

**WEAR TOLERANCE DEMONSTRATION  
OF VEGETATION  
IN HIGH TRAFFIC AREAS  
AT  
FT. LEONARD WOOD, MISSOURI**

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**FINAL REPORT  
TO U.S. ARMY ENVIRONMENTAL CENTER**

**USDA  
NATURAL RESOURCES CONSERVATION SERVICE**

**ELSBERRY, MISSOURI  
PLANT MATERIALS CENTER**

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## **I. INTRODUCTION . . .**

Fort Leonard Wood, Missouri, a United States Army military training installation located in Pulaski County of south central Missouri. Soils in areas of intense training have become compacted and denuded of vegetation resulting in soil erosion and in some cases loss of training lands. This demonstration will aid in the selection of vegetation which is the most tolerant to wear by vehicle or troop traffic. Species chosen for evaluation were selected based on their known or anticipated resistance to wear. This study could also be applicable to similar problem areas in parks, recreational areas and playgrounds.

## **II. BACKGROUND . . .**

Continued use of travel corridors to and from training areas and repetitive training in concentrated areas severely affects vegetation's ability to survive and provide adequate cover to prevent erosion. Under continued use, the vegetation is thinned or completely eliminated. As the vegetation degenerates, the probability of soil erosion increases. With continued use and no and/or unsuccessful revegetation attempts the area becomes eroded with sediment causing pollution and in many situations the area becomes unusable for training.

Soil movement and loss of training area are only two of the problems associated with the loss of vegetation on travel corridors. Stream degradation, surface water pollution, loss of wetlands, sedimentation of drainage ways and loss of wildlife habitat can also result from loss of vegetation.

## **III. OBJECTIVES . . .**

To determine which vegetative species are the most tolerant to wear from troop and vehicle traffic at specific problem sites on an individual military installation.

To determine which species are effective on different soil and site conditions under different traffic regimes.

The species found to be wear tolerant will be recommended for use to re-vegetate denuded corridors or newly developing high traffic areas in their area of effectiveness. Native species that are low maintenance and in most cases low growing are highest priority.

## **IV. Summary . . .**

The best performing species at each location were as follows: (See table 3 on page 24 for a list of species tested at each site and page 8 for a description of each site.)

SITE NO 1	Specker Barracks	'Tufcote' Bermudagrass
SITE NO 2	TA - 244	'Cimmeron' Little Bluestem
SITE NO 3	Shooting Range	'Top Gun' Buffalograss and Lespedeza daurica schimidae
SITE NO 4	Bivouac	SR 3100 Hard Fescue and 'Covar' Sheep Fescue

## **V. DESCRIPTION OF AREA . . .**

Fort Leonard Wood is located in Pulaski County in south central Missouri approximately 125 miles southwest of St. Louis. It is in Major Land Resource Area (MLRA) 116A, Ozark Highland (Figure #2) and plant hardiness zone 5 (Figure #3). The climate is hot in the summer and cool in the winter. Rainfall is fairly heavy and well distributed throughout the year. See Table #1 for temperature and precipitation during the study period, departure from long term average, and notable extremes. The average frost-free period is April 1 to April 15 through October 15 to October 31. The average frost-free season is 190 to 205 days.

Most of the soils in the area are uplands and vary in texture and natural drainage. Most are formed in material weathered from cherty or chert-free limestone or in a thin layer of loess and the underlying cherty limestone residuum.

Site #1, Barracks, was mapped as a Lebanon silt loam with a taxonomic classification of Fine, mixed, mesic Typic Fragiudalfs. This site was disturbed during construction and compacted from use during training.

Site #2, TA-244, was mapped as Viraton silt loam with a taxonomic classification of Fine-loamy, siliceous, mesic Typic Fragiudalfs with inclusions of Clarksville very cherty silt loam with a taxonomic classification of Loamy-skeletal, siliceous, mesic, Typic Paleudults. This site was disturbed by clearing of trees and compacted during training operations with equipment.

Site #3, Shooting Range, was mapped as Udorthents with a taxonomic classification of Mixed, mesic Udorthents and also has inclusions of Clarksville. This site was disturbed and compacted by the construction of the shooting range.

Site #4, Bivouac, was mapped as Lebanon with inclusions of Clarksville as described above. This site was compacted from very concentrated use by troops.

## **VI. LITERATURE REVIEW . . .**

Literature was reviewed for information on plant wear, shade and drought tolerance; maintenance and fertility requirements; height of plants; and reproduction method for establishment. Sources of written information were the Agriculture Handbook No. 170, Grass Varieties of the United States, Agriculture Research Service, National Turfgrass Evaluation Program, U. S. Golf Association, and the Turfgrass and Environmental Research Summary. A summary of this information is in Table #2. Other information was received from the Natural Resources Department at Fort Leonard Wood, University of Missouri at Columbia, and other USDA Natural Resources Conservation personnel.

## VII. MATERIALS AND METHODS...

### A. Species

Typically tall fescue is one of the main species being used for critical area stabilization. In many instances it is successful, but cool season grasses like tall fescue struggle as the climate gets hotter and dryer and are placed on droughty soils. Fort Leonard Wood is in a transition zone between cool season and warm season species where both perform good or bad depending on the soil, use, and weather conditions. See Table #3 for the list of species used in this study.

### B. Site Description

This study was conducted on four different locations on Fort Leonard Wood described below.

<u>Site No.</u>	<u>Site Name.</u>	<u>Description</u>	<u>Problem</u>
1	Specker Barracks	Upland Lawn used for training. Full Sun. Compacted.	Intense wear from foot traffic.
2	TA-244	Upland. Full Sun. Compacted	Heavy vehicle traffic.
3	Shooting Range	Sloping upland. Full sun. Compacted	Maintenance traffic and small arms damage.
4	Bivouac	Upland. Heavy shade. Compacted.	Heavy foot traffic.

Site #1 is the lawn between two barracks that gets considerable use for troop training. It has slopes of 3 to 7 percent and is reseeded often due to lack of vegetation causing the lawn to be unsightly and causing an erosion hazard. The soil is droughty due to compaction, rocks, disturbance and clay content.

Site #2 is an upland ridgetop used for heavy equipment training. The site has full sun and slopes of 1 to 5 percent. This site is very droughty due to soils with low water holding capacity and also from compaction. Lack of vegetation on these types of sites cause erosion problems especially as the slopes get steeper.

Site #3 is an upland hillside used as a firing range. The site has full sun with west facing slopes from 5 to 15 percent. This site is droughty due to low water holding capacity gravelly soils, slope and exposure. Lack of vegetation on this type of site causes erosion problems.

Site #4 is an upland ridgetop used as training area for bivouac. The site has moderate to heavy shade with slopes from 2 to 5 percent. This site is droughty due to soil compaction and competition from trees. This site has concentrated foot traffic that destroys the under story and causes erosion problems.



### **C. Experimental Design**

Site #1 is a randomized complete block, split plot design. Each plot was split in half the summer following establishment. A fence was used to contain the inner half of each plot and the area between replications 1, 2 and 3, 4. The next year the fence was moved again to split the half plot that did not have traffic. This resulted in a half plot that received traffic two years, a fourth of a plot that received traffic in one year only, and a fourth of a plot that received no traffic. First year foot traffic started 7/15/99, with approximately 35 soldiers running ten laps a day, five days a week. The second year new traffic started 5/1/00, with approximately the same intensity. Usage was sporadic at times and it was not possible to monitor it completely. When the fences were moved for the second year traffic to start, the area opened the first year was also subject to usage but the most intensive use was closest to the fence in the second year part of the plot. See Figure #3 on page 25 for plot layout.

Site #2 is a randomized complete block, split plot design. Each plot was split into seven subplots of varying degrees of traffic. The subplots included a check with no traffic, low, medium and high intensity tire traffic from a 3/4 ton 4x4 pickup, and low, medium, and high intensity traffic from an ACE (Armored Combat Earthmover) tank-like vehicle. Plots were exposed to traffic on the following dates: 8/27/99, 5/17/00, 6/20/00, and 8/2/00. Intensities were 12, 24, and 36 passes for low, medium, and high tire traffic and 8, 18, and 26 passes for low, medium, and high track traffic. See Figure #4 on page 26 for plot layout.

Site #3 is a Latin square design with split plots and replicated five times. The plots are on a firing range where they are exposed to small arms fire. Each plot was split into three subplots. The subplot closest to the target received high intensity small arms fire that usually caused a bullet path a few inches deep. The subplot the farthest from the target received the least impact from bullets and the middle subplot was moderate intensity. The firing range was used almost on a daily basis during good weather. See Figure #5 on page 27 for plot layout.

Site #4 is a randomized complete block with four replications. The plots are on a bivouac site that normally gets a high concentration of foot traffic. A change in military use patterns at the fort resulted in this area not being used during the study time period. The plots were evaluated but results will be interpreted for shade tolerance rather than wear tolerance. See Figure #6 on page 28 for plot layout.

