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Agricultural Development and Diversification (ADD) Program

1990 Grant Final Report

Grant Number 05017

Grant Title Evaluation of Agronomic Adaptability, Weed Control Options & Economics of Producing Lupins in Wisconsin

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FINAL REPORT

1991

EVALUATION OF AGRONOMIC ADAPTABILITY, WEED CONTROL OPTIONS AND ECONOMICS OF PRODUCING LUPINS IN WISCONSIN
(YEAR TWO OF STUDY)

PREPARED BY: THOMAS J. GALLENBERG

WOLF RIVER VALLEY SEEDS

Research supported by a grant from the Wisconsin Department of Agriculture, 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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ISSUE NORTH AMERICAN LUPIN ASSOCIATION NEWSLETTER

LUPIN PRODUCTION AND UTILIZATION GUIDE

SUMMARY OF FINAL REPORT

The research project "Evaluation of Agronomic Adaptabilty, Weed Control Options and Economics of Producing Lupins in Wisconsin" was completed in December of 1991. Final reports were submitted by Dr.'s Ed Oplinger and Gordon Harvey in January of 1992. The research methods used were of standard university procedure.

Trials were conducted at the University of Wisconsin and Cooperative Extension Research stations at Arlington, Spooner, and Sturgeon Bay Wisconsin.

The research project was successful in reaching the overall objectives.

Wolf River Valley Seeds gratefully acknowledges the efforts of Bud Sholtz and his staff, Dr. Ed Oplinger and his staff and Dr. Gordon Harvey and his staff for their efforts and support in this project. We are especially grateful to the WDATCP for their financial support through the ADD Grant Program. Thank You.

OVERVIEW OF PROJECT

As outlined, in the summaries of Projects I and II, the basic objectives of this project was to identify the basic production guidelines and weed control options for producing Lupins in Wisconsin.

The primary benefit derived from this project is that farmers in Wisconsin will have access to technical information on producing Lupins, which will eliminate much of the need for experimentation on their own farms. The data derived will be condensed, by Dr.'s Oplinger and Harvey, into a production guide for Wisconsin and distributed through the University of Wisconsin Extension system by county agents.

A portion of the grant proceeds, targeted for informational handouts, was used to purchase 200 copies of the publication, "Lupin-Production and Utilization Guide" produced by the "Center for Alternative Plants and Animal Sciences" at the University of Minnesota. Wolf River Valley Seeds cooperated in the production of this guide, a copy is enclosed, and determined for the cost it would be an excellent publication. Copies were purchased and sent to all county extension agents, appropriate Agronomy personnal at the University of Wisconsin and area Ag instructors at the various technical colleges in the state.

Mark Martinka, a University of Wisconsin graduate student who assisted Dr. Oplinger in project I, plans to use this project as a basis for his Masters Thesis, which hopefully will be published in the Journal of Production Agriculture.

The herbicide trials performed in Project II will serve as an important base for future consideration by chemical companies to add Lupins to their chemical labels. It is very expensive to change or add crops to a label and without the unbiased and accurate trial work performed by Dr. Harvey and other colleges across the country it would be almost impossible to secure the necessary crop efficacy data necessary to secure a crop label.

The information derived from this project can now be used by farmers to determine the economic potential for producing Lupins for their operation.

In the enclosed Lupin guide there is a section on the economics of producing Lupins, however this could vary substantially depending on the current commodity markets or the end use of the crop, sold versus fed on the farm.

There are still many factors that need to be explored further, such as utilization values of Lupins, however many of the production questions have been thoroughly evaluated, and solutions indentified.

As a side note, In March of 1991 an organization was formed and officers elected for the "North American Lupin Association", a copy of the newsletter is enclosed. The association is made up of farmers, researchers and industry who are interested in the advancement of Lupins across North America.

SUMMARY OF 1991 RESULTS - PROJECT I

Evaluation of the Agronomic adaptibilty of Lupins in Wisconsin

The objective of this study was to identify the basic regions of adaptation, the optimum row spacing and seeding rates, optimum planting dates, and the yield potentials of newer varieties compared to the current varieties.

Weather conditions during the growing season were generally warmer than 1990, especially during the flowering period. This in effect reduced the overall yields from 1990's 56.6 bushel per acre to 40.4 bushel per acre for 1991.

Insect problems were not a factor at any of the locations.

STUDY 1 - VARIETY TRIALS

Locations: Arlington, Antigo, Spooner, Sturgeon bay

As stated earlier the higher temparatures reduced the pod and seed set at most locations, except Sturgeon Bay where temperatures are moderated by Lake Michigan.

Most varieties performed as expected, however a new heat tolerant line L1121N exhibited significantly higher yield potential at the Arlington location.

The results of these variety trials is extremely helpful in determining which varieties are best suited for different regions of the state.

The sandy type soils at the Spooner location again had the lowest average yields, however we could attribute that more to soil type than location. The other three trial sites were all on a silt loam soil which generally has a higher moisture holding capacity along with maintaining cooler surface temparatures. Also, certain varieties such as Exp. L0970N seem to tolerate sandy soils much better, therefore it may be that variety selection will br the key to obtaining higher yields on those soil types.

STUDY 2 - ROW SPACING AND SEEDING RATE STUDY

Locations: Arlington , Antigo

In this study the objective was to identify the optimum row spacing and seeding rate for the highest yields. Three varieites were used and the trials were conducted from 1988 to 1991.

The results were as anticipated with the most consistent yields being obtained in seven inch rows with a final plant population between 150,000 and 180,000 plants per acre.

In certain situations, however, the wider row spacings of 15" and 30" may be more suited to a particular farming operation. The trial identified the optimum plant populations to achieve the most consistent yields at these row spacings.

STUDY 3 - DATE OF PLANTING STUDY

Locations: Arlington, Spooner, Sturgeon Bay

The objective of this study was to identify the optimum date to plant Lupins and the yield response to later planting dates.

Lupins, being a cooler season crop, prefer moderate tempartures during the flowering and pod set time period.

The dates established for this study were the estimated optimum time, early spring, a mid planting date, two weeks later, anda late planting date, four weeks later.

The results were as anticipated, with the first (or early spring) planting date yielding 22% more than the mid planting date and 49.9% more than the late, (or 3rd), planting date.

The reason for the severe yield reductions is the crop requires an estimated 50 to 55 days after planting to primary flowering, and the later it is planted the higher the risk for warmer weather conditions during the critical flowering and pod set time frame.

SUMMARY ON PROJECT I

The type of studies performed in Project I are essential to provide farmers with the accurate information needed to produce Lupins or any other crop. Another important aspect is to identify the response of the crop when exposed to situations other than ideal conditions. This allows farmers to assess their individual situations to determine how Lupins can fit into their farming operation..

The results obtained are somewhat suprising, in that the Arlington site had the highest overall two year average yield of 53.8 bushel. This fact highlights that with good management practices and adequate weed control, excellent yields can be obtained, even in the warmer climates.

In summation, the agronomic studies performed by Dr. Oplinger and his staff will give producers a concise outline as to the optimum production practices needed to successfully grow Lupins in Wisconsin.

SUMMARY OF 1991 RESULTS - PROJECT II

Weed Control in Lupins

The objective of this study was to identify successful methods for controlling weeds in Lupins.

The studies performed compared herbicides currently registered, promising experimental herbicides, and mechanical control methods.

Applications were made on a pre-plant incorporate, pre-emerge, and, post emerge basis.

One of the more important aspects of this study was to identify an effective broadleaf herbicide, preferably post emerge, that would be effective on weed species prevelant in Wisconsin. Based on findings in 1990 Imazethapyr (pursuit) demonstrated excellent potential to be an effective broadleaf and grass herbicide. Another herbicide, that in the past performed effectively, was Linuron or Lorox. Both compounds performed exceptionally, again, in the 1991 trials.

Overall, the 1991 studies provided results as anticipated.

The major impact these studies have had over the past two years is the acceptance by the major chemical companies to consider adding the crop species "Lupin" to the labels of herbicides that provide acceptable control without crop injury. This was accomplished by providing replicated data, by an independent source, to demonstrate that their herbicide was indeed safe and effective.

As a result, we were able to secure an annual label for the herbicide Pursuit for the 1992 crop year. Pending further trials by Dr. Harvey and company representatives we may be able to secure a permanent label, which would greatly enhance the regions where Lupins could be planted, which previously were limited by specific weed presures..

Another major project that should be concluded in 1992, initiated in 1990 and 1991, is the final trial work for the herbicide Linuron. Dr. Harvey is involved with a national testing program, IR-4, which tests minor crops to provide efficacy data for labeling. Linuron is a broadleaf herbicide that has shown to be very effective and would gratly enhance our weed control program.

In summation the herbicide trial work performed by Dr. Harvey at the University of Wisconsin is an important step to securing new herbicides for use on Lupins and also providing the necessary guidelines for their safe and effective use in Wisconsin.

MAJOR CONCLUSIONS OF PROJECTS I & II

The major conclusion we have drawn from this project, is that Lupins can be a valuable asset in Wisconsins agricultural system.

Being a major dairy and livestock producer, the consumption of high protein feeds is enormous.

As the production expertise on producing Lupins expands, protein imports from other states could be reduced.

As a crop adapted to the Northern areas of Wisconsin, where rotational or alternative crops are needed, Lupins could be a major factor in stimulating the agricultural economy in these areas.

Many producers are also realizing important rotational effects of incorporating an annual legume into their cropping systems.

In summation, the process involved to introduce a new crop to its maximum potential, is an enormous and ongoing process. It takes the effort and cooperation of all involved in several facets of agriculture.

We feel the knowledge gained by the research work conducted will provide the basis for the continued development of Lupins in Wisconsin for years to come.

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Improving Agriculture Through Crop Biotechnology, Genetics and Production Research

January 14, 1992

Tom Gallenberg
Wolf River Valley Seeds
N2976 Cty M
White Lake, WI 54991

Dear Tom:

Enclosed are the final results from the three lupin cultural experiments we conducted in 1991. We had sent the variety results previously but I've included them again to give you a complete set of data. In addition to the 1991 data, we are including a summary for the 1989-91 years for the Date of Planting Studies which includes 7 tests, and the 1988-91 Row Spacing & Seeding Rate Studies from Arlington and Antigo.

Our intention is to condense this information into a fact sheet which will be useful to educators and growers as they consider management practices to maximize lupin yields in Wisconsin. The data will form the basis of Mark Martinka's M.S. thesis and will also be submitted for publication to the Journal of Production Agriculture.

We are appreciative of your efforts in encouraging research on lupins in Wisconsin and your assistance in arranging for funding the research through WDATCP. We look forward to continued collaborative efforts as we move into the next phase of education regarding lupin production and utilization in Wisconsin.

Sincerely,

Edward S. Oplinger

Edward S. Oplinger
Professor

cj

xc: Mark Martinka

Providing equal opportunities in employment and programming.

FIELD EXPERIMENT HISTORY

Exp. Nos.: 9180, 9181, 9182, 9183 **Year: 1991**
Title: 1991 LUPIN VARIETY TRIALS
Personnel: M.J. Martinka, E.S. Oplinger, R.E. Rand, R. W. Weidman, and F. Gilson
Locations: Arlington, Antigo, Spooner, Sturgeon Bay WI
Supported by: Resource Seeds, WDATCP Ag Diversification Fund, and Wolf River Valley Seeds

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, 46–10, L0970N, L1122N, L2019N, L2082N, L2085N, L2090N, L1121N (Arlington only)

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

Planting: Date: Arl.– 18 Apr.; Antigo–13 May; Spoon.– 27 Apr.; Stur. Bay– 24 Apr.

Harvesting: Date: Arl.– 7 Aug.; Antigo– 6 Sept.; Spoon.– 27 Sept.; Stur. Bay– 26 Aug.

		Material	Rate	Method	Date
Herbicide(s):	Arlington:	Prowl	2 pts/ac	PPI	17 Apr
		Dual	2 pts/ac	PPI	17 Apr
	Antigo:	Lorox	2 pts/ac	PRE	15 May
	Spooner:	Prowl	3 pt/ac	PRE	17 Apr
		Poast + Oil	1.25 Pt/ac	Post	19 June
	Sturgeon Bay:	Prowl	1.5 lb a.i./ac	PPI	24 Apr
Insecticide(s):	Arlington:	Asana XL	2.5 oz/ac		17 June
	Antigo:	none			
	Spooner:	Pydrin	80 mls/ac		12 June ; 3 July
	Sturgeon Bay:	Asana XL	3 oz/100gal dilute.		12,25 June

1991 LUPIN VARIETY TRIAL RESULTS

Variety	1991 Yields					1990–91 Yields				
	Arlington	Antigo	Spooner	Sturgeon Bay	Mean	Arlington	Antigo	Spooner	Sturgeon Bay 1/	Mean
	–bu/a–				bu/a	–bu/a–				bu/a
ULTRA	44.0	39.4	37.3	45.3	41.5	55.5	46.1	42.3	45.3	47.6
PRIMORSKY	37.8	36.7	21.9	43.4	35.0	46.7	41.0	30.6	43.4	40.0
46–10	42.2	38.0	40.0	43.7	41.0	51.4	47.6	39.7	43.7	45.8
L0970N	38.1	27.2	45.0	40.5	37.7	53.5	50.1	48.1	40.5	49.1
L1122N	45.8	44.7	26.7	47.0	41.1					
L2019N	46.6	41.0	39.1	45.5	43.1	57.8	54.2	44.8	45.5	51.3
L2082N	44.0	38.4	36.3	43.6	40.6	55.6	52.1	41.4	43.6	48.8
L2085N	41.8	40.4	32.3	45.8	40.1	54.1	46.6	36.7	45.8	45.8
L2090N	47.8	43.4	34.9	47.1	43.3	56.1	50.4	43.5	47.1	49.6
L1121N	54.7									
Mean	44.3	38.8	34.8	44.7	40.4	53.8	48.5	40.9	44.4	47.2
LSD (10%)	5.3	3.5	3.7	2.3	1.9	3.8	3.8	3.9	2.3	1.8

1/ 1991 Yields only.

