
Miscellaneous	F-80 ('Advantage')	FMC
	D-Tox [55.2% Active]	BioPlus
	NH4SO4	

Insecticides

Terbufos [15 G]	Counter	Cyanamid
Chlorpyrifos [15 G]	Lorsban	Dow/Elanco
Carbofuran [15 G]	Furadan	FMC, Mobay

Pesticide Index

Common Name	Trade Name	Manufacturer
Acifluorfen (0.67) + bentazon (3) [3.67 L]	Galaxy	BASF
Alachlor (2.5) + trifluralin (0.5) [3 L]	Cannon	Monsanto
Alachlor (2.5) + atrazine (1.5) [4 L]	Lariat, Bullet	Monsanto
Atrazine (1.66) + bentazon (1.66) [3.32 L]	Laddok	BASF
Atrazine (2) + bromoxynil (1) [3 L]	Buctril + atrazine	Rhone-Poulenc
Atrazine (1.2) + butylate (4.8) [6 L]	Sutazine+	ICI
Atrazine (1) + cyanazine (3) [4 L] [90 DF]	Extrazine II	DuPont
Atrazine(1) + cyanazine(3) + dicamba(0.67) [4.67 L]	None	Sandoz
Atrazine (2.1) + dicamba (K-salt) (1.1) [3.2 L]	Marksman	Sandoz
Atrazine (2.67) + metolachlor (1.33) [6 L]	Bicep	CIBA-Geigy
Atrazine (2) + paraquat (0.4) [2.4 L]	Colonel	ICI
Atrazine (1) + 2,4-D amine (1) [2 L]	UAP-112	United Agri Prod.
Bentazon + MCPA	Basagran M	BASF
Chlorimuron + linuron [60 DF] (1:12)	Gemini	DuPont
Chlorimuron + linuron [60 DF] (1:18)	Lorox Plus	DuPont
Chlorimuron + metribuzin [75 DF] (1:6)	Canopy	DuPont
Chlorimuron + metribuzin [75 DF] (1:10)	Preview	DuPont
Clomazone (2.25) + trifluralin (3) [5.25 EC]	Commence	FMC
Clomazone + trifluralin	Command II	FMC
Cyanazine (4) + dicamba (0.67) [4.67 L]	None	Sandoz
Dicamba (1) + 2,4-D (2.87) [3.87 L]	Weedmaster	Sandoz
Dicamba (1) + atrazine (2) [3]	PCC-114	United Agri Prod.
Fluazifop-P (0.75) + fomesafen (1) [1.75 L]	Tornado	ICI
Garlon + 2,4-D	Turflon D	Dow/Elanco
Glyphosate (1.2) + 2,4-D (1.9) [3.1 L]	Landmaster	Monsanto
Imazquin (0.33) + pendimethalin (2) [2.33 L]	Squadron	Cyanamid
Imazquin (0.43) + trifluralin (2.57) [3 L]	Tri-scept	Cyanamid
Imazethapyr (0.2) + pendimethalin (2.8) [3 L]	Pursuit Plus	Cyanamid
Imazethapyr (0.2) + trifluralin (2.5) [2.7 L]	Passport	Cyanamid
Linuron(0.25) + metolachlor(2) + paraquat(0.5) [2.75]	Prelude	ICI
Metolachlor (2) + cyanazine (2) [4 L]	Tackle	CIBA-Geigy
Metolachlor (6.55) + metribuzin (1.45) [8 EC]	Turbo	Mobay
Metolachlor (2) + paraquat (0.5) [2.5 L]	None	ICI
Metribuzin (1.33) + trifluralin (2.67) [4 L]	Salute	Mobay
Naptalam (2) + 2,4-DB (0.06) [2.06 L]	Rescue	Uniroyal
2,4-D (2) + triclopyr (1) [3 L]	Crossbow	Dow/Elanco
2,4-D (1.85) + 2,4-DP (1.85) [3.7 L]	Weedone DPC	Rhone-Poulenc