### **D. Plot Installation and Maintenance**

Seed and/or plants were purchased from commercial sources, donated by seed companies, or secured through the plant materials program. Any existing vegetation was destroyed from each site by chemicals, tillage or both. A total of 133 plots were planted the spring of 1998 and a couple of failures were replanted in 1999. For seeding/plugging rates, planting dates and other background information see Tables #4–#7 for individual site information. 1998 was an establishment year with no traffic applied until 1999. The exception was the shooting range where control of its use was not possible. Chemical weed control, primarily 2,4-D, and fertility were used to enhance establishment but weed control problems were still encountered. Each Site had a soil test prior to establishment.

## **E. Treatment Applications**

Site #1, barracks lawn, had foot traffic as treatments for wear tolerance. Foot traffic started the year after establishment on or around 7/5/99, with approximately 35 soldiers running ten laps a day, five days a week, crossing all plots each lap. The second year after the establishment year, new traffic was started on an unused portion of the plot. This new traffic was started on or around 5/1/00, with approximately the same total intensity as the year before but the troops could spread out into both the new traffic and old traffic areas. The new traffic area received most of the use with the old traffic area getting less than the year before. Usage was sporadic at times and it was not possible to monitor it completely.

Site #2, TA-244, had tire traffic and track traffic as treatments for wear tolerance. The tire traffic came from a 3/4 ton 4x4 pickup truck at low, medium, and high intensity defined as 12, 24 and 36 passes across each subplot. The track traffic came from an ACE that weighs approximately 17 tons. It has 16-inch wide tracks and an 8-inch wide raised rubber section in the middle of the track. Traffic was applied at low, medium and high intensity defined as a total of 8, 18, and 26 passes across each subplot. Traffic was applied 8/27/99, 5/17/00, 6/20/00, and 8/2/00.

Site #3, Shooting Range had bullet traffic during most days beginning the day of establishment. Intensity was greatest closest to and in line with the targets.

Site 4, Bivouac, never received any wear but was evaluated in relation to shade tolerance and adaptation to a compacted site.

## **F. Evaluations**

All sites were tested for compaction with a soil compaction-metering rod. Due to the rockiness of the soils along with previous compaction, it did not work well and the meter rated every site highly compacted before traffic was applied.

All plots and/or subplots were evaluated for percent stand, stand density, and vigor. Evaluations were visual ratings of percent stand, plant density and vigor. Percent stand is a rating from 0 to 100% where 0 is no plants and 100% is adequate plants to develop into total ground cover. Plant density is a rating of thickness of vegetation on a 1 to 9 scale where 1 is very thick and 9 is bare ground. Vigor is a rating of plant condition on a 1 to 9 scale where 1 is a very healthy, robust growing plant and 9 is a very weak plant. Evaluations were taken once and/or twice a month during the growing season on sites with continuous use. Evaluations were taken before and after traffic events on sites where use was controlled.

## VIII. Results/Conclusions/Recommendations . . .

### A. Site 1 Barracks

Evaluations for Percent Ground Cover can be found in Table #8 and Graphs #1, #2, and #3. Evaluations for Plant Density can be found in Table #9 and Graphs #4, #5, and #6. Evaluations for Vigor can be found in Table #10 and Graphs #7, #8, and #9.

Summaries of the best plots in each category are as follows:

	<u>No Traffic</u>	<u>First Traffic (1999 and 2000)</u>	<u>Second Traffic (2000 Traffic Only)</u>
<b>Percent Cover</b>			
Warm Season			
Best	‘Tufcote’ bermudagrass	‘Tufcote’ bermudagrass	‘Tufcote’ bermudagrass
Good	‘MO-Buff’ buffalograss		
Cool Season			
Best	‘Adobe’ tall fescue	‘Adobe’ tall fescue	‘Adobe’ tall fescue
Good	‘KY-31’ tall fescue	‘Rebel Jr.’ tall fescue	‘Chieftain II’ tall fescue ‘Rebel Jr.’ tall fescue
<b>Plant Density</b>			
Warm Season			
Best	‘Tufcote’ bermudagrass	‘Tufcote’ bermudagrass	‘Tufcote’ bermudagrass
Good	‘MO-Buff’ buffalograss		
Cool Season			
Best	‘KY-31’ tall fescue	‘Rebel Jr.’ tall fescue	‘Finelawn 5’ GL tall fescue
Good	‘Chieftain II’ tall fescue ‘Adobe’ tall fescue	‘Finelawn 5 GL’ tall fescue	‘KY-31’ tall fescue ‘Rebel Jr.’ tall fescue ‘Adobe’ tall fescue
<b>Vigor</b>			
Warm Season			
Best	‘MO-Buff’ buffalograss	‘Tufcote’ bermudagrass	‘Mirage’ bermudagrass
Good	‘Tufcote’ bermudagrass	‘Mirage’ bermudagrass	‘Tufcote’ bermudagrass
Cool Season			
Best	‘KY-31’ tall fescue	‘KY-31’ tall fescue	‘Finelawn 5 GL’ tall fescue
Good	‘Finelawn 5 GL’ tall fescue	‘Rebel Jr.’ tall fescue	‘Chieftain II’ tall fescue ‘Adobe’ tall fescue

The plot with the best wear tolerance was by far the ‘Tufcote’ bermudagrass and should be considered for high traffic areas where it cannot spread into areas where it could become undesirable. These plots actually increased in size into adjoining plots. This can be good if it is desired to vegetate adjoining ground, but bad if it invades areas where not desired. Other concerns are not being native, and that it is established by sprigs or plugs, not seed. Since it is warm season, it does go dormant and turn brown in the winter. The ‘Mirage’ bermudagrass did not perform nearly as well as the Tufcote, but was established the second year rather than the first so was at a disadvantage. It is a seeded variety that would be simpler to establish. ‘MO- Buff’ buffalograss is a species native to Missouri that is low growing, appears to be low maintenance, and could be considered for areas with less use.

The cool season species performed poorly on this site. The dry summer in 1999 and extremely dry and hot summer in 2000 was a big disadvantage to cool season species. See Table #1 for weather data during this period. The better performing cool seasons, all being tall fescues, are ‘Adobe’, ‘Rebel Jr.’, ‘Chieftain II’ and ‘Finelawn 5GL’.

**B. Site #2 TA-244**

Evaluations for Percent Ground Cover can be found in Table #11 and Graphs #10 to #16. Evaluations for Plant Density can be found in Table #12 and Graphs #17 to #23. Evaluations for Vigor can be found in Table #13 and Graphs #24 to #30.

A summary of the best plots in each category is as follows:

	<b>Percent Cover</b>	<b>Plant Density</b>	<b>Vigor</b>
No traffic (CK)	Little bluestem	Switchgrass Indiangrass	No difference
Low tire	No difference	Little bluestem	Little bluestem Indiangrass
Medium tire	Little bluestem	Little bluestem Tall fescue	No difference
High tire	Little bluestem	Little bluestem Tall fescue	Little bluestem Tall fescue
Low track	No difference	Switchgrass	Switchgrass Tall fescue
Medium track	No difference	No difference	No difference
High track	No difference	No difference	No difference

Little bluestem provided the most cover and rated best for tire traffic. None of the species held up under the track traffic. If these plants had a better establishment opportunity the results could have been better. Plants were not well developed when traffic was applied.

Neither of the *lespedeza* species that were planted germinated and therefore are not included in the test.

### **C. Site #3 Shooting Range**

Evaluations for Percent Ground Cover, Plant Density, and Vigor can be found in Table #14 and Graphs #31 to #33.

The species rank in the order below taking into consideration the above evaluation criteria. On this steeper site, percent ground cover was given twice the importance as the other factors.

‘Top Gun’ buffalograss and *Lespedeza daurica schimidae*

‘TifBlair’ centipedegrass

‘Cimarron’ little bluestem

‘Guymon’ bermudagrass

Buffalograss is a species native to Missouri although the origin of Top Gun is probably outside the state. This species is low growing and does well on this poor site. Top Gun is a seeded variety.

*Lespedeza daurica schimidae* is an introduced, prostrate growing plant. It is very slow starting with very few plants detected until the second year after establishment. It appears adapted and has continued to increase in plant density through the third year. Potential spreading problems have not been determined.

Centipedegrass is not native to Missouri but is common in the southern U. S. It is very low growing and needs little fertility.

Little bluestem appears adapted to this site but is slow to provide ground cover.

Bermudagrass does not appear adapted to this site.

### **D. Site #4 Bivouac**

Evaluations for Percent Ground Cover, Plant Density, and Vigor can be found in Table #15 and Graphs #34 to #36.

This site was not used, so the evaluations pertain to site adaptation in relation to shade tolerance, soils, and climate.

The best performing plots were ‘Covar’ sheep fescue and ‘SR-3100’ hard fescue. Both of these varieties are *Festuca ovina*.

Red fescues have generally been used on this type of site because of their shade tolerance. The shade tolerant tall fescues and bluegrass out performed red fescue in some replications and should also be as or more wear tolerant.