1991 Lupin Variety Trial
Arlington, WI (Expt. 9180)

Entry	1991 Test Results					1990-91 2-Test Averages			
	Yield	Plant Height	Plant Lodging	Harvest Moisture	Seeds/ lb.	Yield	Plant Height	Plant Lodging	Seeds/ lb.
	bu/a	in.	1-5	%		bu/a	in.	1-5	%
ULTRA	44.0	23.0	1.0	12.8	1485	55.5	31.5	1.7	1454
PRIMORSKY	37.8	22.0	1.3	11.8	1724	46.7	29.2	2.9	1640
46-10	42.2	25.0	1.0	12.8	1396	51.4	33.7	2.0	1374
L0970N	38.1	25.5	1.3	17.4	1524	53.5	31.4	1.8	1453
L1122N	45.8	25.5	1.0	14.8	1433				
L2019N	46.6	21.8	1.0	12.1	1474	57.8	30.7	1.7	1438
L2082N	44.0	24.8	1.0	13.9	1559	55.6	32.1	1.8	1561
L2085N	41.8	20.0	1.0	11.7	1688	54.1	28.4	1.9	1735
L2090N	47.8	25.5	1.0	14.9	1423	56.1	34.8	1.4	1453
L1121N	54.7	23.3	1.0	14.0	1741				
Mean	44.3	23.6	1.1	13.6	1545	53.8	31.4	1.9	1514
LSD (10%)	5.3	2.0	ns	1.0	99	3.8	1.8	0.3	55

1991 Lupin Variety Trial
Antigo, WI (Expt. 9181)

Entry	1991 Test Results					1990-91 2-Test Averages			
	Yield	Plant Height	Plant Lodging	Harvest Moisture	Seeds/ lb.	Yield	Plant Height	Plant Lodging	Seeds/ lb.
	bu/a	in.	1-5	%		bu/a	in.	1-5	%
ULTRA	39.4	30.3	1.8	15.5	1361	46.1	33.7	2.9	1721
PRIMORSKY	36.7	29.3	1.8	15.0	1641	41.0	31.4	3.4	1892
46-10	38.0	28.8	1.8	15.1	1615	47.6	34.6	3.2	1772
L0970N	27.2	34.3	3.8	23.0	1932	50.1	36.2	4.1	1909
L1122N	44.7	30.0	1.8	15.4	1417				
L2019N	41.0	28.5	2.0	14.9	1465	54.2	34.3	3.0	1612
L2082N	38.4	30.0	2.3	16.3	1533	52.1	33.5	2.8	1827
L2085N	40.4	27.5	1.0	13.9	1661	46.6	31.9	3.0	2058
L2090N	43.4	32.5	1.8	16.0	1477	50.4	36.3	3.2	1725
Mean	38.8	30.1	2.0	16.1	1567	48.5	34.0	3.2	1815
LSD (10%)	3.5	2.0	0.6	1.5	200	3.8	1.7	0.5	88

1991 Lupin Variety Trial
Spooner, WI (Expt. 9182)

Entry	1991 Test Results					1990-91 2-Test Averages				
	Yield	Plant Height	Plant Lodging	Seeds/ lb.	Plant Density x 1000	Yield	Plant Height	Plant Lodging	Seeds/ lb.	Plant Density x 1000
	bu/a	in.	1-5		- plants/a-	bu/a	in.	1-5		- plants/a-
ULTRA	37.3	23.5	1.0	1784	141	42.3	25.5	1.7	1517	137
PRIMORSKY	21.9	21.5	1.0	2359	123	30.6	23.1	2.5	1818	131
46-10	40.0	26.5	1.0	1718	152	39.7	28.0	2.0	1468	147
L0970N	45.0	29.8	1.0	1468	157	48.1	27.7	1.4	1282	169
L1122N	26.7	24.3	1.0	1874	76					
L2019N	39.1	22.8	1.0	2000	158	44.8	26.2	2.3	1539	155
L2082N	36.3	24.5	1.0	1913	125	41.4	26.5	1.4	1557	135
L2085N	32.3	19.5	1.0	2261	192	36.7	23.1	1.7	1793	167
L2090N	34.9	28.8	1.0	1577	139	43.5	31.7	1.3	1383	132
Mean	34.8	24.6	1.0	1884	140	40.9	26.5	1.8	1545	147
LSD (10%)	3.7	4.5	ns	278	18	3.9	2.1	0.8	139	22

1991 Lupin Variety Trial
Sturgeon Bay, WI (Expt. 9183)

Entry	1991 Test Results						1990-91 2-Test Averages					
	Yield	Plant Height	Plant Lodging	Seeds/ lb.	Plant Density x 1000 Early	Plant Density x 1000 Late	Yield 1/	Plant Height	Plant Lodging	Seeds/ lb.	Plant Density x 1000 Early	Plant Density x 1000 Late
	bu/a	in.	1-5		- plants/a-		bu/a	in.	1-5		- plants/a-	
ULTRA	45.3	23.5	1.0	1600	183	163	28.3	28.0	1.4	1944	187	166
PRIMORSKY	43.4	21.5	1.0	1558	207	186	25.2	26.5	1.9	1948	215	200
46-10	43.7	25.5	1.0	1447	164	150	26.0	29.5	1.3	1748	191	180
L0970N	40.5	26.3	1.0	1429	147	133	25.9	29.4	1.5	1828	177	160
L1122N	47.0	26.8	1.0	1398	160	153						
L2019N	45.5	25.0	1.0	1422	190	179	25.3	28.0	1.5	1806	219	202
L2082N	43.6	27.3	1.0	1570	203	182	25.4	29.4	1.3	1969	233	213
L2085N	45.8	21.0	1.0	1729	197	186	26.2	25.9	1.4	2331	215	202
L2090N	47.1	26.8	1.0	1428	213	199	29.7	31.6	1.0	1859	211	200
Mean	44.7	24.9	1.0	1509	185	170	26.5	28.5	1.4	1929	206	190
LSD (10%)	2.3	2.5	ns	87	25	21	2.4	2.2	0.4	106	24	21

1/ Due to severe leafhopper infestation the yields in 1990 were adversely affected, and are not included in the summary across locations.

FIELD EXPERIMENT HISTORY

Exp. No. 9187 Year: 1991
Title: LUPIN 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, WDATCP Ag. Diversification Fund, and Wolf River Valley Seeds

FIELD INFORMATION

Field No.: 393 Soil Type: Plano silt loam
Soil Test Results: Date: 8/91 pH: 7.0 P(#/A): 150 K(lb/A): 520 OM(T/A): 30
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 (4), Varieties (3), Seeding Rates (4)

Plot Size: Planted: 25' x 7.5' (3.5" rows) x 6' (7" rows), 25' x 7.5' (15" rows), 25' x 10' (30" rows)
Harvested: 21' x 56" (14–3.5" rows), 21' x 53" (7–7" rows), 21' x 5' (4–15" rows), 21' x 5' (2–30" rows)
Row Spacing: 3.5, 7, 15 and 30"

Planting: Date: 18 April Rate (seeds/sq ft): 120,180,240,300 K sd/ac Depth: 1.5"
Equipment: Hefty plot planter

Harvesting: Date: 7 Aug Equipment: Almaco plot combine #1

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

	Material	Rate	Method	Date
Herbicide(s):	Prowl	2 pts/ac	PPI	17 April
	Dual	2 pts/ac	PPI	17 April
Insecticide(s):	Asana XL	2.5 oz/ac		17 June

1991 Lupin Row Spacing and Seeding Rate Study
Arlington, WI (Expt. 9187)

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)		%	
3.5	Ultra	120	22.8	21.3	1.3	79	68	89.0	1731
3.5	Ultra	180	38.5	24.0	1.3	133	123	92.9	1668
3.5	Ultra	240	37.0	23.5	1.0	199	180	90.4	1670
3.5	Ultra	300	40.3	23.8	1.3	194	149	76.6	1582
3.5	Primorsky	120	25.4	19.0	1.8	82	79	96.6	1966
3.5	Primorsky	180	34.2	21.8	1.5	140	122	88.0	1801
3.5	Primorsky	240	37.2	22.3	1.3	160	137	86.2	1732
3.5	Primorsky	300	34.8	22.3	1.0	191	155	82.7	1780
3.5	46–10	120	27.6	26.0	1.3	123	106	86.4	1559
3.5	46–10	180	31.4	25.5	1.3	144	110	76.1	1518
3.5	46–10	240	34.4	22.8	1.0	169	115	68.0	1550
3.5	46–10	300	40.3	25.8	1.3	238	180	75.8	1571
7	Ultra	120	25.2	22.3	1.0	101	92	91.3	1729
7	Ultra	180	37.2	23.5	1.0	150	141	94.7	1604
7	Ultra	240	39.5	22.8	1.5	179	156	87.3	1600
7	Ultra	300	41.8	24.5	1.5	234	191	81.0	1602
7	Primorsky	120	28.5	22.0	1.8	110	102	93.7	1818
7	Primorsky	180	38.1	22.0	1.3	157	147	93.8	1792
7	Primorsky	240	39.5	23.3	1.8	205	166	81.1	1726
7	Primorsky	300	48.1	23.8	1.5	259	207	81.7	1652
7	46–10	120	32.9	25.0	1.5	97	97	100.7	1420
7	46–10	180	40.5	24.8	1.3	156	139	88.9	1455
7	46–10	240	43.7	25.8	1.3	181	168	93.1	1479
7	46–10	300	46.1	26.8	1.5	247	221	89.4	1390
15	Ultra	120	32.9	22.3	1.8	117	102	87.2	1557
15	Ultra	180	35.6	24.0	1.5	167	137	82.1	1479
15	Ultra	240	41.1	25.3	1.5	213	190	88.7	1458
15	Ultra	300	39.1	25.3	2.0	249	216	86.1	1385
15	Primorsky	120	29.2	21.5	1.5	95	89	93.4	1812
15	Primorsky	180	37.4	22.8	2.0	170	143	84.2	1680
15	Primorsky	240	37.8	24.8	2.0	201	175	87.0	1634
15	Primorsky	300	39.5	22.0	2.0	255	153	61.3	1502
15	46–10	120	36.0	27.3	1.5	103	103	97.2	1430
15	46–10	180	36.8	26.3	1.5	181	165	90.7	1517
15	46–10	240	38.3	25.0	1.5	218	174	79.9	1377
15	46–10	300	37.3	25.0	2.0	270	210	78.1	1363
30	Ultra	120	29.3	22.3	1.3	109	107	97.8	1477
30	Ultra	180	31.9	24.0	1.3	158	155	98.4	1435
30	Ultra	240	30.3	24.5	1.3	226	197	87.5	1431
30	Ultra	300	32.0	24.5	1.3	254	205	80.9	1424
30	Primorsky	120	21.3	23.0	1.3	103	103	100.2	1872
30	Primorsky	180	27.2	22.8	2.8	161	136	85.4	1740

Continued

1991 Lupin Row Spacing and Seeding Rate Study
Arlington, WI (Expt. 9187)

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)		%	
30	Primorsky	240	30.2	24.3	2.5	197	152	78.4	1548
30	Primorsky	300	28.5	24.0	2.0	239	185	76.8	1562
30	46–10	120	26.0	25.8	1.0	117	103	87.4	1510
30	46–10	180	22.8	23.8	1.3	151	141	93.8	1548
30	46–10	240	26.8	26.8	1.5	224	184	82.4	1419
30	46–10	300	31.1	25.8	1.5	268	218	81.5	1322
3.5	Ultra		34.7	23.1	1.2	151	130	87.3	1663
3.5	Primorsky		32.9	21.3	1.4	143	123	88.4	1820
3.5	46–10		33.4	25.0	1.2	168	127	76.6	1549
7	Ultra		35.9	23.3	1.3	166	145	88.6	1633
7	Primorsky		38.5	22.8	1.6	183	155	87.6	1747
7	46–10		40.8	25.6	1.4	170	156	93.0	1436
15	Ultra		37.2	24.2	1.7	186	161	86.0	1469
15	Primorsky		36.0	22.8	1.9	180	140	81.5	1657
15	46–10		37.1	25.9	1.6	193	163	86.5	1422
30	Ultra		30.9	23.8	1.3	186	166	91.1	1441
30	Primorsky		26.8	23.5	2.1	175	144	85.2	1681
30	46–10		26.7	25.5	1.3	190	162	86.3	1450
3.5		120	25.3	22.1	1.4	95	84	90.7	1752
3.5		180	34.7	23.8	1.3	139	118	85.7	1662
3.5		240	36.2	22.8	1.1	176	144	81.5	1651
3.5		300	38.5	23.9	1.2	207	161	78.4	1644
7		120	28.8	23.1	1.4	103	97	95.2	1656
7		180	38.6	23.4	1.2	154	142	92.5	1617
7		240	40.9	23.9	1.5	188	163	87.2	1602
7		300	45.3	25.0	1.5	246	206	84.1	1548
15		120	32.7	23.7	1.6	105	98	92.6	1599
15		180	36.6	24.3	1.7	173	148	85.7	1558
15		240	39.1	25.0	1.7	211	179	85.2	1490
15		300	38.6	24.1	2.0	258	193	75.2	1417
30		120	25.5	23.7	1.2	110	104	95.1	1620
30		180	27.3	23.5	1.8	156	144	92.5	1574
30		240	29.1	25.2	1.8	215	178	82.8	1466
30		300	30.5	24.8	1.6	254	203	79.7	1436
	Ultra	120	27.5	22.0	1.3	101	92	91.3	1623
	Ultra	180	35.8	23.9	1.3	152	139	92.0	1546
	Ultra	240	37.0	24.0	1.3	204	181	88.4	1539
	Ultra	300	38.3	24.5	1.5	232	190	81.2	1498

Continued

1991 Lupin Row Spacing and Seeding Rate Study
Arlington, WI (Expt. 9187)

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)		%	
	Primorsky	120	26.1	21.4	1.6	97	93	96.0	1867
	Primorsky	180	34.2	22.3	1.9	157	137	87.8	1753
	Primorsky	240	36.2	23.6	1.9	191	157	83.2	1660
	Primorsky	300	37.7	23.0	1.6	236	175	75.7	1624
	46–10	120	30.6	26.0	1.3	110	102	92.9	1480
	46–10	180	32.9	25.1	1.3	158	139	87.4	1509
	46–10	240	35.8	25.1	1.3	198	160	80.8	1456
	46–10	300	38.7	25.8	1.6	256	207	81.2	1411
3.5			33.7	23.1	1.3	154	127	84.1	1677
7			38.4	23.9	1.4	173	152	89.7	1606
15			36.7	24.3	1.7	186	155	84.7	1516
30			28.1	24.3	1.6	184	157	87.5	1524
	Ultra		34.7	23.6	1.3	172	151	88.2	1552
	Primorsky		33.6	22.6	1.7	170	141	85.7	1726
	46–10		34.5	25.5	1.4	180	152	85.6	1464
		120	28.1	23.1	1.4	103	96	93.4	1657
		180	34.3	23.8	1.5	156	138	89.1	1603
		240	36.3	24.2	1.5	198	166	84.2	1552
		300	38.2	24.4	1.6	241	191	79.3	1511
Mean			34.2	23.9	1.5	174	148	86.5	1581
Probabilty (%)									
Row Spacing (R)			< 0.1	5.9	3.1	< 0.1	< 0.1	3.6	< 0.1
Variety (V)			37.1	< 0.1	< 0.1	4.2	1.9	31.0	< 0.1
R x V			3.2	41.3	9.3	5.9	10.2	4.1	5.8
Seeding Rate (SR)			< 0.1	< 0.1	23.5	< 0.1	< 0.1	< 0.1	< 0.1
R x SR			0.6	12.4	< 0.1	4.5	42.1	> 50	9.6
V x SR			23.1	< 0.1	6.7	18.4	2.1	23.9	< 0.1
R x V x SR			> 50	26.4	13.1	42.7	13.1	25.4	12.4
LSD (10%)									
Row Spacing (R)			1.6	0.7	0.3	8.7	7.3	3.3	45.5
Variety (V)			ns	0.5	0.2	6.9	7.0	ns	34.9
Seeding Rate (SR)			1.7	0.6	ns	7.6	8.4	3.6	26.9
C.V. (%)			14.9	6.8	26.8	12.8	16.8	12.2	5.0

1988–91 Combined Lupin Row Spacing and Seeding Rate Studies
\rlington, WI (Expt. 9197)