A seeding mixture of tall, hard, and red fescues and possibly even shade and drought tolerant bluegrass should be tried on these sites with diverse soils and shade intensities.

**IX. LITERATURE CITED . . .**

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FIGURE #1

MAJOR LAND RESOURCE REGIONS OF THE UNITED STATES

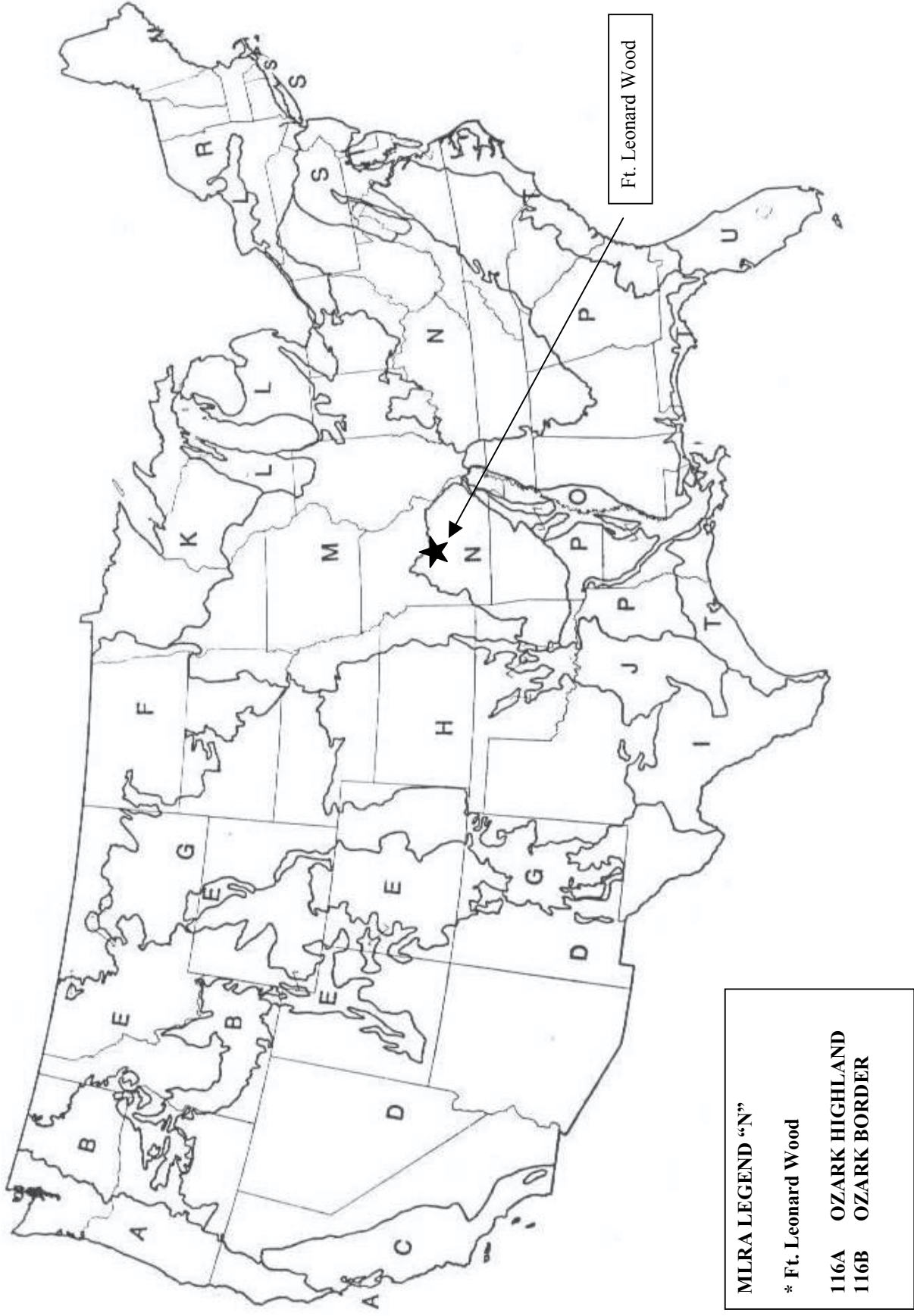
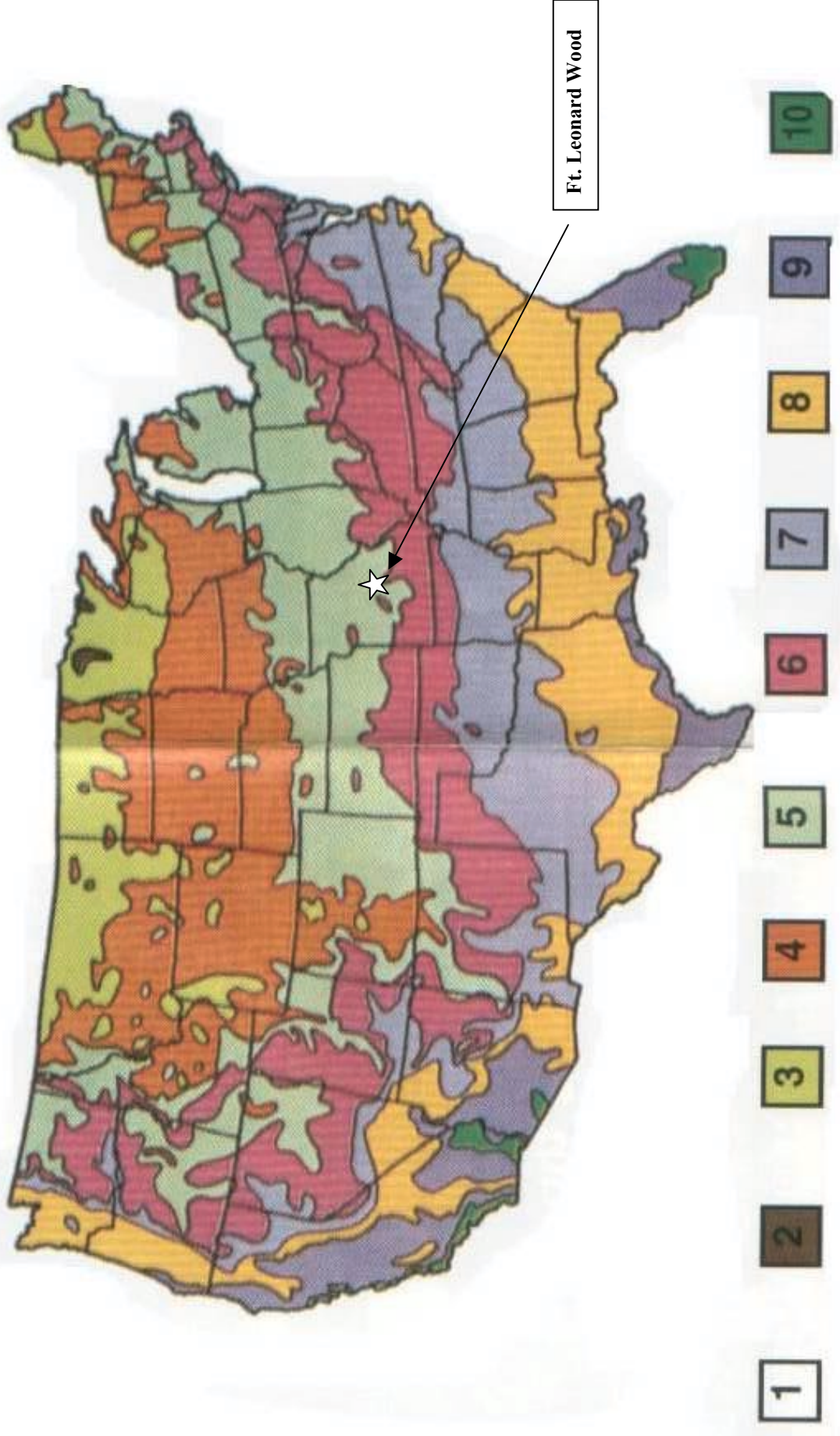


FIGURE #2

USDA PLANT HARDINESS ZONE MAP



Average Annual Minimum Temperature  
Plant Hardiness Zone 5 = -10 degrees to -20 degrees Fahrenheit



## WEATHER DATA

TABLE #1

PRECIPITATION (equivalent inches of water)							
					Departure from 35-Year Average		
	<b>1998 Total</b>	<b>1999 Total</b>	<b>2000 Total</b>	<b>Previous 35-Yr Avg.</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>
January	.36	2.36	2.27	1.68	-1.32	+0.68	+0.59
February	4.80	2.84	1.50	1.94	+2.86	+0.90	-0.44
March	8.74	3.03	2.99	3.55	+5.19	-.52	-0.56
April	3.70	8.22	1.27	4.05	-.35	+4.17	-2.78
May	3.60	4.19	1.48	4.72	-1.12	-.53	-3.24
June	5.70	3.74	1.48	5.14	+.56	-1.40	-3.66
July	8.37	.98	2.22	3.14	+5.23	-2.16	-0.92
August	1.65	1.74	.62	4.00	-2.35	-2.26	-3.38
September	5.78	1.14	2.62	5.18	+.60	-4.04	-2.56
October	2.82	.46		3.55	-.73	-3.09	
November	1.33	.61		4.15	-2.82	-3.54	
December	1.32	8.28		2.76	-1.44	+5.52	
<b>Total</b>	<b>48.17</b>	<b>35.85</b>	<b>16.45</b> (9 months)	<b>43.86</b>	<b>+4.31</b>	<b>-7.09</b>	<b>-16.95</b> (9 months)