Year	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)		%	
1988	7	Ultra	120	28.2	20.5	1.0	89	77	87.0	1463
1988	7	Ultra	180	35.3	18.0	1.0	157	150	95.8	1320
1988	7	Ultra	240	39.6	20.3	1.0	213	167	79.5	1356
1988	7	Primorsky	120	30.4	18.5	1.0	136	107	82.5	1361
1988	7	Primorsky	180	34.8	18.5	1.0	118	117	101.5	1319
1988	7	Primorsky	240	35.7	18.8	1.0	236	204	87.8	1327
1988	7	46–10	120	34.7	18.3	1.0	154	135	87.3	1309
1988	7	46–10	180	38.6	20.5	1.0	255	216	87.0	1255
1988	7	46–10	240	41.6	21.5	1.0	282	236	86.0	1268
1988	15	Ultra	120	20.8	20.5	1.0	85	84	99.3	1382
1988	15	Ultra	180	22.1	20.0	1.0	115	108	94.3	1389
1988	15	Ultra	240	25.8	20.0	1.0	174	180	112.0	1347
1988	15	Primorsky	120	28.5	18.5	1.0	86	76	87.3	1473
1988	15	Primorsky	180	22.1	17.5	1.0	118	119	104.8	1368
1988	15	Primorsky	240	31.9	20.0	1.0	178	156	97.5	1348
1988	15	46–10	120	32.3	21.8	1.0	127	110	89.8	1289
1988	15	46–10	180	29.2	19.0	1.0	136	140	101.8	1352
1988	15	46–10	240	33.5	20.5	1.0	188	156	87.3	1364
1988	30	Ultra	120	24.7	21.0	1.0	99	95	95.8	1289
1988	30	Ultra	180	23.0	21.3	1.0	130	134	104.8	1225
1988	30	Ultra	240	21.2	19.5	1.0	148	120	81.5	1261
1988	30	Primorsky	120	24.3	21.0	1.0	101	67	67.3	1328
1988	30	Primorsky	180	20.9	20.0	1.0	141	117	83.3	1312
1988	30	Primorsky	240	25.1	17.8	1.0	149	148	100.8	1317
1988	30	46–10	120	25.1	21.3	1.0	121	102	85.0	1247
1988	30	46–10	180	27.7	21.0	1.0	155	129	84.0	1220
1988	30	46–10	240	25.1	18.8	1.0	162	149	92.3	1289
1989	7	Ultra	120	35.5	23.8	1.0	109	107	98.0	1558
1989	7	Ultra	180	39.6	24.5	1.0	162	144	90.0	1549
1989	7	Ultra	240	40.4	24.0	1.3	203	178	88.0	1566
1989	7	Primorsky	120	36.0	23.8	1.0	128	120	96.3	1675
1989	7	Primorsky	180	36.4	23.5	1.0	188	175	93.5	1641
1989	7	Primorsky	240	39.8	23.0	1.0	224	201	89.3	1622
1989	7	46–10	120	28.5	24.0	1.0	75	75	102.5	1585
1989	7	46–10	180	30.4	23.0	1.0	135	129	96.8	1521
1989	7	46–10	240	37.2	23.5	1.0	156	157	100.8	1544
1989	15	Ultra	120	31.2	24.0	1.3	127	124	101.0	1587
1989	15	Ultra	180	33.9	23.8	1.3	143	142	102.6	1552
1989	15	Ultra	240	36.7	24.5	1.8	162	162	100.3	1510
1989	15	Primorsky	120	34.7	23.8	1.0	121	117	96.3	1658
1989	15	Primorsky	180	35.1	24.5	1.0	158	153	97.5	1631
1989	15	Primorsky	240	37.0	25.0	1.3	203	182	90.0	1609
1989	15	46–10	120	25.7	24.0	1.0	78	80	104.8	1585
1989	15	46–10	180	31.6	23.8	1.0	125	124	99.5	1558
1989	15	46–10	240	35.4	23.8	1.3	145	142	97.5	1524
1989	30	Ultra	120	24.4	24.0	2.0	105	102	96.5	1525
1989	30	Ultra	180	22.9	24.8	2.0	134	136	102.3	1548
1989	30	Ultra	240	24.6	24.5	2.5	195	156	81.5	1561
1989	30	Primorsky	120	23.6	23.3	1.5	120	126	105.8	1685
1989	30	Primorsky	180	25.8	24.0	2.0	197	174	89.5	1678
1989	30	Primorsky	240	24.3	25.3	2.3	256	201	78.3	1663
1989	30	46–10	120	21.8	24.3	1.8	72	71	98.3	1599
1989	30	46–10	180	23.6	24.0	1.8	127	116	91.5	1560
1989	30	46–10	240	23.1	24.8	2.3	146	148	104.0	1555

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1988–91 Combined Lupin Row Spacing and Seeding Rate Studies
Arlington, WI (Expt. 9197)

Year	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)		%	
1990	7	Ultra	120	66.0	41.0	2.5	114	118	97.3	1426
1990	7	Ultra	180	67.6	38.5	2.5	163	164	100.0	1420
1990	7	Ultra	240	69.8	37.5	2.3	216	203	94.3	1366
1990	7	Primorsky	120	62.5	36.8	2.8	133	112	84.5	1510
1990	7	Primorsky	180	65.2	39.5	3.5	188	180	96.0	1522
1990	7	Primorsky	240	65.9	40.5	4.0	256	244	96.3	1457
1990	7	46–10	120	68.7	43.0	2.0	134	122	92.0	1378
1990	7	46–10	180	64.4	41.5	3.0	173	141	81.8	1372
1990	7	46–10	240	71.3	41.0	2.5	235	227	97.0	1324
1990	15	Ultra	120	62.4	39.5	2.3	142	135	96.3	1407
1990	15	Ultra	180	64.6	39.8	2.0	198	161	84.3	1425
1990	15	Ultra	240	62.4	37.8	2.5	249	212	85.3	1356
1990	15	Primorsky	120	63.0	38.5	2.8	146	140	95.5	1494
1990	15	Primorsky	180	60.8	39.0	3.5	217	201	92.8	1473
1990	15	Primorsky	240	61.8	39.0	3.5	265	222	86.5	1439
1990	15	46–10	120	64.0	42.5	2.3	129	125	96.3	1281
1990	15	46–10	180	58.8	39.8	2.3	216	198	97.3	1318
1990	15	46–10	240	63.3	41.3	2.0	237	236	100.8	1307
1990	30	Ultra	120	59.2	38.8	1.5	123	114	92.3	1315
1990	30	Ultra	180	57.4	37.0	1.8	187	173	94.3	1320
1990	30	Ultra	240	57.5	37.3	2.0	229	199	89.5	1279
1990	30	Primorsky	120	54.4	36.8	2.0	173	150	88.8	1467
1990	30	Primorsky	180	55.6	37.8	3.3	182	158	87.5	1424
1990	30	Primorsky	240	57.8	36.5	3.8	269	204	75.8	1429
1990	30	46–10	120	53.3	39.5	1.8	128	134	104.8	1314
1990	30	46–10	180	57.0	40.3	2.5	200	172	86.5	1239
1990	30	46–10	240	59.8	39.0	2.5	242	214	89.8	1236
1991	7	Ultra	120	25.2	22.3	1.0	101	92	91.3	1729
1991	7	Ultra	180	37.2	23.5	1.0	150	141	94.7	1604
1991	7	Ultra	240	39.5	22.8	1.5	179	156	87.3	1600
1991	7	Primorsky	120	28.5	22.0	1.7	110	102	93.7	1818
1991	7	Primorsky	180	38.1	22.0	1.3	157	147	93.9	1792
1991	7	Primorsky	240	39.5	23.3	1.8	205	166	81.1	1726
1991	7	46–10	120	32.9	25.0	1.5	97	97	100.7	1420
1991	7	46–10	180	40.5	24.8	1.3	156	139	88.9	1455
1991	7	46–10	240	43.7	25.8	1.3	181	168	93.2	1479
1991	15	Ultra	120	32.9	22.3	1.8	117	102	87.2	1557
1991	15	Ultra	180	35.6	24.0	1.5	167	137	82.1	1479
1991	15	Ultra	240	41.1	25.3	1.5	213	190	88.7	1458
1991	15	Primorsky	120	29.2	21.5	1.5	95	89	93.4	1812
1991	15	Primorsky	180	37.4	22.8	2.0	170	143	84.2	1680
1991	15	Primorsky	240	37.8	24.8	2.0	201	175	87.0	1634
1991	15	46–10	120	36.1	27.3	1.5	103	103	97.2	1430
1991	15	46–10	180	36.8	26.3	1.5	181	165	90.7	1517
1991	15	46–10	240	38.3	25.0	1.5	218	174	79.9	1377
1991	30	Ultra	120	29.3	22.3	1.3	109	107	97.8	1477
1991	30	Ultra	180	31.9	24.0	1.3	158	155	98.4	1435
1991	30	Ultra	240	30.3	24.5	1.3	226	197	87.5	1431
1991	30	Primorsky	120	21.3	23.0	1.3	103	103	100.2	1872
1991	30	Primorsky	180	27.2	22.8	2.8	161	136	85.4	1740
1991	30	Primorsky	240	30.2	24.3	2.5	197	152	78.5	1548
1991	30	46–10	120	26.0	25.8	1.0	117	103	87.4	1510
1991	30	46–10	180	22.8	23.8	1.3	151	141	93.8	1548
1991	30	46–10	240	26.8	26.8	1.5	224	184	82.4	1419

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1988–91 Combined Lupin Row Spacing and Seeding Rate Studies
Arlington, WI (Expt. 9197)

Year	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)		%	
1988	7	Ultra		34.4	19.6	1.0	153	131	87.4	1379
1988	7	Primorsky		33.6	18.6	1.0	163	143	90.6	1336
1988	7	46–10		38.3	20.1	1.0	230	196	86.8	1277
1988	15	Ultra		22.9	20.2	1.0	124	124	101.8	1373
1988	15	Primorsky		27.5	18.7	1.0	127	117	96.5	1396
1988	15	46–10		31.7	20.4	1.0	150	135	92.9	1335
1988	30	Ultra		22.9	20.6	1.0	126	117	94.0	1258
1988	30	Primorsky		23.4	19.6	1.0	130	111	83.8	1319
1988	30	46–10		26.0	20.3	1.0	146	127	87.1	1252
1989	7	Ultra		38.5	24.1	1.1	158	143	92.0	1557
1989	7	Primorsky		37.4	23.4	1.0	180	165	93.0	1646
1989	7	46–10		32.0	23.5	1.0	122	120	100.0	1550
1989	15	Ultra		33.9	24.1	1.4	144	143	101.3	1549
1989	15	Primorsky		35.6	24.4	1.1	161	151	94.6	1633
1989	15	46–10		30.9	23.8	1.1	116	116	100.6	1566
1989	30	Ultra		24.0	24.4	2.2	145	131	93.4	1545
1989	30	Primorsky		24.5	24.2	1.9	191	167	91.2	1675
1989	30	46–10		22.8	24.3	1.9	115	112	97.9	1571
1990	7	Ultra		67.8	39.0	2.4	164	162	97.2	1404
1990	7	Primorsky		64.5	38.9	3.4	192	178	92.3	1496
1990	7	46–10		68.1	41.8	2.5	181	163	90.3	1358
1990	15	Ultra		63.1	39.0	2.3	196	169	88.6	1396
1990	15	Primorsky		61.8	38.8	3.3	209	188	91.6	1468
1990	15	46–10		62.0	41.2	2.2	194	186	98.1	1302
1990	30	Ultra		58.0	37.7	1.8	180	162	92.0	1305
1990	30	Primorsky		55.9	37.0	3.0	208	171	84.0	1440
1990	30	46–10		56.7	39.6	2.3	190	174	93.7	1263
1991	7	Ultra		33.9	22.8	1.2	143	130	91.1	1644
1991	7	Primorsky		35.4	22.4	1.6	157	138	89.5	1779
1991	7	46–10		39.0	25.2	1.3	145	135	94.2	1452
1991	15	Ultra		36.5	23.8	1.6	165	143	86.0	1498
1991	15	Primorsky		34.8	23.0	1.8	155	135	88.2	1709
1991	15	46–10		37.0	26.2	1.5	168	147	89.3	1441
1991	30	Ultra		30.5	23.6	1.3	164	153	94.6	1447
1991	30	Primorsky		26.2	23.3	2.2	153	130	88.0	1720
1991	30	46–10		25.2	25.4	1.3	164	143	87.9	1492
1988	7		120	31.1	19.1	1.0	126	106	85.6	1377
1988	7		180	36.2	19.0	1.0	176	161	94.8	1298
1988	7		240	39.0	20.2	1.0	244	202	84.4	1317
1988	15		120	27.2	20.3	1.0	99	90	92.1	1381
1988	15		180	24.5	18.8	1.0	123	123	100.3	1369
1988	15		240	30.4	20.2	1.0	180	164	98.9	1353
1988	30		120	24.7	21.1	1.0	107	88	82.7	1288
1988	30		180	23.8	20.8	1.0	142	127	90.7	1252
1988	30		240	23.8	18.7	1.0	153	139	91.5	1289
1989	7		120	33.4	23.8	1.0	104	101	98.9	1606
1989	7		180	35.4	23.7	1.0	162	149	93.4	1570
1989	7		240	39.1	23.5	1.1	194	178	92.7	1577
1989	15		120	30.5	23.9	1.1	109	107	100.7	1610
1989	15		180	33.5	24.0	1.1	142	140	99.8	1580
1989	15		240	36.4	24.4	1.4	170	162	95.9	1549
1989	30		120	23.3	23.8	1.8	99	100	100.2	1603
1989	30		180	24.1	24.3	1.9	153	142	94.4	1595
1989	30		240	24.0	24.8	2.3	199	169	87.9	1593

Continued

1988–91 Combined Lupin Row Spacing and Seeding Rate Studies
\rlington, WI (Expt. 9197)

Year	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)		%	
1990	7		120	65.7	40.3	2.4	127	117	91.3	1438
1990	7		180	65.7	39.8	3.0	174	161	92.6	1438
1990	7		240	69.0	39.7	2.9	235	225	95.8	1383
1990	15		120	63.1	40.2	2.4	139	133	96.0	1394
1990	15		180	61.4	39.5	2.6	210	187	91.4	1405
1990	15		240	62.5	39.3	2.7	250	223	90.8	1367
1990	30		120	55.6	38.3	1.8	141	133	95.3	1365
1990	30		180	56.7	38.3	2.5	190	168	89.4	1328
1990	30		240	58.4	37.6	2.8	247	206	85.0	1315
1991	7		120	28.8	23.1	1.4	103	97	95.2	1656
1991	7		180	38.6	23.4	1.2	154	142	92.5	1617
1991	7		240	40.9	23.9	1.5	188	163	87.2	1602
1991	15		120	32.7	23.7	1.6	105	98	92.6	1599
1991	15		180	36.6	24.3	1.7	173	148	85.7	1558
1991	15		240	39.1	25.0	1.7	211	179	85.2	1490
1991	30		120	25.5	23.7	1.2	110	104	95.1	1620
1991	30		180	27.3	23.5	1.8	156	144	92.5	1574
1991	30		240	29.1	25.2	1.8	215	178	82.8	1466
1988		Ultra	120	24.6	20.7	1.0	91	85	94.0	1378
1988		Ultra	180	26.8	19.8	1.0	134	131	98.3	1311
1988		Ultra	240	28.9	19.9	1.0	178	156	91.0	1321
1988		Primorsky	120	27.7	19.3	1.0	107	83	79.0	1387
1988		Primorsky	180	25.9	18.7	1.0	125	118	96.5	1333
1988		Primorsky	240	30.9	18.8	1.0	188	169	95.3	1330
1988		46–10	120	30.7	20.4	1.0	134	115	87.3	1281
1988		46–10	180	31.8	20.2	1.0	182	162	90.9	1276
1988		46–10	240	33.4	20.3	1.0	211	181	88.5	1307
1989		Ultra	120	30.4	23.9	1.4	114	111	98.5	1557
1989		Ultra	180	32.1	24.3	1.4	146	141	98.3	1550
1989		Ultra	240	33.9	24.3	1.8	187	165	89.9	1546
1989		Primorsky	120	31.4	23.6	1.2	123	121	99.4	1672
1989		Primorsky	180	32.4	24.0	1.3	181	167	93.5	1650
1989		Primorsky	240	33.7	24.4	1.5	228	195	85.8	1631
1989		46–10	120	25.3	24.1	1.3	75	75	101.8	1590
1989		46–10	180	28.5	23.6	1.3	129	123	95.9	1546
1989		46–10	240	31.9	24.0	1.5	149	149	100.8	1541
1990		Ultra	120	62.5	39.8	2.1	126	122	95.3	1382
1990		Ultra	180	63.2	38.4	2.1	183	166	92.8	1388
1990		Ultra	240	63.2	37.5	2.3	231	204	89.7	1334
1990		Primorsky	120	59.9	37.3	2.5	151	134	89.6	1490
1990		Primorsky	180	60.5	38.8	3.4	195	180	92.1	1473
1990		Primorsky	240	61.8	38.7	3.8	263	223	86.2	1442
1990		46–10	120	62.0	41.7	2.0	131	127	97.7	1324
1990		46–10	180	60.1	40.5	2.6	196	170	88.5	1309
1990		46–10	240	64.8	40.4	2.3	238	226	95.9	1289
1991		Ultra	120	29.1	22.3	1.3	109	100	92.1	1587
1991		Ultra	180	34.9	23.8	1.3	158	144	91.7	1506
1991		Ultra	240	37.0	24.2	1.4	206	181	87.8	1496
1991		Primorsky	120	26.3	22.2	1.5	102	98	95.8	1834
1991		Primorsky	180	34.2	22.5	2.0	163	142	87.8	1737
1991		Primorsky	240	35.8	24.1	2.1	201	164	82.2	1636
1991		46–10	120	31.6	26.0	1.3	106	101	95.1	1453
1991		46–10	180	33.4	24.9	1.3	163	148	91.1	1507
1991		46–10	240	36.2	25.8	1.4	208	175	85.1	1425

Continued

1988–91 Combined Lupin Row Spacing and Seeding Rate Studies
\rlington, WI (Expt. 9197)

Year	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	38.7	26.9	1.4	103	98	93.4	1544
	7	Ultra	180	44.9	26.1	1.4	158	150	95.1	1473
	7	Ultra	240	47.3	26.1	1.5	203	176	87.3	1472
	7	Primorsky	120	39.3	25.3	1.6	127	110	89.2	1591
	7	Primorsky	180	43.6	25.9	1.7	163	155	96.2	1568
	7	Primorsky	240	45.2	26.4	1.9	230	203	88.6	1533
	7	46–10	120	41.2	27.6	1.4	115	107	95.6	1423
	7	46–10	180	43.5	27.4	1.6	180	156	88.6	1401
	7	46–10	240	48.4	27.9	1.4	213	197	94.2	1404
	15	Ultra	120	36.8	26.6	1.6	118	111	95.9	1483
	15	Ultra	180	39.1	26.9	1.4	156	137	90.8	1461
	15	Ultra	240	41.5	26.9	1.7	199	186	96.6	1418
	15	Primorsky	120	38.8	25.6	1.6	112	105	93.1	1609
	15	Primorsky	180	38.9	25.9	1.9	165	154	94.8	1538
	15	Primorsky	240	42.1	27.2	1.9	212	184	90.2	1507
	15	46–10	120	39.5	28.9	1.4	109	104	97.0	1396
	15	46–10	180	39.1	27.2	1.4	164	157	97.3	1436
	15	46–10	240	42.6	27.6	1.4	197	177	91.3	1393
	30	Ultra	120	34.4	26.5	1.4	109	104	95.6	1401
	30	Ultra	180	33.8	26.8	1.5	152	150	99.9	1382
	30	Ultra	240	33.4	26.4	1.7	200	168	85.0	1383
	30	Primorsky	120	30.9	26.0	1.4	124	112	90.5	1588
	30	Primorsky	180	32.4	26.1	2.3	170	146	86.4	1538
	30	Primorsky	240	34.3	25.9	2.4	218	176	83.3	1489
	30	46–10	120	31.5	27.7	1.4	110	102	93.9	1417
	30	46–10	180	32.8	27.3	1.6	158	140	89.0	1392
	30	46–10	240	33.7	27.3	1.8	193	174	92.1	1375
1988	7			35.4	19.4	1.0	182	157	88.3	1331
1988	15			27.4	19.8	1.0	134	125	97.1	1368
1988	30			24.1	20.2	1.0	134	118	88.3	1276
1989	7			36.0	23.7	1.0	153	143	95.0	1584
1989	15			33.5	24.1	1.2	140	136	98.8	1579
1989	30			23.8	24.3	2.0	150	137	94.2	1597
1990	7			66.8	39.9	2.8	179	168	93.2	1419
1990	15			62.3	39.7	2.6	200	181	92.8	1389
1990	30			56.9	38.1	2.3	193	169	89.9	1336
1991	7			36.1	23.5	1.4	148	134	91.6	1625
1991	15			36.1	24.3	1.6	163	142	87.8	1549
1991	30			27.3	24.1	1.6	160	142	90.1	1553
1988		Ultra		26.7	20.1	1.0	134	124	94.4	1337
1988		Primorsky		28.2	18.9	1.0	140	124	90.3	1350
1988		46–10		32.0	20.3	1.0	175	152	88.9	1288
1989		Ultra		32.1	24.2	1.6	149	139	95.6	1551
1989		Primorsky		32.5	24.0	1.3	177	161	92.9	1651
1989		46–10		28.6	23.9	1.3	118	116	99.5	1559
1990		Ultra		63.0	38.6	2.1	180	164	92.6	1368
1990		Primorsky		60.8	38.3	3.2	203	179	89.3	1468
1990		46–10		62.3	40.9	2.3	188	174	94.0	1308
1991		Ultra		33.7	23.4	1.3	158	142	90.5	1530
1991		Primorsky		32.1	22.9	1.9	155	135	88.6	1736
1991		46–10		33.7	25.6	1.4	159	141	90.5	1462

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1988–91 Combined Lupin Row Spacing and Seeding Rate Studies
ırlington, WI (Expt. 9197)

Year	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)		%	
1988			120	27.6	20.1	1.0	111	95	86.8	1349
1988			180	28.2	19.5	1.0	147	137	95.2	1306
1988			240	31.1	19.7	1.0	192	169	91.6	1320
1989			120	29.1	23.9	1.3	104	102	99.9	1606
1989			180	31.0	24.0	1.3	152	144	95.9	1582
1989			240	33.1	24.3	1.6	188	170	92.2	1573
1990			120	61.5	39.6	2.2	136	128	94.2	1399
1990			180	61.3	39.2	2.7	191	172	91.1	1390
1990			240	63.3	38.9	2.8	244	218	90.6	1355
1991			120	29.0	23.5	1.4	106	100	94.3	1625
1991			180	34.2	23.8	1.5	161	145	90.2	1583
1991			240	36.3	24.7	1.6	205	173	85.0	1519
	7	Ultra		43.6	26.4	1.4	154	141	91.9	1496
	7	Primorsky		42.7	25.8	1.7	173	156	91.3	1564
	7	46–10		44.4	27.7	1.5	169	153	92.8	1409
	15	Ultra		39.1	26.8	1.6	157	145	94.4	1454
	15	Primorsky		39.9	26.2	1.8	163	148	92.7	1551
	15	46–10		40.4	27.9	1.4	157	146	95.2	1408
	30	Ultra		33.9	26.6	1.5	154	141	93.5	1389
	30	Primorsky		32.5	26.0	2.0	171	145	86.7	1539
	30	46–10		32.7	27.4	1.6	154	139	91.6	1395
	7		120	39.8	26.6	1.5	115	105	92.7	1519
	7		180	44.0	26.5	1.5	167	153	93.3	1481
	7		240	47.0	26.8	1.6	215	192	90.0	1470
	15		120	38.4	27.0	1.5	113	107	95.3	1496
	15		180	39.0	26.7	1.6	162	149	94.3	1478
	15		240	42.1	27.2	1.7	203	182	92.7	1439
	30		120	32.3	26.7	1.4	114	106	93.3	1469
	30		180	33.0	26.7	1.8	160	145	91.8	1437
	30		240	33.8	26.6	2.0	204	173	86.8	1416
		Ultra	120	36.7	26.7	1.5	110	105	95.0	1476
		Ultra	180	39.3	26.6	1.4	155	146	95.3	1439
		Ultra	240	40.7	26.5	1.6	201	177	89.6	1424
		Primorsky	120	36.3	25.6	1.5	121	109	90.9	1596
		Primorsky	180	38.3	26.0	1.9	166	152	92.5	1548
		Primorsky	240	40.6	26.5	2.1	220	188	87.4	1510
		46–10	120	37.4	28.0	1.4	111	105	95.5	1412
		46–10	180	38.4	27.3	1.5	167	151	91.6	1409
		46–10	240	41.6	27.6	1.6	201	183	92.6	1391
1988				29.0	19.8	1.0	150	133	91.2	1325
1989				31.1	24.0	1.4	148	139	96.0	1587
1990				62.0	39.2	2.6	190	173	92.0	1381
1991				33.2	24.0	1.5	157	139	89.9	1576
	7			43.6	26.6	1.5	166	150	92.0	1490
	15			39.8	27.0	1.6	159	146	94.1	1471
	30			33.0	26.7	1.7	159	141	90.6	1441
		Ultra		38.9	26.6	1.5	155	142	93.3	1446
		Primorsky		38.4	26.0	1.9	169	150	90.3	1551
		46–10		39.1	27.7	1.5	160	146	93.2	1404
			120	36.8	26.8	1.5	114	106	93.8	1495
			180	38.7	26.6	1.6	163	149	93.1	1465
			240	41.0	26.9	1.8	207	182	89.8	1442
Mean				38.8	26.8	1.6	161	146	92.3	1467

Continued

1988–91 Combined Lupin Row Spacing and Seeding Rate Studies
Arlington, WI (Expt. 9197)

Year	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)		%	
Probability (%)										
Year (Y)				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	2.9	< 0.1
Row Spacing (R)				< 0.1	31.9	1.0	30.9	8.5	14.3	0.1
Y x R				0.6	1.0	< 0.1	< 0.1	0.2	21.5	0.3
Variety (V)				> 50	< 0.1	< 0.1	0.7	16.6	9.9	< 0.1
Y x R				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	> 50	< 0.1
R x V				> 50	> 50	24.3	36.4	> 50	> 50	0.2
Y x R x V				19.3	> 50	27.6	37.0	25.4	> 50	18.5
Seeding Rate (S)				< 0.1	> 50	< 0.1	< 0.1	< 0.1	2.5	< 0.1
Y x S				1.4	13.1	< 0.1	3.3	11.9	1.1	< 0.1
R x S				0.1	> 50	0.6	> 50	9.9	> 50	> 50
Y x R x S				25.7	27.1	19.5	< 0.1	19.7	> 50	4.2
V x S				> 50	16.8	0.1	13.3	> 50	37.0	0.2
Y x V x S				> 50	44.3	3.6	> 50	> 50	27.2	< 0.1
R x V x S				> 50	> 50	32.6	> 50	18.3	6.2	4.5
Y x R x V x S				> 50	> 50	> 50	26.9	19.6	45.2	32.2
LSD (10%)										
Year (Y)				1.4	0.5	0.1	9.4	7.6	3.4	21.5
Row Spacing (R)				1.2	ns	0.1	ns	6.6	ns	18.8
Variety (V)				ns	0.4	0.1	7.1	ns	2.6	16.2
Seeding Rate (S)				1.0	ns	0.1	5.4	4.9	2.6	11.1
C.V. (%)				12.8	7.9	25.2	17.0	17.1	14.2	3.9

FIELD EXPERIMENT HISTORY

Exp. No. 9188 Year: 1991
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, WDATCP Ag. Diversification Fund, and Wolf River Valley Seeds

FIELD INFORMATION

Soil Type: Antigo silt loam
Tillage Operations: Conventional (Spring plowed, field cultivator)
Previous Crop: Sod

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: 13 May Rate (seeds/sq ft): 120, 180,240 K sd/ac Depth: 1"
- Equipment: Hefty plot planter

Harvesting: Date: 6 Sept Equipment: Almaco plot combine #1

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

	Material	Rate	Method	Date
Herbicide(s):	Lorox	2 pts/ac	Pre–emergence	15 May

1991 Lupin Row Spacing and Seeding Rate Study
Antigo, WI (Expt. 9188)

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	37.1	28.3	2.0	102	95	92.8	1361
7	Ultra	180	39.4	28.3	2.7	148	119	79.7	1436
7	Ultra	240	42.9	29.0	2.0	129	150	115.7	1486
7	Primorsky	120	39.3	27.0	2.0	102	96	94.6	1639
7	Primorsky	180	41.8	27.3	2.3	130	121	92.4	1625
7	Primorsky	240	48.4	28.3	2.0	178	155	87.8	1538
7	46–10	120	34.7	25.3	2.0	93	84	90.4	1551
7	46–10	180	35.0	29.0	2.0	129	121	93.8	1379
7	46–10	240	37.0	26.0	2.0	170	160	94.7	1383
15	Ultra	120	31.9	27.0	2.0	127	117	92.8	1491
15	Ultra	180	35.7	26.3	2.7	150	142	94.6	1574
15	Ultra	240	33.3	27.3	3.7	181	159	87.0	1812
15	Primorsky	120	34.8	25.7	2.0	112	98	87.7	1714
15	Primorsky	180	38.2	25.7	1.7	160	134	84.6	1583
15	Primorsky	240	32.2	27.3	2.7	227	191	85.0	1683
15	46–10	120	30.3	26.3	2.0	116	111	95.5	1490
15	46–10	180	32.5	25.3	2.3	159	140	87.8	1485
15	46–10	240	34.7	26.7	2.7	225	193	85.7	1627
30	Ultra	120	21.2	23.7	2.7	84	76	90.3	1686
30	Ultra	180	23.8	27.0	3.3	154	127	82.5	1746
30	Ultra	240	24.6	26.3	4.3	174	155	89.1	2253
30	Primorsky	120	22.8	24.3	2.7	102	93	92.5	1814
30	Primorsky	180	22.2	27.0	3.7	159	133	83.6	1844
30	Primorsky	240	18.5	23.7	4.3	177	150	84.9	1837
30	46–10	120	20.6	24.7	2.7	100	93	92.6	1705
30	46–10	180	22.9	27.0	3.0	160	142	88.1	1663
30	46–10	240	26.3	25.7	4.0	193	143	75.6	1664
7	Ultra		39.8	28.6	2.2	126	121	96.1	1428
7	Primorsky		43.2	27.6	2.1	137	124	91.6	1601
7	46–10		35.6	26.8	2.0	131	122	92.9	1438
15	Ultra		33.7	26.9	2.8	153	139	91.5	1626
15	Primorsky		35.1	26.2	2.1	166	141	85.8	1660
15	46–10		32.5	26.1	2.3	167	148	89.6	1534
30	Ultra		23.2	25.7	3.4	137	119	87.3	1895
30	Primorsky		21.2	25.0	3.6	146	125	87.0	1832
30	46–10		23.3	25.8	3.2	151	126	85.4	1677
7		120	37.1	26.9	2.0	99	92	92.6	1517
7		180	38.7	28.2	2.3	135	120	88.6	1480
7		240	42.8	27.8	2.0	159	155	99.4	1469
15		120	32.3	26.3	2.0	118	109	92.0	1565
15		180	35.5	25.8	2.2	156	139	89.0	1548
15		240	33.4	27.1	3.0	211	181	85.9	1707
30		120	21.5	24.2	2.7	95	87	91.8	1735
30		180	23.0	27.0	3.3	158	134	84.7	1751
30		240	23.1	25.2	4.2	181	149	83.2	1918