WEATHER EXTREMES			
		Date	Temperature (F)
<b>Coldest Day of the Year</b>		3/12/98	4°
		1/04/99	-10°
<b>Hottest Day of the Year</b>		1/26/00	12°
		7/20/98	100°
		7/25/99	104°
		8/28/00	105°
		<b>1998</b>	<b>1999</b>
		<b>2000 (First 9 months)</b>	
<b>No. of Days with Temp. 90° or Above</b>		45	43
<b>No. of Days with Temp. 100° or Above</b>		1	7
<b>No. of Days with Temp. 32° or Below</b>		54	58
<b>No. of Days with Temp. 0° or Below</b>		0	1
			0

## Notable Dry Periods\*

Year	Dates	Duration	Precipitation
<b>1998</b>	1/19-2/9	22 Days	Trace
	6/22-7/5	14 Days	0.20"
	8/12-9/12	32 Days	0.23"
	12/20-1/2/99	14 Days	0.11"
<b>1999</b>	1/4-1/22	19 Days	0.13"
	7/3-7/26	24 Days	Trace
	8/14-9/18	36 Days	0.17"
	10/9-11/22	45 Days	0.16"
	12/13-1/2/00	21 Days	0.21"
<b>2000</b>	1/11-1/27	17 Days	0.23"
	1/30-2/16	18 Days	0.04"
	3/30-4/15	17 Days	0.12"
	5/10-5/24	14 Days	0.19"
	5/28-6/11	15 Days	0.23"
	7/2-7/16	15 Days	0.21"
	7/30-8/7	19 Days	0.12"
	8/25-9/11	18 Days	0.02"

\*Dry periods are defined as two weeks or longer with 0.25" or less cumulative precipitation.

## Air Temperatures (°F)

	1998		1999		2000		34 Year Average	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
January	44.16	33.68	40.10	29.30	43.16	28.39	41.41	20.18
February	49.21	37.64	53.07	37.71	53.45	39.07	46.60	25.00
March	48.97	37.35	53.39	36.55	59.42	42.32	56.88	34.52
April	65.53	48.30	66.90	52.10	68.47	47.90	67.44	44.49
May	81.48	64.00	75.06	57.81	78.77	62.03	75.09	53.31
June	84.00	69.30	82.60	66.70	79.93	65.07	83.11	61.83
July	85.68	72.26	91.65	74.10	86.42	70.83	88.94	66.40
August	87.29	72.35	87.39	68.19	95.45	73.42	88.20	64.55
September	83.97	67.63	80.67	57.67	83.10	60.47	79.68	57.25
October	68.77	52.16	72.64	50.52			69.43	45.61
November	59.60	45.00	65.83	46.47			56.34	35.44
December	45.90	31.10	48.29	32.68			45.46	25.33

Departure from 34 Year Average						
	1998		1999		2000	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
January	+2.75	+13.50	-1.31	+9.12	+1.75	+8.21
February	+2.61	+12.64	+6.47	+12.71	+6.85	+14.07
March	-7.91	+2.83	-3.49	+2.03	+2.54	+7.80
April	-1.91	+3.81	-.54	+7.61	+1.03	+3.41
May	+6.39	+10.69	-.03	+4.50	+3.68	+8.72
June	+.89	+7.47	-.51	+4.87	-3.18	+3.24
July	-3.26	+5.86	+2.71	+7.70	-2.52	+4.43
August	-.91	+7.80	-.81	+3.64	+7.25	+8.87
September	+4.29	+10.38	+9.99	-.58	+3.42	+3.22
October	-.66	+6.55	+3.21	+14.91		
November	+3.26	+9.56	+9.49	+11.03		
December	-.44	+5.77	+2.83	+7.35		
Average Monthly Departure	+4.43	+8.07	+1.58	+7.07	+2.31	+6.89



TABLE #2

<u>Species</u>	<u>Varieties</u>	<u>PHZ/ LRR</u>	<u>Shade Tolerance</u>	<u>Drought Tolerance</u>	<u>Wear Tolerance</u>	<u>Low Maintenance Requirements</u>	<u>Low Fertility Requirements</u>	<u>Growing Heights</u>	<u>Seed/ Vege- tative</u>
<i>Buchloe dactyloides</i> buffalograss	NTG-5 Top Gun Bison	6 / * 6 / N 6 / *	Sun Sun Sun	Good Good Good	* * *	Low Low *	* * *	Low Low 8 cm. *	Seed Seed Seed
<i>Cynodon dactylon</i> bermudagrass	Midfield Midiron Tufcote	6 / * 6 / * 6 / N	Sun Sun Sun	Good * *	Good/4.8 Good/4.3 Good/*	* * *	* * *	Low * Low	Vegetative * *
<i>Festuca arundinacea</i> tall fescue	ITR90-2 Leprechaun Titan	6 / * 6 / N 6 / N	* * *	* Very Good Very Good	* High Good	* Low Med-Low	* Good Good	Double-Dwarf Low Low	Seed Seed Seed
<i>Zoysia japonica</i> zoysia grass	Meyer	6 / N	Sun	Good	Good	*	Good	Low	*
<i>Poa pratensis</i> Kentucky bluegrass	Unique	6 / *	Sun/Shade	*	Good / 6.3	*	*	Low	Seed
<i>Eremochloa ophiuroides</i> centipede grass	Oklawn	7 / N	Sun/Shade	Good	* / *	Low	Low	Very Low	Seed/ Sprigs
*/ * Information not available									
1/ See Figure 2 for Plant Hardiness Zone (PHZ) and Figure 1 Land Resource Region (LRR)									
1=Lowest tolerance, 9=Maximum tolerance									
<b>LITERATURE SEARCH SUMMARY</b>									
<b>Potential Wear Tolerance Species</b>									
		<b>1/</b>				<b>Low</b>	<b>Low</b>		<b>Seed/</b>

TABLE #2

<u>Species</u>	<u>Varieties</u>	<u>PHZ/ LRR</u>	<u>Shade Tolerance</u>	<u>Drought Tolerance</u>	<u>Wear Tolerance</u>	<u>Maintenance Requirements</u>	<u>Fertility Requirements</u>	<u>Growing Heights</u>	<u>Vege- tative</u>
<i>Cynodon dactylon</i> bermudagrass	Midfield Midiron Tufcote Guymon Quickstand	6 / * 6 / * 6 / N 6 / N 6 / N	Sun Sun Sun Sun Sun	Good * * * Good	* / 4.8 * / 4.3 Good/* * / 3.9 * / *	* * * * Low	* * * * Low	Low * Low Low Low	Vegetative * * Seed Sprigs
<i>Lolium perenne</i> perennial ryegrass	Loretta Nomad	6 / * 6 / N	Sun sun	* *	Good / 6.0 Good / 5.0	* *	* *	* Prostrate	Seed Seed
<i>Agrostis gigantea</i> Redtop	Streaker	6 / N	Sun	*	* / *	*	*	Medium	Seed
<i>Agrostis stolonifera</i> creeping bentgrass	Cobra	3 / N	Sun	Good	* / *	Medium	High	Very Low	Vegetative
<i>Panicum virgatum</i> switchgrass	Cave-In-Rock	6 / N	Sun	Good	*	Low	Low	High 5' - 6'	Seed
<i>Phalaris arundinacea</i> reed canarygrass	Ioreed	6 / N	Sun	Fair	*	Low	Low	High 6'	Seed
<i>Schizachyrium scoparium</i> little bluestem	Cimarron	6 / N	Sun	good	*	Low	Low	Mod. 3'	Seed
*/* Information not available									
1/ See Figure 2 for Plant Hardiness Zone (PHZ) and Figure 1 Land Resource Region (LRR)									
1=Lowest tolerance, 9=Maximum tolerance									
<b>LITERATURE SEARCH SUMMARY</b>									
Potential Wear Tolerance Species									
		1/				Low			
<u>Species</u>	<u>Varieties</u>	<u>PHZ/ LRR</u>	<u>Shade Tolerance</u>	<u>Drought Tolerance</u>	<u>Wear Tolerance</u>	<u>Maintenance Requirements</u>	<u>Fertility Requirements</u>	<u>Growing Heights</u>	<u>Seed/ Vegetative</u>