Continued

1991 Lupin Row Spacing and Seeding Rate Study
Antigo, WI (Expt. 9188)

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)		%	
	Ultra	120	30.1	26.3	2.2	104	96	92.0	1513
	Ultra	180	33.0	27.2	2.9	151	129	85.6	1585
	Ultra	240	33.6	27.6	3.3	161	155	97.3	1850
	Primorsky	120	32.3	25.7	2.2	105	96	91.6	1722
	Primorsky	180	34.1	26.7	2.6	149	129	86.9	1684
	Primorsky	240	33.0	26.4	3.0	194	165	85.9	1686
	46–10	120	28.5	25.4	2.2	103	96	92.8	1582
	46–10	180	30.1	27.1	2.4	149	134	89.9	1509
	46–10	240	32.7	26.1	2.9	196	165	85.3	1558
7			39.5	27.6	2.1	131	122	93.5	1489
15			33.8	26.4	2.4	162	143	89.0	1607
30			22.5	25.5	3.4	145	124	86.6	1801
	Ultra		32.2	27.0	2.8	139	127	91.6	1650
	Primorsky		33.1	26.3	2.6	150	130	88.1	1697
	46–10		30.5	26.2	2.5	150	132	89.3	1550
		120	30.3	25.8	2.2	104	96	92.1	1606
		180	32.4	27.0	2.6	150	131	87.5	1593
		240	33.1	26.7	3.1	184	162	89.5	1698
Mean			31.9	26.5	2.6	146	130	89.7	1632
Probabilty (%)									
Row Spacing (R)			< 0.1	19.8	2.7	0.6	4.5	7.0	< 0.1
Variety (V)			2.8	34.4	> 50	19.8	> 50	> 50	0.7
R x V			1.2	> 50	> 50	> 50	> 50	> 50	14.4
Seeding Rate (SR)			1.8	27.1	< 0.1	< 0.1	< 0.1	9.1	0.8
R x SR			12.1	40.2	0.8	5.5	20.5	1.8	6.4
V x SR			> 50	> 50	> 50	7.2	> 50	2.4	< 0.1
R x V x SR			24.1	> 50	> 50	> 50	27.9	1.9	29.4
LSD (10%)									
Row Spacing (R)			1.5	ns	0.8	9.4	12.8	4.5	42.8
Variety (V)			1.6	ns	ns	ns	ns	ns	68.1
Seeding Rate (SR)			1.7	ns	0.3	10.3	8.3	3.5	58.2
C.V. (%)			11.2	10.4	24.5	15.4	14.0	8.5	7.8

1988–91 Combined Lupin Row Spacing and Seeding Rate Studies
\ntigo, WI (Expt. 9198)

Year	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)		%	
1988	7	Ultra	120	15.3	20.8	1.0	45	39	96.5	1508
1988	7	Ultra	180	23.5	21.0	1.0	99	75	77.8	1514
1988	7	Ultra	240	27.5	20.3	1.0	108	118	121.8	1533
1988	7	Primorsky	120	18.5	16.8	1.0	56	47	92.3	1779
1988	7	Primorsky	180	18.4	16.5	1.0	99	79	80.8	1636
1988	7	Primorsky	240	24.9	17.5	1.0	127	131	118.5	1596
1988	7	46–10	120	18.2	19.0	1.0	56	45	88.8	1352
1988	7	46–10	180	27.7	16.8	1.0	121	101	84.8	1289
1988	7	46–10	240	29.3	20.5	1.0	119	120	106.5	1364
1988	15	Ultra	120	23.6	19.0	1.0	60	46	83.3	1553
1988	15	Ultra	180	28.3	20.8	1.0	82	64	74.8	1552
1988	15	Ultra	240	32.2	20.0	1.0	92	95	101.0	1435
1988	15	Primorsky	120	20.0	18.5	1.0	59	39	67.0	1674
1988	15	Primorsky	180	25.4	16.8	1.0	80	98	128.8	1614
1988	15	Primorsky	240	33.5	18.8	1.0	125	124	102.0	1432
1988	15	46–10	120	28.4	21.8	1.0	64	56	88.0	1419
1988	15	46–10	180	29.3	20.5	1.0	112	100	90.8	1442
1988	15	46–10	240	32.6	19.8	1.0	112	132	124.0	1311
1988	30	Ultra	120	19.5	19.8	1.0	68	54	79.8	1406
1988	30	Ultra	180	25.5	23.5	1.0	93	90	97.5	1531
1988	30	Ultra	240	21.6	20.5	1.0	114	101	88.8	1466
1988	30	Primorsky	120	16.7	15.3	1.0	64	65	105.5	1495
1988	30	Primorsky	180	18.7	17.8	1.0	83	80	101.0	1555
1988	30	Primorsky	240	25.3	18.3	1.0	163	143	88.0	1408
1988	30	46–10	120	22.3	22.0	1.0	68	62	101.5	1311
1988	30	46–10	180	25.2	19.3	1.0	99	91	93.0	1341
1988	30	46–10	240	26.6	17.5	1.0	99	110	113.3	1211
1989	7	Ultra	120	44.2	29.3	1.3	111	99	63.2	1421
1989	7	Ultra	180	44.2	29.8	2.0	180	173	44.8	1395
1989	7	Ultra	240	49.3	29.0	1.8	188	150	82.1	1395
1989	7	Primorsky	120	46.9	25.0	1.0	150	119	54.8	1513
1989	7	Primorsky	180	49.5	27.0	1.0	174	164	68.9	1504
1989	7	Primorsky	240	47.7	26.3	1.3	224	190	59.8	1478
1989	7	46–10	120	42.7	27.8	1.0	77	79	46.0	1510
1989	7	46–10	180	45.7	30.5	1.3	162	137	84.1	1397
1989	7	46–10	240	46.0	27.0	1.3	147	126	61.2	1422
1989	15	Ultra	120	44.7	28.5	1.5	131	118	66.0	1448
1989	15	Ultra	180	41.9	28.8	1.8	166	148	66.1	1475
1989	15	Ultra	240	41.9	30.0	2.3	220	189	85.5	1446
1989	15	Primorsky	120	41.7	27.3	2.0	113	103	41.1	1611
1989	15	Primorsky	180	46.7	28.8	1.8	159	156	45.0	1541
1989	15	Primorsky	240	41.9	28.8	2.0	204	164	81.3	1570
1989	15	46–10	120	45.1	30.8	1.8	107	96	42.5	1510
1989	15	46–10	180	41.2	27.5	2.0	119	106	65.0	1480
1989	15	46–10	240	41.9	27.5	1.3	152	118	76.9	1448
1989	30	Ultra	120	32.2	30.5	2.3	117	107	92.5	1509
1989	30	Ultra	180	35.5	29.8	2.5	138	119	37.4	1451
1989	30	Ultra	240	32.1	28.5	2.8	191	157	54.4	1451
1989	30	Primorsky	120	35.5	28.8	3.0	115	103	39.1	1602
1989	30	Primorsky	180	34.9	28.0	3.0	161	151	67.3	1512
1989	30	Primorsky	240	29.6	29.5	3.3	218	198	91.5	1577
1989	30	46–10	120	28.6	29.8	2.0	57	51	40.0	1597
1989	30	46–10	180	33.1	30.5	2.0	114	88	77.8	1443
1989	30	46–10	240	33.4	28.8	2.3	155	135	39.9	1420

Continued

1988–91 Combined Lupin Row Spacing and Seeding Rate Studies
\ntigo, WI (Expt. 9198)

Year	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)		%	
1990	7	Ultra	120	63.0	35.8	3.0	134	120	90.0	1948
1990	7	Ultra	180	61.9	38.0	4.0	152	130	87.3	2054
1990	7	Ultra	240	60.1	35.0	3.3	202	150	74.0	1916
1990	7	Primorsky	120	54.6	34.8	3.8	145	142	99.0	2139
1990	7	Primorsky	180	43.6	36.0	4.8	176	158	89.5	1814
1990	7	Primorsky	240	47.2	37.0	4.5	205	180	88.8	1624
1990	7	46–10	120	69.6	39.0	3.0	131	135	104.8	1728
1990	7	46–10	180	57.4	38.3	3.5	185	160	86.3	1913
1990	7	46–10	240	57.5	37.8	3.3	237	214	89.8	1859
1990	15	Ultra	120	59.5	35.8	2.8	108	87	80.8	2051
1990	15	Ultra	180	51.0	35.5	3.5	129	130	100.5	2073
1990	15	Ultra	240	56.7	35.0	4.0	190	160	84.0	2053
1990	15	Primorsky	120	49.1	35.0	3.3	106	97	93.5	2212
1990	15	Primorsky	180	44.4	35.8	4.3	156	142	91.4	2081
1990	15	Primorsky	240	44.7	33.0	4.3	214	194	90.5	2223
1990	15	46–10	120	70.3	34.8	2.5	122	112	95.0	1692
1990	15	46–10	180	61.3	37.3	3.3	155	135	87.0	1805
1990	15	46–10	240	60.1	37.8	3.5	215	186	87.3	1606
1990	30	Ultra	120	50.2	34.0	3.8	101	96	95.5	1996
1990	30	Ultra	180	47.1	35.5	3.3	132	122	92.1	2054
1990	30	Ultra	240	45.3	32.3	3.3	171	151	88.5	2079
1990	30	Primorsky	120	40.9	32.8	3.8	119	105	88.3	2146
1990	30	Primorsky	180	36.3	39.8	4.3	171	153	89.8	2292
1990	30	Primorsky	240	37.4	35.5	4.8	196	186	95.0	2392
1990	30	46–10	120	57.8	36.3	2.8	124	113	92.3	1751
1990	30	46–10	180	49.9	34.5	3.8	159	148	93.5	1853
1990	30	46–10	240	48.2	38.8	3.5	212	199	93.8	1856
1991	7	Ultra	120	37.1	28.3	2.0	102	95	92.8	1361
1991	7	Ultra	180	39.4	28.3	2.8	148	119	79.8	1436
1991	7	Ultra	240	42.9	29.0	2.0	129	150	115.7	1486
1991	7	Primorsky	120	39.3	27.0	2.0	102	96	94.6	1639
1991	7	Primorsky	180	41.8	27.3	2.3	130	121	92.4	1625
1991	7	Primorsky	240	48.4	28.3	2.0	178	156	87.9	1538
1991	7	46–10	120	34.7	25.3	2.0	93	84	90.4	1551
1991	7	46–10	180	35.0	29.0	2.0	129	121	93.8	1379
1991	7	46–10	240	37.0	26.0	2.0	170	160	94.7	1383
1991	15	Ultra	120	31.9	27.0	2.0	127	117	92.8	1492
1991	15	Ultra	180	35.7	26.3	2.8	150	142	94.6	1575
1991	15	Ultra	240	33.3	27.3	3.8	181	159	87.0	1812
1991	15	Primorsky	120	34.8	25.8	2.0	112	98	87.7	1714
1991	15	Primorsky	180	38.3	25.8	1.8	160	135	84.6	1583
1991	15	Primorsky	240	32.2	27.3	2.8	227	192	85.0	1683
1991	15	46–10	120	30.3	26.3	2.0	116	111	95.5	1491
1991	15	46–10	180	32.5	25.3	2.3	160	140	87.8	1485
1991	15	46–10	240	34.8	26.8	2.8	225	193	85.7	1627
1991	30	Ultra	120	21.2	23.8	2.8	84	76	90.3	1686
1991	30	Ultra	180	23.8	27.0	3.3	154	127	82.5	1746
1991	30	Ultra	240	24.6	26.3	4.3	174	155	89.1	2253
1991	30	Primorsky	120	22.8	24.3	2.8	102	93	92.5	1814
1991	30	Primorsky	180	22.2	27.0	3.8	159	133	83.6	1844
1991	30	Primorsky	240	18.5	23.8	4.3	177	150	84.9	1837
1991	30	46–10	120	20.6	24.8	2.8	100	93	92.6	1705
1991	30	46–10	180	22.9	27.0	3.0	160	142	88.2	1663
1991	30	46–10	240	26.3	25.8	4.0	193	143	75.6	1664

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1988–91 Combined Lupin Row Spacing and Seeding Rate Studies
Antigo, WI (Expt. 9198)

Year	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)		%	
1988	7	Ultra		22.1	20.7	1.0	84	77	98.7	1518
1988	7	Primorsky		20.6	16.9	1.0	94	85	97.2	1671
1988	7	46–10		25.1	18.8	1.0	99	89	93.3	1335
1988	15	Ultra		28.0	19.9	1.0	78	68	86.3	1513
1988	15	Primorsky		26.3	18.0	1.0	88	87	99.3	1573
1988	15	46–10		30.1	20.7	1.0	96	96	100.9	1390
1988	30	Ultra		22.2	21.3	1.0	92	81	88.7	1468
1988	30	Primorsky		20.2	17.1	1.0	103	96	98.2	1486
1988	30	46–10		24.7	19.6	1.0	89	88	102.6	1287
1989	7	Ultra		45.9	29.3	1.7	160	141	63.3	1403
1989	7	Primorsky		48.0	26.1	1.1	182	158	61.2	1498
1989	7	46–10		44.8	28.4	1.2	129	114	63.7	1443
1989	15	Ultra		42.8	29.1	1.8	172	152	72.5	1456
1989	15	Primorsky		43.4	28.3	1.9	159	141	55.8	1574
1989	15	46–10		42.7	28.6	1.7	126	107	61.5	1479
1989	30	Ultra		33.3	29.6	2.5	149	128	61.4	1470
1989	30	Primorsky		33.3	28.8	3.1	165	150	66.0	1563
1989	30	46–10		31.7	29.7	2.1	109	91	52.6	1487
1990	7	Ultra		61.7	36.3	3.4	162	133	83.8	1973
1990	7	Primorsky		48.5	35.9	4.3	176	160	92.4	1859
1990	7	46–10		61.5	38.3	3.3	184	170	93.6	1833
1990	15	Ultra		55.7	35.4	3.4	142	126	88.4	2059
1990	15	Primorsky		46.1	34.6	3.9	159	145	91.8	2172
1990	15	46–10		63.9	36.6	3.1	164	144	89.7	1701
1990	30	Ultra		47.5	33.9	3.4	135	123	92.0	2043
1990	30	Primorsky		38.2	36.0	4.3	162	148	91.0	2276
1990	30	46–10		52.0	36.5	3.3	165	153	93.2	1820
1991	7	Ultra		39.8	28.5	2.3	126	121	96.1	1428
1991	7	Primorsky		43.2	27.5	2.1	137	124	91.6	1601
1991	7	46–10		35.6	26.8	2.0	131	122	93.0	1438
1991	15	Ultra		33.7	26.8	2.8	153	139	91.5	1626
1991	15	Primorsky		35.1	26.3	2.2	166	141	85.8	1660
1991	15	46–10		32.5	26.1	2.3	167	148	89.6	1534
1991	30	Ultra		23.2	25.7	3.4	137	119	87.3	1895
1991	30	Primorsky		21.1	25.0	3.6	146	125	87.0	1832
1991	30	46–10		23.2	25.8	3.3	151	126	85.4	1677
1988	7		120	17.3	18.8	1.0	52	44	92.5	1546
1988	7		180	23.2	18.1	1.0	106	85	81.1	1480
1988	7		240	27.2	19.4	1.0	118	123	115.6	1498
1988	15		120	24.0	19.8	1.0	61	47	79.4	1549
1988	15		180	27.7	19.3	1.0	91	87	98.1	1536
1988	15		240	32.7	19.5	1.0	110	117	109.0	1392
1988	30		120	19.5	19.0	1.0	66	60	95.6	1404
1988	30		180	23.2	20.2	1.0	92	87	97.2	1476
1988	30		240	24.5	18.8	1.0	125	118	96.7	1362
1989	7		120	44.6	27.3	1.1	112	99	54.7	1481
1989	7		180	46.5	29.1	1.4	172	158	65.9	1432
1989	7		240	47.7	27.4	1.4	186	156	67.7	1432
1989	15		120	43.8	28.8	1.8	117	106	49.9	1523
1989	15		180	43.3	28.3	1.8	148	137	58.7	1498
1989	15		240	41.9	28.8	1.8	192	157	81.2	1488
1989	30		120	32.1	29.7	2.4	96	87	57.2	1569
1989	30		180	34.5	29.4	2.5	138	119	60.8	1468
1989	30		240	31.7	28.9	2.8	188	163	61.9	1483