TABLE #2

<i>Tripsacum dactyloides</i> eastern gamagrass	Pete	6 / N	Sun	Good	*	Medium	Fair	High 5'	Seed
<i>Bothriochloa caucasian</i> caucasian bluestem	-	6 / N	Sun	Good	*	Low	Low	High 4'	Seed
<i>Lespedeza daurica schimadea</i> daurica lespedeza	-	6 / N	Sun	Good	*	Low	Low	Prostrate	Seed
<i>Lespedeza thunbergii</i> shrub lespedeza	VA-70	6 / N	Sun	Good	*	Low	Low	High 6'	Seed
<i>Lespedeza cuneata</i> sericea lespedeza	Appalow	6 / N	Sun	Good	*	Low	Low	Low 6"	Seed
<i>Elymus lanceolatus</i> streambank wheatgrass	Sodar	6 / *	Sun	Good	* / *	Good	*	Medium	Seed
<i>Elymus elymoides</i> bottlebrush squirrel tail	*	* / *	Sun	Good	* / *	*	*	10-50 cm	*
* / * Information not available									
1/ See Figure 2 for Plant Hardiness Zone (PHZ) and Figure 1 Land Resource Region (LRR)									
1=Lowest tolerance, 9=Maximum tolerance									

## SPECIES LIST

TABLE #3

Genus	Species	Variety	Common Name	Site Numbers
Festuca	arundinacea	Rebel Jr.	tall fescue	1
Festuca	arundinacea	Leprechaun	tall fescue	1
Festuca	arundinacea	Fine Lawn 5GL	tall fescue	1,4
Festuca	arundinacea	Jaguar	tall fescue	1
Festuca	arundinacea	Chieftain II	tall fescue	1,4
Festuca	arundinacea	Fine Lawn Petite	tall fescue	4
Festuca	arundinacea	Kentucky 31	tall fescue	1,2
Festuca	arundinacea	Adobe	tall fescue	1
Festuca	rubra	Shademaster II	red fescue	4
Festuca	rubra	Flyer	red fescue	4
Festuca	ovina	SR-3100	hard fescue	4
Festuca	ovina	Covar	sheep fescue	4
Cynodon	dactylon	Tufcote	bermudagrass	1
Cynodon	dactylon	Guymon	bermudagrass	3
Cynodon	dactylon	Mirage	bermudagrass	1
Buchloe	dactyloides	MO-Buff	buffalograss	1
Buchloe	dactyloides	Top Gun	buffalograss	3
Lespedeza	thunbergii	VA-70	shrub lespedeza	2
Lespedeza	daurica schimadae		daurica schimadae	2, 3
Panicum	virgatum	Cave-In-Rock	switchgrass	2
Phalaris	arundinacea	loreed	reed canarygrass	*
Schizachyrium	scoparium	Cimarron	little bluestem	2,3
Zoysia	japonica	Meyer	zoysia grass	1
Elymus	lanceolatus	Sodar	streambank wheatgrass	*
Elymus	elymoides		bottlebrush squirrel tail	3
Eremochloa	ophiuroides	TifBlair	centipedegrass	3
Poa	pratense	Unique	Kentucky bluegrass	1, 4
Sorghastrum	nutans	Rumsey	indiangrass	2
Lolium	perenne	Divine	perennial rye	1, 4



**Site #1 Site Description: Disturbed Upland Lawn - Specker Barracks**

Plot Size: 8' X 25' Randomized Complete Block  
 Number of Species: 6 Site Dimensions: 78' X 208' Split Plot Design  
 Total Accessions: 12 Type of Traffic: Foot Four Replications

- |                            |  |
|----------------------------|--|
| 1 Rebel Jr. Tall Fescue    | 7 Meyer Zoysia Grass                     |
| 2 Leprechaun Tall Fescue   | 8 Unique Bluegrass / Mirage bermudagrass |
| 3 Finelawn 5GL Tall Fescue | 9 Chieftain Tall Fescue                  |
| 4 Tufcote Bermudagrass     | 10 Jaguar Tall Fescue                    |
| 5 Mo-Buff Buffalograss     | 11 Adobe Tall Fescue                     |
| 6 Divine Perennial Rye     | 12 KY-31 Tall Fescue                     |

Sidewalk/Concrete Driveway

6' Gemini Tall Fescue Boarder

Rep 1

Rep 2

*1	4	10	7	1	11	2	9	5	8	3	12	6	4	12	8	3	10	2	7	9	11	5	1	6	*3
	1st Traffic																								
	2nd Traffic																								
	No Traffic																								

16' Jaguar Tall Fescue Roadway

Rep 3

Rep 4

	No Traffic																								
	2nd Traffic																								
	1st Traffic																								
*2	2	7	8	9	1	11	3	6	12	5	4	10	1	10	4	2	6	7	11	8	9	5	12	3	*3

6' Jaguar Tall Fescue Boarder

Dates Planted: Total Number of Plots 48  
 Plots 1-4,6,9-12 4/22/98  
 Plot 8 4/23/98 Bermudagrass plugged 4/20/99  
 Plots 5 & 7 5/27/98

\*1 = 8' Gemini Tall Fescue Boarder  
 \*2 = 8' Jaguar Tall Fescue Boarder  
 \*3 = 8' Brigade Hard Fescue Boarder

Site #2																							Site Description: Disturbed Upland - TA-244								Figure #4		
Plot Size: 10' X 40'												Randomized Complete																					
Number of Species: 6								Site Dimensions: 40' X 265'								Split Plot Design																	
Total Accessions: 6						Type of Traffic: Heavy Vehicle Traffic						Four Replications																					
1 Rumsey Indiangrass											4 Lespedeza Daurica Schimadae																						
2 VA-70 Shrub Lespedeza											5 KY-31 Tall Fescue																						
3 Cave-In-Rock Switchgrass											6 Cimarron Little Bluestem																						
W E S T																																	
Rep 1					Rep 2					Rep 3					Rep 4																		
IVI	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	IVI									
PI	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	PI									
L	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	///	L									
CHECK	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	CHECK									
IVI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	IVI									
PI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	PI									
L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L									
a	1	2	3	4	5	6	3	1	6	4	5	2	4	1	2	6	5	3	3	5	4	1	6	2	b								
R O A D																																	
																				Number of													
																				Total Passes													
Low intensity vehicle track traffic											L /////					8																	
Moderate intensity vehicle track traffic											M /////					18																	
High intensity vehicle track traffic											H /////					26																	
Low intensity vehicle tire traffic											L =====					12																	
Moderate intensity vehicle tire traffic											M=====					24																	
High intensity vehicle tire traffic											H=====					36																	
Planted 4/9/98																																	
a	10' - Leprechaun Tall Fescue Boarder																																
b	5' - Leprechaun Tall Fescue Boarder Next To Plot																																
	10' - Chieftain Tall Fescue Boarder Farther North																																

### Site #3 Site Description: Sloping Disturbed Upland - Shooting Range

Plot Size: 8'x20'

Latin Square Design

Number of species: 5

Site Dimensions: 20' x 40'

Split plots (bullet intensity)

Total Accessions: 5

Type of Traffic: Small Arms Damage

Five Replications

- 1 Bottlebrush squirrel tail/Cimarron little bluestem plugged 4/20/99
- 2 Lespedeza daurica schimadae
- 3 Guymon bermudagrass
- 4 Top Gun buffalograss
- 5 TifBlair centipedegrass

East (Top of Hill)

Rep 1

Rep 2

x	Plot #
x	1
x	2
x	3
x	4
x	5

Plot #	x
3	x
4	x
2	x
5	x
1	x

8'

< - x ---- 20' ---- >

x

KY-31 Tall

x x x

Fescue Boarder

x

DIVERSION

x

Rep 3

Rep 4

Rep 5

x	Plot #
x	3
x	2
x	4
x	1
x	5

Jaguar Tall

Fescue Boarder

x	Plot #
x	2
x	5
x	1
x	3
x	4

x	Plot #
x	4
x	3
x	5
x	1
x	2

x

x x x

x

x

x x x

x

x

T - Target

T

T

S - Shooter

S

S

x = Bullet Paths Across Plots

xxx=Estimated point of highest bullet intensity--bullet impact (intensity) lessens on bullet path as you get farther from this point.

Total number of plots - 25

Total number of subplots - 75

Planted 5/8/98

Plot #1 planted 5/8/98 with bottlebrush squirrel tail that failed and plugged 4/20/99 with Cimarron little bluestem

### Site #4 Site Description: Wooded Upland - Bivouac

Plot Size: 4' X 4' Grid Plots

Randomized Complete Block

Number of species: 6

Site Dimensions: 12' X 12' Per Rep

Total Accessions: 9

Type of Traffic: Foot

Four Replications

- 1 Shademaster II Red Fescue
- 2 Flyer Red Fescue
- 3 Covar Sheep Fescue
- 4 SR-3100 Hard Fescue
- 5 Unique Bluegrass

- 6 Chieftain II Tall Fescue
- 7 Finelawn 5GL Tall Fescue
- 8 Finelawn Petite Tall Fescue
- 9 Divine Perennial Rye

Rep 1

1	5	3
4	9	6
7	2	8

Rep 2

4	6	2
9	5	3
1	8	7

Rep 3

6	2	9
8	3	1
7	4	5

Rep 4

3	8	7
4	2	5
6	1	9

Bivouac Area around Plots Seeded to Shademaster II Red Fescue

Pavilion

Planted 4/7-8/98

Total number of plots 36

TABLE #4

	<b>SITE #1 - BARRACKS</b>					
Plot Size:	8' x 25'				Randomized Complete Block	
Number of species:	6				Four Replications	
Total Accessions:	12					
Site Description:	Disturbed Upland Lawn					
Site Dimensions:	82' x 208					
Type of Traffic:	Foot					
						<b>Seeding</b>
<b>Site</b>			<b>Plot</b>			<b>Rate</b>
<b>No.</b>	<b>Genus</b>	<b>Species</b>	<b>No.</b>	<b>Variety</b>	<b>Common Name</b>	<b>PLS #/Ac.</b>
1	<i>Festuca</i>	<i>arundinacea</i>	1	Rebel Jr.	tall fescue	5# bulk/ 1000 sq. ft.
1	<i>Festuca</i>	<i>arundinacea</i>	2	Leprechaun	tall fescue	5# bulk/ 1000 sq. ft.
1	<i>Festuca</i>	<i>arundinacea</i>	3	Fine lawn 5GL	tall fescue	5# bulk/ 1000 sq. ft.
1	<i>Cynodon</i>	<i>dactylon</i>	4	Tufcote	bermudagrass	1 plug/ sq. ft.
1	<i>Buchloe</i>	<i>dactyloides</i>	5	Mo-Buff	buffalograss	1 plug/ sq. ft.
1	<i>Lolium</i>	<i>perenne</i>	6	Divine	perennial rye	5# bulk/ 1000 sq. ft.
1	<i>Zoysia</i>	<i>japonica</i>	7	Meyer	zoysia grass	sod
1	<i>Cynodon</i>	<i>dactylon</i>	8	Mirage	bermudagrass	1 plug/ sq. ft.
1	<i>Festuca</i>	<i>arundinacea</i>	9	Chieftain II	tall fescue	5# bulk/ 1000 sq. ft.
1	<i>Festuca</i>	<i>arundinacea</i>	10	Jaguar	tall fescue	5# bulk/ 1000 sq. ft.
1	<i>Festuca</i>	<i>arundinacea</i>	11	Adobe	tall fescue	5# bulk/ 1000 sq. ft.
1	<i>Festuca</i>	<i>arundinacea</i>	12	Kentucky 31	tall fescue	5# bulk/ 1000 sq. ft.
Planted:						
Plots 1-4, 6, 9-12 (4/22/98)			Plot 8 (4/23/99)		Plots 5, 7 (5/27/98)	

TABLE #5

		<b>SITE #2 - TA-244</b>				
Plot Size:	10' x 40'				Randomized Complete Block	
Number of species:	6				Split Plot Design	
Total Accessions:	6				Four Replications	
Site Description:	Disturbed Upland					
Site Dimensions:	40' x 200'					
Type of Traffic:	Heavy Vehicle Traffic					
						<b>Seeding</b>
<b>Site</b>			<b>Plot</b>			<b>Rate</b>
<b>No.</b>	<b>Genus</b>	<b>Species</b>	<b>No.</b>	<b>Variety</b>	<b>Common Name</b>	<b>PLS #/Ac.</b>
2	<i>Sorghastrum</i>	<i>nutans</i>	1	Rumsey	indiangrass	14
2	<i>Lespedeza</i>	<i>thunbergii</i>	2	VA-70	shrub lespedeza	12
2	<i>Panicum</i>	<i>virgatum</i>	3	Cave-In-Rock	switchgrass	8
2	<i>Lespedeza</i>	<i>daurica</i>	4		lespedeza schimidae	15
		<i>schimadae</i>				
2	<i>Festuca</i>	<i>arundinacea</i>	5	KY 31 (check)	tall fescue	30
2	<i>Schizachyrium</i>	<i>scoparium</i>	6	Cimarron	little bluestem	15
Planted 4/9/98						

TABLE #6

<b>SITE #3 - SHOOTING RANGE</b>						
Plot Size:		8' x 20'		Latin Square Design		
Number of species:		5		Split Plots (bullet intensity)		
Total Accessions:		5		Five Replications		
Site Description:		Sloping Disturbed Upland				
Site Dimensions:		20' x 40'				
Type of Traffic:		Small Arms Damage				
						<b>Seeding</b>
<b>Site</b>					<b>Plot</b>	<b>Rate</b>
<b>No.</b>	<b>Genus</b>	<b>Species</b>	<b>No.</b>	<b>Variety</b>	<b>Common Name</b>	<b>PLS #/Ac.</b>
3	<i>Elymus</i>	<i>elymoides</i>	1		bottlebrush squirrel tail	9
3	<i>Schizachyrium</i>	<i>scoparium</i>	1	Cimarron	little bluestem	1 plug/sq. ft.
	<i>(Plot #1 reestablished 4/17/99)</i>					
3	<i>Lespedeza</i>	<i>daurica</i> <i>schimidae</i>	2		daurica lespedeza	15
3	<i>Cynodon</i>	<i>dactylon</i>	3	Guymon	bermudagrass	4
3	<i>Buchloe</i>	<i>dactyloides</i>	4	Top Gun	buffalograss	2# PLS/ 1000 sq. ft.
3	<i>Eremochloa</i>	<i>ophiuroides</i>	5	Tif Blair	centipedegrass	1 plug/sq. ft.
Planted 5/8/98						

TABLE #7

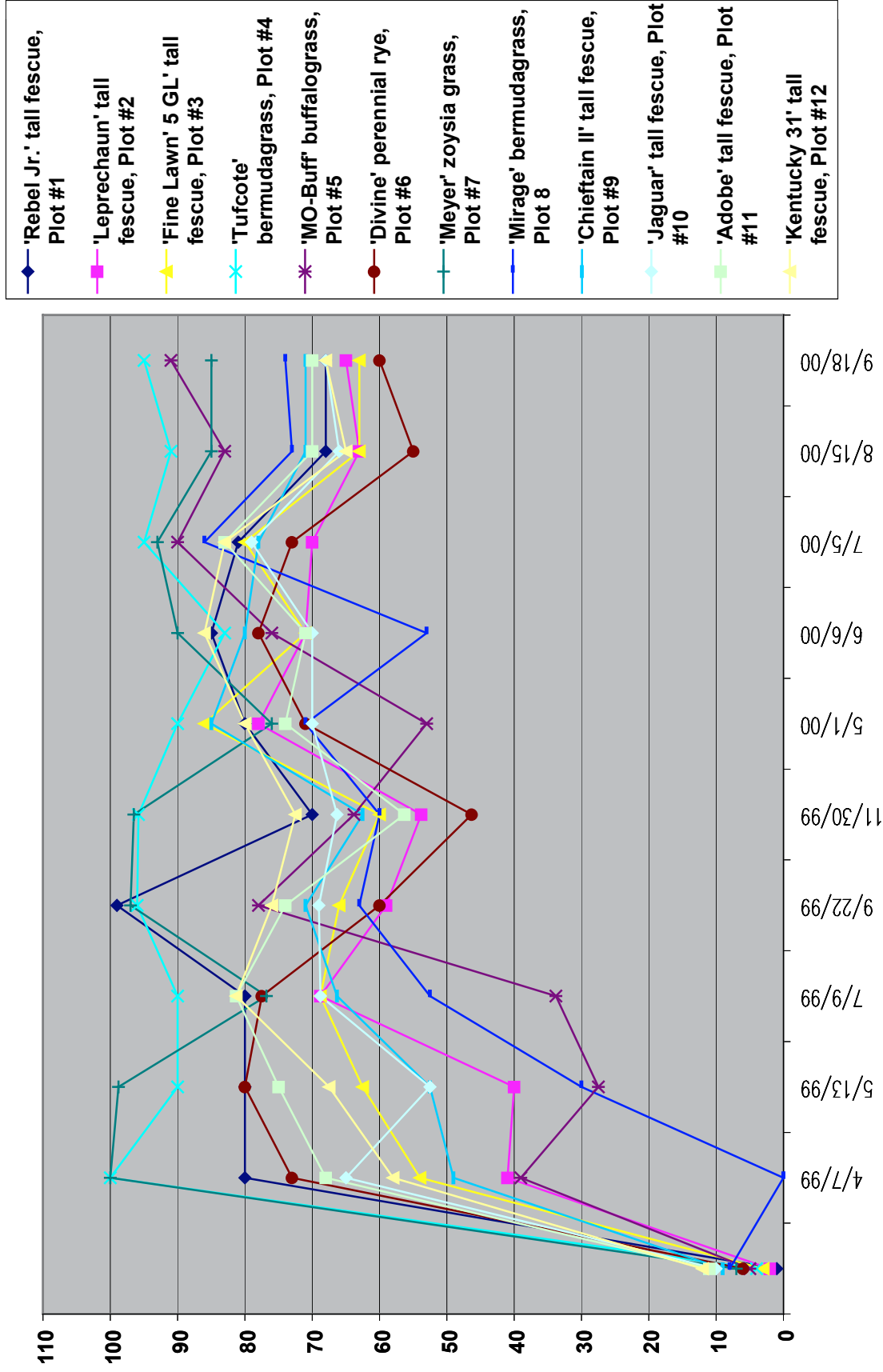
		<b>SITE #4 - BIVOUAC</b>				
Plot Size:	4' X 4' Grid Plots			Randomized Complete Block		
Number of species:	5			Four Replications		
Total Accessions:	9					
Site Description:	Wooded Upland					
Site Dimensions:	12' x 12' Per Rep					
Type of Traffic:	Foot					
						<b>Seeding</b>
<b>Site</b>			<b>Plot</b>			<b>Rate</b>
<b>No.</b>	<b>Genus</b>	<b>Species</b>	<b>No.</b>	<b>Variety</b>	<b>Common Name</b>	<b>PLS #/Ac.</b>
4	<i>Festuca</i>	<i>rubra</i>	1	Shademaster II	red fescue	2.5# bulk/ 1,000 sq. ft.
4	<i>Festuca</i>	<i>rubra</i>	2	Flyer	red fescue	2.5# bulk/ 1,000 sq. ft.
4	<i>Festuca</i>	<i>ovina</i>	3	Covar	sheep fescue	2.0# bulk/ 1,000 sq. ft.
4	<i>Festuca</i>	<i>ovina</i>	4	SR-3100	hard fescue	2.0# bulk/ 1,000 sq. ft.
4	<i>Poa</i>	<i>pratense</i>	5	Unique	Kentucky bluegrass	1.5# bulk/ 1,000 sq. ft.
4	<i>Festuca</i>	<i>arundinacea</i>	6	Chieftain II	tall fescue	5.0# bulk/ 1,000 sq. ft.
4	<i>Festuca</i>	<i>arundinacea</i>	7	Finelawn 5GL	tall fescue	5.0# bulk/ 1,000 sq. ft.
4	<i>Festuca</i>	<i>arundinacea</i>	8	Finelawn 5GL	tall fescue	5.0# bulk/ 1,000 sq. ft.
5	<i>Lolium</i>	<i>perenne</i>	9	Divine	perennial rye	3,0# bulk/ 1,000 sq. ft.
Planted	4/7-8/98					