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1988–91 Combined Lupin Row Spacing and Seeding Rate Studies
\ntigo, WI (Expt. 9198)

Year	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)		%	
1990	7		120	62.4	36.5	3.3	136	132	97.9	1938
1990	7		180	54.3	37.4	4.1	171	149	87.7	1927
1990	7		240	54.9	36.6	3.7	215	181	84.2	1799
1990	15		120	59.6	35.2	2.8	112	99	89.8	1985
1990	15		180	52.3	36.2	3.7	147	136	92.9	1986
1990	15		240	53.8	35.3	3.9	207	180	87.2	1961
1990	30		120	49.6	34.3	3.4	114	105	92.0	1964
1990	30		180	44.4	36.6	3.8	154	141	91.8	2066
1990	30		240	43.6	35.5	3.8	193	179	92.4	2109
1991	7		120	37.1	26.8	2.0	99	92	92.6	1517
1991	7		180	38.7	28.2	2.3	135	120	88.6	1480
1991	7		240	42.8	27.8	2.0	159	155	99.4	1469
1991	15		120	32.3	26.3	2.0	118	109	92.0	1565
1991	15		180	35.5	25.8	2.3	156	139	89.0	1548
1991	15		240	33.4	27.1	3.1	211	181	85.9	1707
1991	30		120	21.5	24.3	2.8	95	87	91.8	1735
1991	30		180	23.0	27.0	3.3	158	134	84.7	1751
1991	30		240	23.1	25.3	4.2	181	149	83.2	1918
1988		Ultra	120	19.4	19.8	1.0	58	46	86.5	1489
1988		Ultra	180	25.8	21.8	1.0	91	76	83.3	1532
1988		Ultra	240	27.1	20.3	1.0	105	104	103.8	1478
1988		Primorsky	120	18.4	16.8	1.0	59	50	88.3	1649
1988		Primorsky	180	20.8	17.0	1.0	87	86	103.5	1602
1988		Primorsky	240	27.9	18.2	1.0	138	133	102.8	1479
1988		46–10	120	22.9	20.9	1.0	63	54	92.8	1360
1988		46–10	180	27.4	18.8	1.0	111	97	89.5	1357
1988		46–10	240	29.5	19.3	1.0	110	120	114.6	1295
1989		Ultra	120	40.4	29.4	1.7	120	108	73.9	1459
1989		Ultra	180	40.6	29.4	2.1	161	147	49.5	1440
1989		Ultra	240	41.1	29.2	2.3	199	165	74.0	1431
1989		Primorsky	120	41.3	27.0	2.0	126	108	45.0	1575
1989		Primorsky	180	43.7	27.9	1.9	164	157	60.4	1519
1989		Primorsky	240	39.7	28.2	2.2	215	184	77.5	1542
1989		46–10	120	38.8	29.4	1.6	80	75	42.8	1539
1989		46–10	180	40.0	29.5	1.8	132	110	75.6	1440
1989		46–10	240	40.4	27.8	1.6	151	126	59.3	1430
1990		Ultra	120	57.5	35.2	3.2	114	101	88.8	1998
1990		Ultra	180	53.3	36.3	3.6	138	127	93.3	2060
1990		Ultra	240	54.1	34.1	3.5	188	153	82.2	2016
1990		Primorsky	120	48.2	34.2	3.6	123	115	93.6	2165
1990		Primorsky	180	41.4	37.2	4.4	168	151	90.2	2062
1990		Primorsky	240	43.1	35.2	4.5	205	187	91.4	2080
1990		46–10	120	65.9	36.7	2.8	125	120	97.3	1723
1990		46–10	180	56.2	36.7	3.5	166	148	88.9	1857
1990		46–10	240	55.2	38.1	3.4	221	200	90.3	1773
1991		Ultra	120	30.1	26.3	2.3	104	96	92.0	1513
1991		Ultra	180	33.0	27.2	2.9	151	129	85.6	1585
1991		Ultra	240	33.6	27.5	3.3	161	155	97.3	1850
1991		Primorsky	120	32.3	25.7	2.3	105	96	91.6	1722
1991		Primorsky	180	34.1	26.7	2.6	149	129	86.9	1684
1991		Primorsky	240	33.0	26.4	3.0	194	166	85.9	1686
1991		46–10	120	28.5	25.4	2.3	103	96	92.8	1582
1991		46–10	180	30.1	27.1	2.4	150	134	89.9	1509
1991		46–10	240	32.7	26.2	2.9	196	165	85.3	1558

Continued

1988–91 Combined Lupin Row Spacing and Seeding Rate Studies
Antigo, WI (Expt. 9198)

Year	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	39.9	28.5	1.8	98	88	85.6	1559
	7	Ultra	180	42.3	29.3	2.4	145	124	72.4	1600
	7	Ultra	240	44.9	28.3	2.0	157	142	98.4	1582
	7	Primorsky	120	39.8	25.9	1.9	113	101	85.2	1768
	7	Primorsky	180	38.3	26.7	2.3	145	130	82.9	1645
	7	Primorsky	240	42.1	27.3	2.2	184	164	88.7	1559
	7	46–10	120	41.3	27.8	1.8	89	86	82.5	1535
	7	46–10	180	41.4	28.6	1.9	149	130	87.2	1494
	7	46–10	240	42.5	27.8	1.9	168	155	88.0	1507
	15	Ultra	120	39.9	27.6	1.8	107	92	80.7	1636
	15	Ultra	180	39.2	27.8	2.3	132	121	84.0	1669
	15	Ultra	240	41.0	28.1	2.8	171	151	89.4	1686
	15	Primorsky	120	36.4	26.6	2.1	97	84	72.3	1803
	15	Primorsky	180	38.7	26.8	2.2	139	133	87.4	1705
	15	Primorsky	240	38.1	26.9	2.5	193	168	89.7	1727
	15	46–10	120	43.5	28.4	1.8	102	94	80.3	1528
	15	46–10	180	41.1	27.6	2.1	136	120	82.6	1553
	15	46–10	240	42.3	27.9	2.1	176	157	93.4	1498
	30	Ultra	120	30.8	27.0	2.4	92	83	89.5	1649
	30	Ultra	180	33.0	28.9	2.5	129	115	77.4	1695
	30	Ultra	240	30.9	26.9	2.8	163	141	80.2	1812
	30	Primorsky	120	29.0	25.3	2.6	100	92	81.3	1764
	30	Primorsky	180	28.0	28.1	3.0	143	129	85.4	1801
	30	Primorsky	240	27.7	26.8	3.3	188	169	89.8	1803
	30	46–10	120	32.3	28.2	2.1	87	80	81.6	1591
	30	46–10	180	32.8	27.8	2.4	133	117	88.1	1575
	30	46–10	240	33.6	27.7	2.7	165	147	80.6	1538
1988	7			22.6	18.8	1.0	92	84	96.4	1508
1988	15			28.1	19.5	1.0	87	84	95.5	1492
1988	30			22.4	19.3	1.0	94	88	96.5	1414
1989	7			46.2	27.9	1.3	157	137	62.8	1448
1989	15			43.0	28.6	1.8	152	133	63.3	1503
1989	30			32.8	29.3	2.6	141	123	60.0	1507
1990	7			57.2	36.8	3.7	174	154	89.9	1888
1990	15			55.2	35.5	3.5	155	138	90.0	1977
1990	30			45.9	35.5	3.7	154	141	92.1	2046
1991	7			39.5	27.6	2.1	131	122	93.5	1489
1991	15			33.8	26.4	2.4	162	143	89.0	1607
1991	30			22.5	25.5	3.4	145	124	86.6	1801
1988		Ultra		24.1	20.6	1.0	85	76	91.2	1500
1988		Primorsky		22.4	17.3	1.0	95	89	98.2	1577
1988		46–10		26.6	19.7	1.0	95	91	98.9	1338
1989		Ultra		40.7	29.3	2.0	160	140	65.8	1443
1989		Primorsky		41.6	27.7	2.0	169	149	61.0	1545
1989		46–10		39.7	28.9	1.6	121	104	59.3	1470
1990		Ultra		55.0	35.2	3.4	146	127	88.1	2025
1990		Primorsky		44.2	35.5	4.2	165	151	91.7	2102
1990		46–10		59.1	37.1	3.2	171	156	92.2	1784
1991		Ultra		32.2	27.0	2.8	139	127	91.6	1650
1991		Primorsky		33.1	26.3	2.6	150	130	88.1	1697
1991		46–10		30.4	26.2	2.5	150	132	89.3	1550

Continued

1988–91 Combined Lupin Row Spacing and Seeding Rate Studies
intigo, WI (Expt. 9198)

Year	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)		%	
1988			120	20.3	19.2	1.0	60	50	89.2	1500
1988			180	24.7	19.2	1.0	96	86	92.1	1497
1988			240	28.2	19.2	1.0	118	119	107.1	1417
1989			120	40.2	28.6	1.8	109	97	53.9	1524
1989			180	41.4	28.9	1.9	153	138	61.8	1466
1989			240	40.4	28.4	2.0	189	159	70.3	1467
1990			120	57.2	35.3	3.2	121	112	93.2	1962
1990			180	50.3	36.7	3.8	157	142	90.8	1993
1990			240	50.8	35.8	3.8	205	180	87.9	1956
1991			120	30.3	25.8	2.3	104	96	92.1	1606
1991			180	32.4	27.0	2.6	150	131	87.5	1593
1991			240	33.1	26.7	3.1	184	162	89.5	1698
	7	Ultra		42.4	28.7	2.1	133	118	85.5	1580
	7	Primorsky		40.1	26.6	2.1	147	132	85.6	1657
	7	46–10		41.7	28.1	1.9	136	123	85.9	1512
	15	Ultra		40.1	27.8	2.3	136	121	84.7	1664
	15	Primorsky		37.7	26.8	2.3	143	128	83.2	1745
	15	46–10		42.3	28.0	2.0	138	124	85.4	1526
	30	Ultra		31.6	27.6	2.6	128	113	82.4	1719
	30	Primorsky		28.2	26.7	3.0	144	130	85.5	1789
	30	46–10		32.9	27.9	2.4	128	115	83.4	1568
	7		120	40.3	27.4	1.8	100	92	84.4	1621
	7		180	40.7	28.2	2.2	146	128	80.8	1580
	7		240	43.2	27.8	2.0	169	154	91.7	1549
	15		120	39.9	27.5	1.9	102	90	77.8	1655
	15		180	39.7	27.4	2.2	136	125	84.7	1642
	15		240	40.5	27.7	2.5	180	159	90.8	1637
	30		120	30.7	26.8	2.4	93	85	84.1	1668
	30		180	31.3	28.3	2.7	135	120	83.6	1690
	30		240	30.7	27.1	2.9	172	152	83.6	1718
		Ultra	120	36.9	27.7	2.0	99	88	85.3	1615
		Ultra	180	38.2	28.7	2.4	135	120	77.9	1655
		Ultra	240	39.0	27.8	2.5	163	145	89.3	1694
		Primorsky	120	35.1	25.9	2.2	103	92	79.6	1778
		Primorsky	180	35.0	27.2	2.5	142	131	85.2	1717
		Primorsky	240	35.9	27.0	2.7	188	167	89.4	1696
		46–10	120	39.0	28.1	1.9	93	86	81.4	1551
		46–10	180	38.4	28.0	2.2	139	122	86.0	1541
		46–10	240	39.5	27.8	2.2	170	153	87.4	1514
1988				24.4	19.2	1.0	91	85	96.1	1471
1989				40.7	28.6	1.9	150	131	62.0	1486
1990				52.8	35.9	3.6	161	145	90.7	1971
1991				31.9	26.5	2.7	146	130	89.7	1632
	7			41.4	27.8	2.0	139	124	85.7	1583
	15			40.0	27.5	2.2	139	124	84.4	1645
	30			30.9	27.4	2.7	133	119	83.8	1692
		Ultra		38.0	28.0	2.3	133	117	84.2	1654
		Primorsky		35.3	26.7	2.5	145	130	84.8	1730
		46–10		39.0	28.0	2.1	134	121	84.9	1535
			120	37.0	27.2	2.0	98	89	82.1	1648
			180	37.2	28.0	2.4	139	124	83.1	1637
			240	38.1	27.5	2.5	174	155	88.7	1635
Mean				37.4	27.6	2.3	137	123	84.6	1640

Continued

1988–91 Combined Lupin Row Spacing and Seeding Rate Studies
ıntigo, WI (Expt. 9198)

Year	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)		%	
Probabilty (%)										
Year (Y)				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Row Spacing (R)				< 0.1	> 50	< 0.1	8.2	24.8	> 50	7.1
Y x R				< 0.1	11.3	0.2	< 0.1	2.7	> 50	12.2
Variety (V)				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	> 50	< 0.1
Y x R				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	> 50	1.6
R x V				1.9	22.3	8.9	> 50	> 50	> 50	> 50
Y x R x V				1.8	7.5	17.8	> 50	> 50	> 50	8.3
Seeding Rate (S)				3.4	3.8	< 0.1	< 0.1	< 0.1	8.2	> 50
Y x S				< 0.1	> 50	< 0.1	10.8	> 50	6.6	0.5
R x S				4.6	16.1	1.2	19.8	> 50	32.1	14.1
Y x R x S				25.7	> 50	1.5	43.1	8.3	> 50	15.5
V x S				> 50	16.8	> 50	10.8	24.4	> 50	1.0
Y x V x S				1.3	4.3	> 50	27.9	> 50	8.0	7.1
R x V x S				7.6	> 50	20.6	> 50	> 50	> 50	31.4
Y x R x V x S				15.9	5.6	> 50	> 50	> 50	> 50	> 50
LSD (10%)										
Year (Y)				1.8	0.9	0.2	5.3	7.1	6.5	88.6
Row Spacing (R)				1.6	ns	0.2	4.6	ns	ns	76.7
Variety (V)				0.7	0.4	0.2	5.5	5.2	4.2	44.8
Seeding Rate (S)				0.8	0.5	0.1	6.0	5.4	5.3	ns
C.V. (%)				10.4	8.7	23.8	22.6	22.4	31.8	9.7

FIELD EXPERIMENT HISTORY

Exp. No. 9184-86 **Year: 1991**
Title: LUPIN DATE OF PLANTING STUDY AT THREE LOCATIONS
Personnel: M.J. Martinka, E.S. Oplinger, R.E. Rand, and R.W. Weidman
Locations: Arlington, Spooner, Sturgeon Bay WI
Supported by: Hatch Project 1890, WDATCP Ag Diversification Fund, and Wolf River Valley Seeds

FIELD INFORMATION

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

EXPERIMENTAL PROCEDURE

Experimental Design: RCB plot design Replicates: 4

Variables: Date of Planting (3)