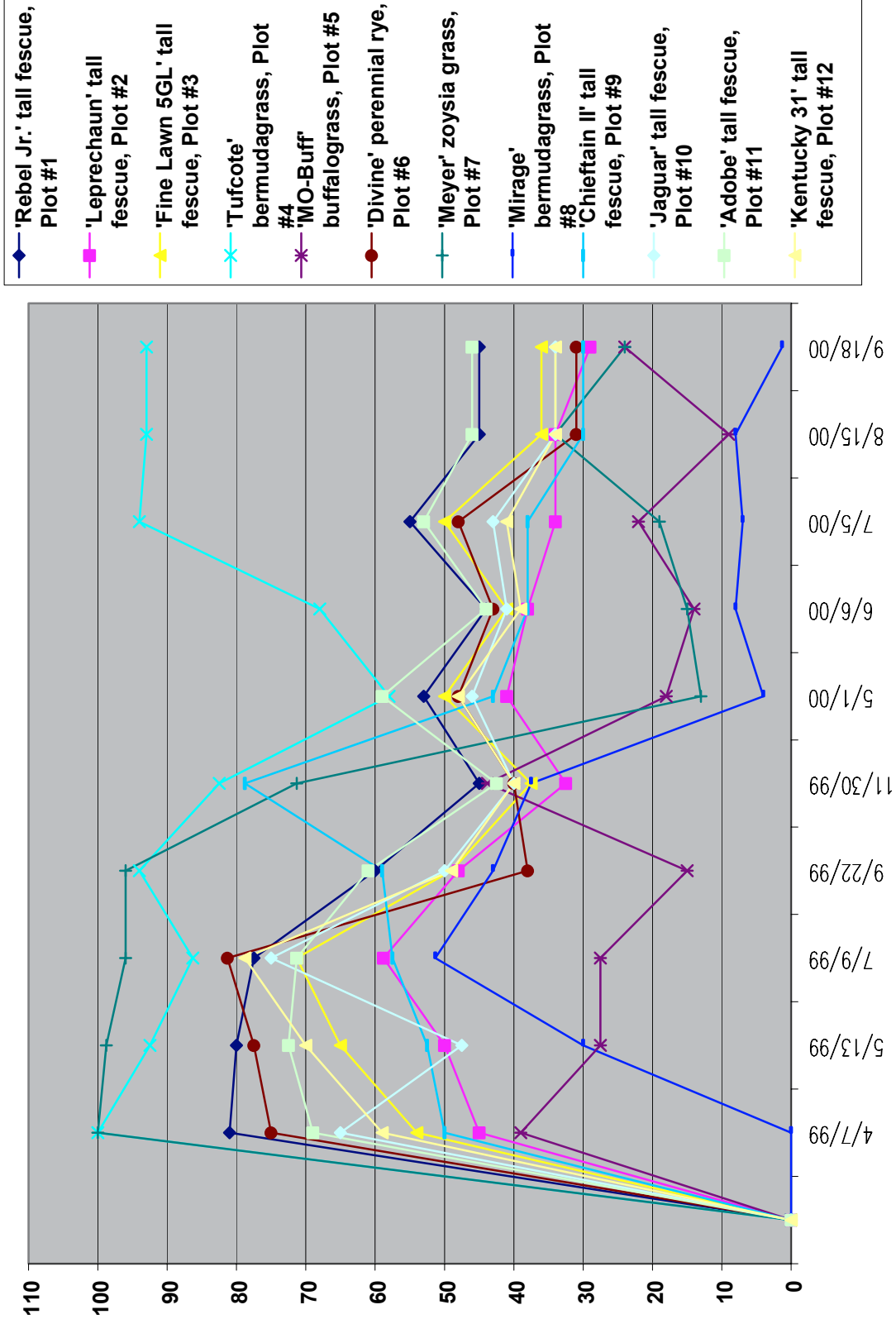




SITE #1 BARRACKS - PERCENT GROUND COVER - NO TRAFFIC



SITE #1 BARRACKS - PERCENT GROUND COVER - 1ST YEAR TRAFFIC



SITE #1 BARRACKS - PERCENT GROUND COVER - 2ND YEAR TRAFFIC

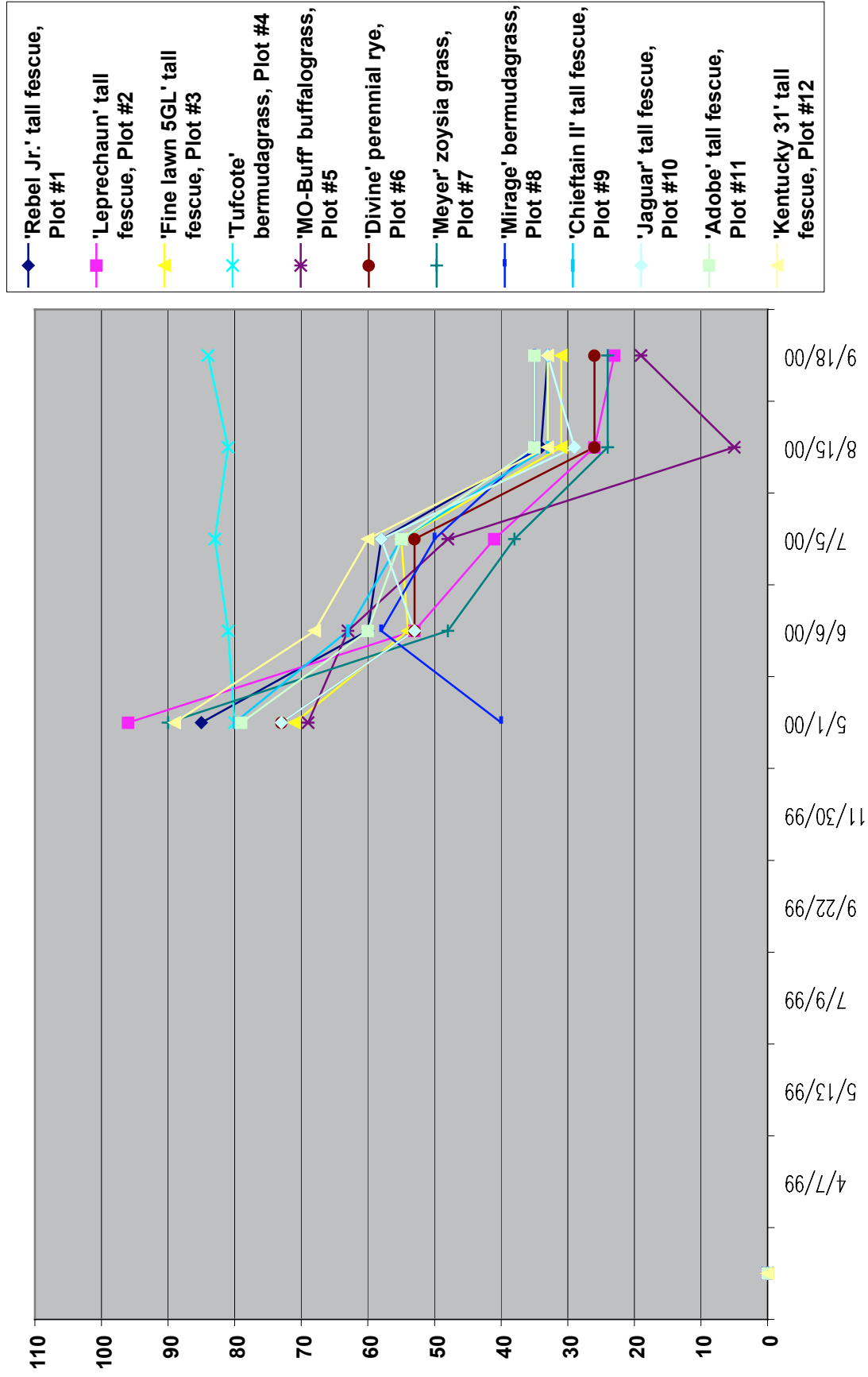


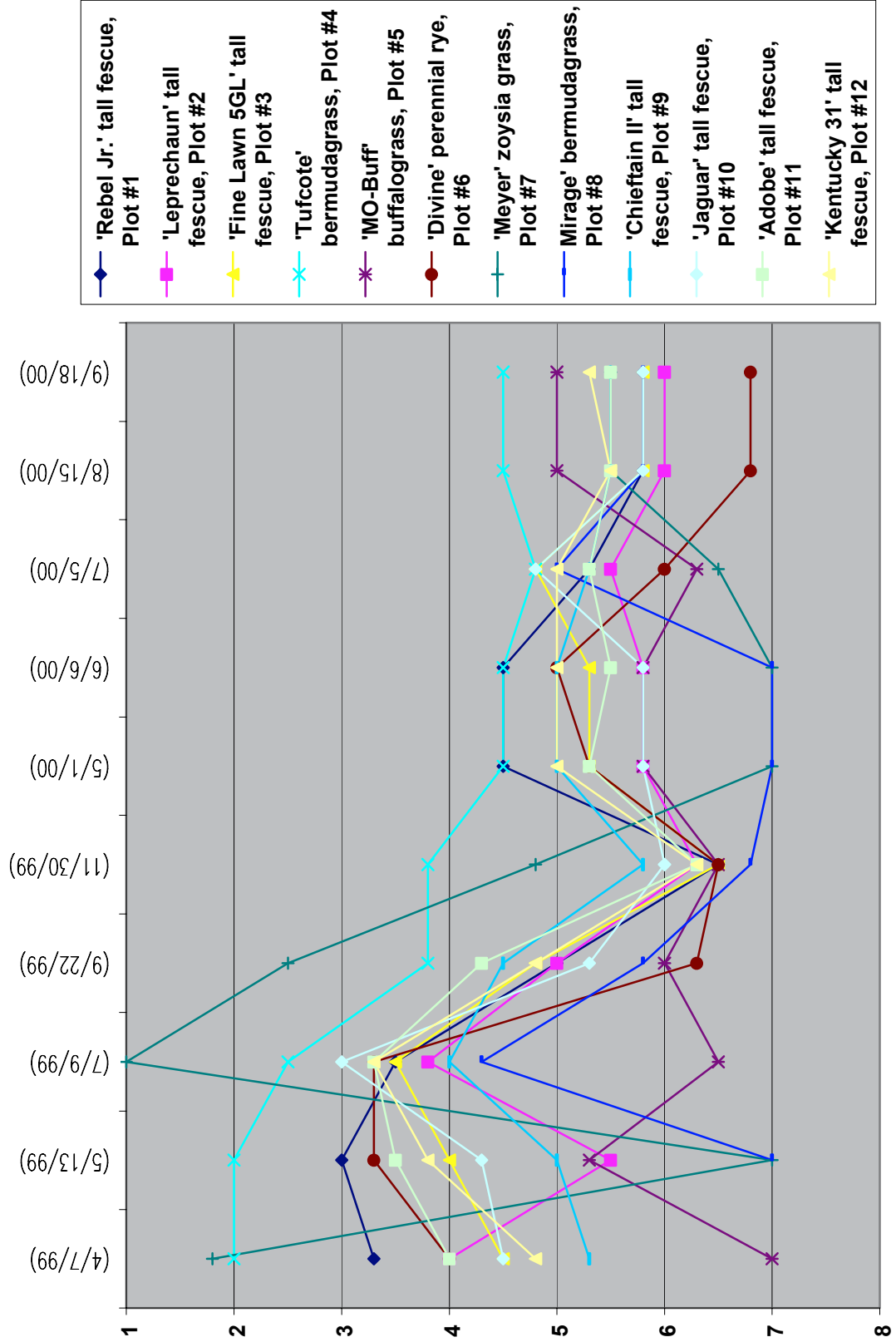
TABLE #9

Site #1 - Barracks															Plant Density															(1=High 9=Bare Ground)														
Plot #	4/7/99	5/13/99	6/9/99	7/9/99	7/30/99	8/12/99	9/22/99	No Traffic			11/30/99	Plot #			3/14/00	4/19/00	5/1/00	5/17/00	6/6/00	6/20/00	7/5/00	8/2/00	8/15/00	8/30/00	9/18/00	9/25/00	Plot #																	
	1.8	2.0	1.0	1.0	1.0	1.8	2.5	2.3	4.8	7	6.8	3.5	4.5	4.5	4.5	6.3	4.8	4.8	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4															
4	2.0	2.0	1.5	2.5	1.8	1.8	3.8	2.3	3.8	4	6.3	3.5	5.8	5.8	7.8	6.3	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5															
11	4.0	3.5	3.3	3.3	4.0	3.8	4.3	6.3	6.3	11	5.3	4.0	5.0	5.0	7.0	5.0	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	12															
9	5.3	5.0	4.3	4.0	3.3	3.8	4.5	6.3	5.8	9	6.5	4.5	7.0	7.0	7.5	6.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	7															
3	4.5	4.0	3.8	3.5	3.3	3.5	4.8	6.5	6.5	3	6.8	4.5	5.0	5.0	6.5	5.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	9															
12	4.8	3.8	3.5	3.3	3.5	3.5	4.8	6.3	6.3	12	6.3	4.0	5.3	5.3	6.5	5.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	11															
1	3.3	3.0	3.5	3.5	3.8	3.8	5.0	5.8	6.5	1	3.0	5.5	4.5	4.5	6.5	5.3	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	1															