Plot Size:

Arlington	Spooner	Sturgeon Bay
Planted: 6' x 25'	Planted: 4' x 18'	Planted: 4' x 18'
Harvested: 4.4'x 21'	Harvested: 2' x 12'	Harvested: 2' x 16'
Row Spacing: 7"	Row Spacing: 12"	Row Spacing: 12"

Planting:

Arlington
Date: April 18, May 1, and 16 Rate (seeds/a): 180000 Depth: 1"
Equipment: Hefty G tractor with mounted cone type planter

Spooner
Date: April 17, May 3, and 16 Rate (seeds/a): 180000 Depth: 1"
Equipment: Hand Planted and Harvested

Sturgeon Bay
Date: April 24, May 9, and 23 Rate (seeds/a): 180000 Depth: 1"
Equipment: Hand Planted and Harvested

Harvesting:

Arlington
Date: Aug 7, 12 Equipment: Almaco plot combine #1

Spooner
Date: Aug 27, Sept 20 Harvested pods threshed With stationary Almaco Thresher

Sturgeon Bay
Date: Aug 26, Sept 3 Harvested plants threshed With stationary Almaco Thresher

Cultivar(s): Ultra

		Material	Rate	Method	Date
Herbicide(s):	Arlington:	Prowl	2 pts/ac	PPI	17 Apr
		Dual	2 pts/ac	PPI	17 Apr
	Spooner:	Prowl	3 pt/ac	PRE	17 Apr
		Poast + Oil	1.25 pt/ac	Post	19 June
	Sturgeon Bay:	Prowl	1.5 lb a.i./ac	PPI	24 Apr
Insecticide(s):	Arlington:	Asana XL	2.5 oz/ac		17 June
	Spooner:	Pydrin	80 mls/ac		12 June ; 3 July
	Sturgeon Bay:	Asana XL	3 oz/100gal dilute.		12, 25 June

1991 Lupin Date of Planting x Inoculation Study
Arlington WI (Expt. 9184)

Planting Date	Innoculation	Yield	Plant Height	Plant Lodging	Population Emergence	Population Harvest	Survival	Seeds/ lb.
					--- plants/a ---			
		(bu/a)	(in.)	(1–5)	(x1000)		(%)	
April 18	Non–inoulated	24.1	23.5	2.0	233	207	88	1890
April 18	Inoculated	24.5	23.3	2.0	197	174	89	1879
May 1	Non–inoulated	16.0	23.0	1.0	164	130	80	1837
May 1	Inoculated	21.4	24.0	1.0	187	167	91	1696
May 16	Non–inoulated	8.9	25.3	2.3	158	116	74	1540
May 16	Inoculated	8.6	25.0	2.3	153	116	75	1385
	Non–inoulated	16.3	23.9	1.8	185	151	80	1756
	Inoculated	18.1	24.1	1.8	179	152	85	1653
April 18		24.3	23.4	2.0	215	190	89	1884
May 1		18.7	23.5	1.0	175	149	85	1766
May 16		8.7	25.1	2.3	156	116	74	1462
Mean		17.2	24.0	1.8	182	152	83	1704
Probability (%)								
Planting Date (P)		<0.1	13.1	0.4	1.3	0.9	8.2	0.3
Inoculation (I)		17.6	>50	>50	>50	>50	30.4	5.2
P x I		16.4	>50	>50	19.7	<0.1	>50	>50
LSD (10%)								
Planting Date (P)		3.3	ns	0.5	27	30	10	134
Inoculation (I)		ns	ns	ns	22	9	ns	84
C.V. (%)		17.1	11.0	26.9	16.4	7.6	12.7	6.7

1991 Lupin Date of Planting x Variety Study
Arlington WI (Expt. 9184)

Planting Date	Variety	Yield	Plant Height	Plant Lodging	Population Emergence	Population Harvest	Survival	Seeds/ lb.
					--- plants/a ---			
		bu/a	in.	(1–5)	(x1000)		%	
April 18	Ultra	24.5	23.3	2.0	197	174	89	1879
April 18	L 2019N	30.7	24.5	2.8	220	178	80	1662
May 1	Ultra	21.4	24.0	1.0	187	167	91	1696
May 1	L 2019N	27.1	24.8	1.0	211	175	82	1622
May 16	Ultra	8.6	25.0	2.3	153	116	75	1385
May 16	L 2019N	14.8	26.0	2.0	192	162	85	1321
	Ultra	18.1	24.1	1.8	179	152	85	1653
	L 2019N	24.2	25.1	1.9	208	172	82	1535
April 18		27.6	23.9	2.4	209	176	85	1770
May 1		24.2	24.4	1.0	199	171	86	1659
May 16		11.7	25.5	2.1	172	139	80	1353
Mean		21.2	24.6	1.8	193	162	84	1594
Probability (%)								
Planting Date (P)		<0.1	>50	<0.1	8.7	13.9	>50	<0.1
Variety (V)		<0.1	17.4	>50	1.4	1.8	>50	3.3
P x V		>50	>50	11.4	>50	5.8	7.6	37.1
LSD (10%)								
Planting Date (P)		3.6	ns	0.5	26.6	ns	ns	122.7
Variety (V)		2.2	ns	ns	17.4	12.5	ns	86.0
C.V. (%)		14.2	6.8	24.1	12.0	10.3	9.9	7.2

1991 Lupin Date of Planting Study's
Spooner, Sturgeon Bay WI (Expt. 9185–86)

Variety	Yield	Plant Height	Plant Lodging	Population Emergence	Population Harvest	Survival	Seeds/ lb.
				--- plants/a ---			
	bu/a	in.	(1–5)	(x1000)		%	
Spooner							
April 17	26.0	20.0	1.0	142			1825
May 3	24.1	32.0	1.0	171			1370
May 16	12.3	28.8	1.0	135			1445
Mean	20.8	26.9	1.0	149			1547
LSD (10%)	4.9	3.3	ns	8.2			
C.V. (%)	17.3	8.8		4.0			
Sturgeon Bay							
April 24	48.3	25.3	1.0	168	156	93.2	1630
May 9	32.0	27.5	1.0	150	146	97.2	1594
May 23	11.6	35.0	1.0	175	133	76.6	1917
Mean	30.6	29.3	1.0	164	145	89.0	1714
LSD (10%)	3.1	6.1	ns	ns	ns	12.9	112
C.V. (%)	7.5	15.3		13.0	16.8	10.5	4.7

1989–91 Combined Lupin Date of Planting Studies
Arlington, Spooner, Sturgeon Bay WI (Expt. 9194)

Enviroment	Date	Yield	Plant Height	Plant Lodging	Population Emergence	Population Harvest	Survival	Seeds/ lb.
					--- plants/a ---			
		bu/a	in.	(1–5)	(x1000)		%	
Arlington 1989	April 18	32.8	23.5	1.3	156	139	89.0	1663
Arlington 1989	May 5	28.5	23.0	1.0	141	127	91.3	1554
Arlington 1989	May 26	5.0	24.8	1.5	89	77	85.8	1709
Spooner 1989	April 19	24.5	22.5	1.0	140	120	86.2	1552
Spooner 1989	May 3	19.8	24.8	1.0	123	110	89.7	1551
Spooner 1989	May 19	7.5	18.9	1.0	105	88	84.2	1518
Arlington 1990	April 22	52.3	36.9	3.0	176	122	69.7	1338
Arlington 1990	May 7	49.2	34.0	3.5	145	141	99.7	1471
Arlington 1990	May 22	45.2	34.1	4.5	128	111	89.2	1339
Spooner 1990	April 23	50.2	28.0	1.0	163	140	88.1	1127
Spooner 1990	May 9	29.9	24.6	1.0	110	86	79.0	1297
Spooner 1990	May 21	39.2	34.3	1.0	126	119	94.1	896
Arlington 1991	April 18	24.1	23.5	2.0	233	207	88.0	1890
Arlington 1991	May 1	16.0	23.0	1.0	164	130	79.8	1837
Arlington 1991	May 16	8.9	25.3	2.3	158	116	73.5	1540
Spooner 1991	April 17	26.1	20.0	1.0	142	123	87.0	1825
Spooner 1991	May 3	24.1	32.0	1.0	171	152	89.1	1371
Spooner 1991	May 16	12.3	28.8	1.0	135	110	81.3	1446
Sturgeon Bay 1991	April 24	48.3	25.3	1.0	168	156	93.2	1631
Sturgeon Bay 1991	May 9	32.0	27.5	1.0	150	146	97.2	1594
Sturgeon Bay 1991	May 23	11.7	35.0	1.0	175	133	76.6	1918
Arlington 1989		22.1	23.8	1.3	129	114	88.7	1642
Spooner 1989		17.3	22.1	1.0	123	106	86.7	1540
Arlington 1990		48.9	35.0	3.7	150	125	86.2	1383
Spooner 1990		39.8	29.0	1.0	133	115	87.0	1107
Arlington 1991		16.3	23.9	1.8	185	151	80.4	1756
Spooner 1991		20.8	26.9	1.0	149	128	85.8	1547
Sturgeon Bay 1991		30.6	29.3	1.0	164	145	89.0	1714
	April 20	36.9	25.7	1.5	168	144	85.9	1575
	May 5	28.5	27.0	1.4	143	127	89.4	1525
	May 20	18.5	28.7	1.8	131	108	83.5	1481
Mean		28.0	27.1	1.5	148	126	86.3	1527
Probability (%)								
Enviroment (E)		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	> 50	< 0.1
Planting Date (P)		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	5.2	< 0.1
E x P		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
LSD (10%)								
Enviroment (E)		3.7	1.4	0.1	16.7	16.2	ns	78.9
Planting Date (P)		1.2	1.1	0.2	9.2	7.8	7.6	38.7
C.V. (%)		9.9	9.1	23.0	13.9	13.7	10.2	5.6

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Thomas J. Gallenberg
Wolf River Valley Seeds
N2976 County M
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Wednesday 18 September 1991

Dear Tom:

Gordon Harvey asked me to send you a copy of our weed control studies that were done on lupins at the Arlington Research Station this year. There were three studies done (one study had two parts) and I've included all of the application data sheets as well.

If there are any questions please feel free to give us a call.

Sincerely,

John L. Kutil

John L. Kutil
Research specialist

Title: 1991 Weed Management Systems Study in Lupins (LUPN 3 91)

Personnel: R.G. Harvey, J.W. Albright, T.M. Anthon and J.L. Kutil

Location: Arlington Research Station Department: Agronomy

Plot information:

A. Field no.: 371
B. Soil type: Plano silt loam
C. % OM: 3.0
D. pH: 6.5
E. Variety: 'Ultra'
F. Date planted: Apr 24
G. Planting pop.: 155 lb/A
H. Planting depth: 1-1.5 inches
I. Row spacing: 8 inches
J. Date harvested: Aug 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 24	May 13	Jun 10
D. Treatment:	PPI	EP	PDIR
E. Soil surface:	Moist	Dry	Dry
F. Soil temp.(2 in) (F):	53	79	74
G. Air temperature (F):	59	85	74
H. Wind/direction (mph):	2-5 W	2-4 W	8-12 SW
I. Relative humidity(%):	33	47	82
J. Sky description:	Clear	P.Cloudy	Cloudy
K. Crop - height (in):	--	2-3	18
- stage(node):	--	2-3	11
L. Colq - height (in):	--	0-1	4-18
- stage (lf):	--	0-2	8-20
Rrpw - height (in):	--	0-1	4-16
- stage (lf):	--	0-1	8-14
Vele - height (in):	--	0-0.5	4-8
- stage (lf):	--	0-2	6-8
Gift - height (in):	--	0-1	8-12
- stage (lf):	--	0-2	6

Previous Cropping and Tillage: Soybeans; Chisel plowed (fall) and field cultivated (spring).

Fertilization: None.

Other Pesticides Used: None.

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

Results and Comments: Rotary hoeing done on May 10.

Table. Weed management systems study in lupins (R.G. Harvey, J.W. Albright, T.M. Anthon and J.L. Kutil).

Treatments[a]	Time of application	Rate of application	Weed control[c] Jun 7 Colq	Jun 7 Rrpw	Jun 7 Vele	Jun 7 Gift	Jul 29 Colq	Jul 29 Rrpw	Jul 29 Vele	Jul 29 Gift	Yield[d]
		(lb/A)	(%)								(Bu/A)
Lupins planted in 30-inch rows:											
No Mechanical Weed Control											
No herbicide	---	---	0	0	0	0	0	0	0	0	7
Pendimethalin	PPI	1.0	89	91	66	89	78	93	74	78	10
Pendimethalin + imazethapyr	PPI	1.0+0.047	97	99	93	95	96	99	87	89	19
Imazethapyr + NIS	EP	0.047+0.25%	91	99	94	95	69	99	86	91	13
Imazethapyr + MSO + 10-34-0	PDIR	0.063+ 4qt+1qt	62	88	54	60	48	88	61	60	11
Linuron + COC	PDIR	1.0+1qt	45	90	69	27	63	96	75	34	8
Rotary hoe											
No herbicide	---	---	31	38	28	36	13	17	18	10	9
Pendimethalin	PPI	1.0	90	95	70	87	85	93	75	83	7
Pendimethalin + imazethapyr	PPI	1.0+0.047	98	99	95	95	95	99	89	94	18
Imazethapyr + NIS	EP	0.047+0.25%	91	99	99	92	71	99	93	86	16
Cultivation											
No herbicide	---	---	61	87	70	77	12	54	47	22	10
Pendimethalin	PPI	1.0	93	96	77	94	82	98	79	77	17
Pendimethalin + imazethapyr	PPI	1.0+0.047	98	99	94	95	97	99	91	94	21
Imazethapyr + NIS	EP	0.047+0.25%	92	99	97	96	78	98	92	92	16
Lupins planted in 15-inch rows:											
No Mechanical Weed Control											
No herbicide	---	---	0	0	0	0	0	0	0	0	12
Pendimethalin	PPI	1.0	94	95	75	92	89	97	74	76	20
Pendimethalin + imazethapyr	PPI	1.0+0.047	97	99	96	96	94	99	94	95	33
Imazethapyr + NIS	EP	0.047+0.25%	89	98	97	95	77	98	90	88	28
Imazethapyr + MSO + 10-34-0	PDIR	0.063+ 4qt+1qt	68	79	54	69	59	85	59	69	23
Linuron + COC	PDIR	1.0+1qt	50	91	66	30	64	94	71	25	17
Rotary hoe											
No herbicide	---	---	28	50	31	41	0	0	0	0	11
Pendimethalin	PPI	1.0	93	98	77	91	90	97	78	86	24
Pendimethalin + imazethapyr	PPI	1.0+0.047	98	99	95	95	98	99	93	95	27
Imazethapyr + NIS	EP	0.047+0.25%	94	99	97	94	88	99	97	90	29
Lupins planted in 7-inch rows:											
No Mechanical Weed Control											
No herbicide	---	---	0	0	0	0	0	0	0	0	9
Pendimethalin	PPI	1.0	93	97	79	86	80	97	76	75	18
Pendimethalin + imazethapyr	PPI	1.0+0.047	98	99	97	96	92	99	94	91	29
Imazethapyr + NIS	EP	0.047+0.25%	89	99	98	93	77	99	94	86	25
Rotary hoe											
No herbicide	---	---	25	48	43	47	0	0	0	0	12
Pendimethalin	PPI	1.0	95	98	78	92	93	96	81	89	21
Pendimethalin + imazethapyr	PPI	1.0+0.047	98	99	95	98	97	99	92	95	29
Imazethapyr + NIS	EP	0.047+0.25%	99	99	99	97	90	99	98	91	20
		LSD (0.10) =	17	17	14	18	14	15	18	16	8

[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: 1991 Lupin Weed Control Studies at Arlington (LUPN 1,4 91)

Personnel: R.G. Harvey, J.W. Albright, T.M. Anthon and J.L. Kutil

Location: Arlington Research Station Department: Agronomy

Plot information:

A. Field no.: 371
B. Soil type: Plano silt loam
C. % OM: 3.0
D. pH: 6.5
E. Variety: 'Ultra'
F. Date planted: Apr 24
G. Planting pop.: 155 lb/A
H. Planting depth: 1-1.5 inches
I. Row spacing: 8 inches
J. Date harvested: Aug 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 24	Apr 25	May 13	May 22
D. Treatment:	PPI/BAND	PRE	EP	POST
E. Soil surface:	Moist	Dry	Dry	Dry
F. Soil temp.(2 in) (F):	53	48	79	75
G. Air temperature (F):	59	60	85	73
H. Wind/direction (mph):	2-5 W	2-7 S	2-4 W	4-7 S
I. Relative humidity(%):	33	38	47	74
J. Sky description:	Clear	Cloudy	P.Cloudy	Cloudy
K. Crop - height (in):	--	--	2-3	2.5-4
- stage (lf):	--	--	2-3	4-6
L. Colq - height (in):	--	--	0-1	0.5-1
- stage (lf):	--	--	0-2	1-4
Rrpw - height (in):	--	--	0-1	0.5-1
- stage (lf):	--	--	0-1	1-2
Vele - height (in):	--	--	0-0.5	1-6
- stage (lf):	--	--	0-2	3-4
Gift - height (in):	--	--	0-1	0.5-1
- stage (lf):	--	--	0-2	1-4

Previous Cropping and Tillage: Soybeans; Chisel plowed (fall) and field cultivated (spring).

Fertilization: None.

Other Pesticides Used: None.

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

Results and Comments: _____

Table. Lupin weed control studies at Arlington (R.G. Harvey, J.W. Albright, T.M. Anthon and J.L. Kutil).

Treatments[a]	Time of application	Rate of application	Crop vigor[b] reduction Jun 7	Weed control[c] Jun 7 Colq	Jun 7 Rrpw	Jun 7 Vele	Jun 7 Gift	Jul 29 Colq	Jul 29 Rrpw	Jul 29 Vele	Jul 29 Gift	Yield[d]
		(lb/A)	(%)	(%)								(Bu/A)
Section A: Preplant incorporated treatments.												
Weedy check	---	---	-	0	0	0	0	0	0	0	0	10
Handweeded	---	---	-	97	99	92	97	97	99	96	96	29
Clomazone	PPI	0.5	-	95	99	95	92	71	98	98	92	24
Clomazone	PPI	0.75	-	95	97	97	94	86	97	96	92	33
EPTC	PPI	2.0	-	81	99	76	84	70	98	74	76	13
EPTC	PPI	3.0	-	98	98	93	95	79	94	94	91	29
Alachlor	PPI	2.0	-	97	99	92	94	67	97	87	87	21
Alachlor	PPI	4.0	-	95	99	89	99	84	98	84	91	26
Metolachlor	PPI	2.0	-	83	99	84	97	71	99	84	92	21
Metolachlor	PPI	4.0	-	97	99	84	98	80	98	87	91	20
Imazethapyr	PPI	0.047	-	99	99	97	93	92	99	95	86	38
Imazethapyr	PPI	0.063	-	99	99	99	97	97	99	97	92	31
Metribuzin	PPI	0.38	-	99	99	96	85	94	99	94	67	23
Pendimethalin	PPI	0.75	-	99	98	85	95	86	97	85	84	15
Pendimethalin	PPI	1.0	-	97	99	89	93	85	98	89	88	26
Pendimethalin	PPI	1.5	-	99	97	93	96	97	97	85	87	33
Trifluralin	PPI	0.75	-	95	99	81	97	87	99	79	90	27
Trifluralin	PPI	0.85	-	97	98	95	96	91	97	93	91	33
Trifluralin	PPI	1.0	-	98	99	85	94	81	98	87	90	20
Trifluralin	PPI	1.5	-	98	99	91	93	82	98	92	91	23
Trifluralin + clomazone	PPI	0.75+0.5	-	94	98	99	99	87	96	99	97	33
Trifluralin + clomazone	PPI	0.75+0.75	-	99	99	99	97	88	98	97	94	33
Pendimethalin + clomazone	PPI	1.0+0.5	-	97	99	99	95	84	99	98	89	30
Pendimethalin + clomazone	PPI	1.0+0.75	-	99	97	99	98	96	99	99	95	33
Pendimethalin + EPTC	PPI	1.0+2.0	-	99	97	88	97	94	96	83	93	31
Pendimethalin + EPTC	PPI	1.0+3.0	-	98	99	94	97	89	95	92	89	28
Pendimethalin + alachlor	PPI	1.0+2.5	-	99	99	94	95	92	99	91	88	32
Pendimethalin + metolachlor	PPI	1.0+2.0	-	99	99	94	98	94	98	92	95	39
Pendimethalin + metolachlor	PPI	1.0+3.0	-	99	99	94	98	91	97	92	93	28
Pendimethalin + metolachlor	PPI	1.5+2.0	-	98	99	95	95	93	99	95	92	36
Pendimethalin + imazethapyr	PPI	0.35+0.032	-	99	99	97	97	93	97	92	87	31
Pendimethalin + imazethapyr	PPI	0.5+0.047	-	98	99	94	95	97	99	93	85	27
Pendimethalin + imazethapyr	PPI	1.0+0.047	-	98	99	99	96	95	99	98	94	34
Pendimethalin + imazethapyr	PPI	1.0+0.063	-	99	99	97	97	98	99	97	95	32
Pendimethalin / imazethapyr + X-77	PPI/ EP	1.0/ 0.047+0.25%	-	99	99	99	99	97	99	96	98	31
Pendimethalin / imazethapyr + X-77	PPI/ EP	1.0/ 0.063+0.25%	-	99	99	99	99	98	99	95	98	34
		LSD (0.10) =	-	5	3	7	5	11	5	6	6	9

(continued)

Table. Lupin weed control studies at Arlington (R.G. Harvey, J.W. Albright, T.M Anthon and J.L. Kutil) (continued).

Treatments[a]	Time of application	Rate of application	Crop vigor[b] reduction	Weed control[c]								Yield[d]
				Jun 7				Jul 29				
			Jun 7	Colq	Rrpw	Vele	Gift	Colq	Rrpw	Vele	Gift	
		(lb/A)	(%)	(%)								(Bu/A)
Section B: Preemergence treatments.												
Weedy check	---	---	0	0	0	0	0	0	0	0	0	8
Alachlor	PRE	2.0	0	83	99	66	99	47	98	58	95	17
Alachlor	PRE	4.0	0	91	99	40	98	78	98	24	96	13
Metolachlor	PRE	2.0	0	82	96	64	99	45	96	64	96	24
Metolachlor	PRE	4.0	0	79	98	40	98	45	96	30	97	18
Linuron	PRE	0.5	0	92	97	70	60	83	97	68	35	12
Linuron	PRE	0.75	0	92	99	62	67	88	99	40	40	11
Linuron	PRE	1.0	0	99	99	97	81	97	99	88	52	21
Imazethapyr	PRE	0.047	0	99	99	97	98	96	99	91	93	42
Imazethapyr	PRE	0.063	0	98	99	99	99	95	99	96	95	40
Pendimethalin	PRE	0.75	0	95	89	79	90	90	83	64	84	19
Pendimethalin	PRE	1.0	0	98	93	96	93	97	88	89	88	28
Pendimethalin	PRE	1.5	0	99	99	94	96	97	92	87	88	43
Alachlor + linuron	PRE	2.0+0.75	0	99	99	89	99	99	99	76	95	37
Alachlor + linuron	PRE	2.0+1.0	0	99	99	89	99	98	99	82	96	37
Pendimethalin + imazethapyr	PRE	1.0+0.047	0	99	99	99	99	99	99	99	97	40
Pendimethalin + imazethapyr	PRE	1.0+0.063	0	99	99	98	99	98	99	98	98	39
Metolachlor + linuron	PRE	2.0+0.75	0	95	98	87	99	93	99	85	96	31
Metolachlor + linuron	PRE	2.0+1.0	0	99	99	89	99	99	99	81	95	34
Metolachlor + imazethapyr	PRE	2.0+0.047	0	99	99	98	98	97	99	98	97	40
Metolachlor + imazethapyr	PRE	2.0+0.063	3	99	99	99	99	98	99	98	99	36
Metolachlor + cyanazine	PRE	2.0+0.75	0	98	98	85	99	87	98	77	97	25
Metolachlor + cyanazine	PRE	2.0+1.0	0	95	99	87	98	91	99	81	96	29
Metolachlor + cyanazine	PRE	2.0+2.0	0	99	99	86	98	95	98	68	98	26
Metolachlor + metribuzin	PRE	2.0+0.25	0	98	99	92	99	95	99	83	96	38
Metolachlor + metribuzin	PRE	2.0+0.38	0	99	99	96	97	97	99	89	94	36
Metolachlor + lactofen	PRE	2.0+0.19	0	98	99	81	98	86	97	72	95	17
Metolachlor + lactofen	PRE	2.0+0.25	2	97	99	92	99	94	99	84	96	24
Metolachlor + lactofen	PRE	2.0+0.38	5	99	99	78	99	90	98	46	95	21
Metolachlor + lactofen	PRE	2.0+0.5	7	98	99	75	97	88	99	68	95	22
Metolachlor + primisulfuron	PRE	2.0+0.036	0	98	99	91	99	96	99	81	97	34
Metolachlor / primisulfuron	PRE/POST	2.0/0.036	0	96	99	99	99	79	99	95	97	32
V-53482	PRE	12g	3	90	97	73	43	81	95	63	43	11
V-53482	PRE	18g	0	98	98	88	76	92	97	84	53	10
V-53482	PRE	35g	0	97	99	95	78	95	99	91	53	10
Metolachlor / V-53482	PRE/POST	2.0/12g	54	89	99	99	99	20	98	93	93	22
Metolachlor / V-53482	PRE/POST	2.0/18g	28	88	99	98	97	53	98	93	92	14
Sethoxydim + COC	POST	0.15+1.25%	0	14	47	11	47	1	40	9	34	7
Sethoxydim + V-53482 + COC	POST	0.19+12g+1.25%	66	87	98	98	69	65	97	80	31	1
Sethoxydim + V-53482 + COC	POST	0.19+18g+1.25%	38	95	98	98	57	93	96	97	29	3
Metolachlor + imazethapyr	BAND	2.0+0.063	0	91	99	79	96	53	98	68	84	21
Metolachlor + cyanazine	BAND	2.0+1.0	7	77	99	85	68	45	98	80	89	22
Metolachlor + cyanazine	BAND	2.0+2.0	0	85	93	76	97	50	89	73	95	16
Metolachlor + metribuzin	BAND	2.0+0.5	0	68	95	81	95	29	95	69	88	13
		LSD (0.10) =	13	15	10	15	14	17	10	16	12	11

[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: 1991 Imazethapyr Rate, Timing, Additive and Lupin Variety Weed Control Study (LUPN 2 91)

Personnel: R.G. Harvey, J.W. Albright, T.M. Anthon and J.L. Kutil

Location: Arlington Research Station Department: Agronomy

Plot information:

A. Field no.: 371
B. Soil type: Plano silt loam
C. % OM: 3.0
D. pH: 6.5
E. Variety: See below
F. Date planted: Apr 24
G. Planting pop.: 155 lb/A
H. Planting depth: 1-1.5 inches
I. Row spacing: 8 inches
J. Date harvested: Aug 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 24	May 13	May 22
D. Treatment:	PPI	EP	POST
E. Soil surface:	Moist	Dry	Dry
F. Soil temp.(2 in) (F):	53	79	75
G. Air temperature (F):	59	85	73
H. Wind/direction (mph):	2-5 W	2-4 W	4-7 S
I. Relative humidity(%):	33	47	74
J. Sky description:	Clear	P.Cloudy	Cloudy
K. Crop - height (in):	--	2-3	2.5-4
- stage (lf):	--	2-3	4-6
L. Colq - height (in):	--	0-1	0.5-1
- stage (lf):	--	0-2	1-4
Rrpw - height (in):	--	0-1	0.5-1
- stage (lf):	--	0-1	1-2
Vele - height (in):	--	0-0.5	1-6
- stage (lf):	--	0-2	3-4
Gift - height (in):	--	0-1	0.5-1
- stage (lf):	--	0-2	1-4

Previous Cropping and Tillage: Soybeans; Chisel plowed (fall) and field cultivated (spring).

Fertilization: None.

Other Pesticides Used: None.

Varieties in Study: 'Ultra', 'Primorsky' and '46-10'.

(continued)

Title: 1991 Imazethapyr Rate, Timing, Additive and Lupin Variety Weed Control Study (LUPN 2 91) (continued)

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

Results and Comments: _____

Table. Imazethapyr rate, timing, additive and lupin variety weed control study (R.G. Harvey, J.W. Albright, T.H. Anthon and J.L. Kutil).

Treatments[a]	Time of application	Rate of application	Crop vigor[b] reduction	Weed control[c]								Yield[d]
				Jun 7				Jul 29				
			Jun 7	Colq	Rrpw	Vele	Gift	Colq	Rrpw	Vele	Gift	
		(lb/A)	(%)	(%)								(Bu/A)
Herbicide treatments[e]												
Weedy check	---	---	0	0	0	0	0	0	0	0	0	5
Imazethapyr	PPI	0.047	0	96	99	96	91	88	99	94	82	33
Imazethapyr	PPI	0.063	2	98	99	99	93	93	99	94	88	32
Imazethapyr	EP	0.047	0	88	99	99	87	73	99	97	81	35
Imazethapyr	EP	0.063	0	80	99	99	98	56	99	98	96	33
Imazethapyr + NIS	EP	0.047+0.25%	2	94	99	99	97	87	99	97	93	38
Imazethapyr + NIS	EP	0.063+0.25%	3	95	99	98	97	87	99	97	95	42
Imazethapyr + X-77 + 10-34-0	EP	0.047+ 0.25%+1.25%	2	96	99	98	97	86	99	95	95	38
Imazethapyr + X-77 + 10-34-0	EP	0.063+ 0.25%+1.25%	2	99	99	99	98	95	99	98	96	37
Imazethapyr	POST	0.047	1	80	99	99	92	68	99	98	85	32
Imazethapyr	POST	0.063	0	66	99	99	98	39	99	98	98	24
Imazethapyr + X-77	POST	0.047+0.25%	19	90	99	99	98	78	99	95	96	28
Imazethapyr + X-77	POST	0.063+0.25%	28	91	99	98	95	83	99	96	92	35
Imazethapyr + X-77 + 10-34-0	POST	0.047+ 0.25%+1.25%	27	84	99	99	99	61	99	98	96	30
Imazethapyr + X-77 + 10-34-0	POST	0.063+ 0.25%+1.25%	36	93	99	99	98	88	99	98	97	33
		LSD (0.10) =	6	6	0	2	3	8	0	4	4	5
Lupine hybrids												
'Ultra'			5	85	96	95	92	72	96	92	88	33
'Primorsky'			4	85	96	95	91	73	96	93	86	33
'46-10'			4	86	96	95	92	74	96	93	88	30
		LSD (0.10) =	3	2	0	1	2	3	0	2	2	2

[a] X-77 is 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.

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