2	4.0	5.5	4.3	3.8	3.5	3.5	5.0	5.8	6.3	2	2.3	4.8	5.3	5.3	6.8	4.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	3															
10	4.5	4.3	3.8	3.0	4.0	3.0	5.3	5.3	6.0	10	6.3	4.8	7.0	7.0	7.3	5.0	5.8	5.8	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	8															
8	7.0	5.5	4.3	3.5	3.3	3.3	5.8	6.3	6.8	8	6.3	4.8	5.8	5.8	6.5	4.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	10															
5	7.0	5.3	6.3	6.5	6.8	5.8	6.0	5.5	6.5	5	5.5	5.8	5.8	5.8	6.8	5.5	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	2															
6	4.0	3.3	3.3	3.3	3.3	4.3	6.3	6.8	6.5	6	5.5	6.8	5.0	5.0	7.0	6.0	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6															
1st Traffic																																												
Plot #	4/7/99	5/13/99	6/9/99	7/9/99	7/30/99	8/12/99	9/22/99	10/20/99	11/30/99	Plot #	3/14/00	4/19/00	5/1/00	5/17/00	6/6/00	6/20/00	7/5/00	8/2/00	8/15/00	8/30/00	9/18/00	9/25/00	Plot #																					
7	1.8	1.0	1.0	2.0	1.8	2.0	6.0	5.8	7.0	7	7.8	5.8	6.3	7.3	7.0	6.5	5.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4															
4	2.0	2.0	1.5	3.3	2.3	2.5	6.0	6.0	5.3	4	5.8	7.3	6.0	7.0	7.3	7.3	6.3	6.5	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	1															
11	4.3	3.3	3.5	4.3	3.3	4.0	6.8	6.5	7.0	11	8.3	8.0	6.8	7.3	7.8	8.0	6.8	7.0	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	3															
9	5.3	4.8	4.3	5.3	4.0	4.5	7.0	5.8	7.0	9	6.5	8.0	6.8	7.0	7.5	8.0	7.3	7.3	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	12															
12	4.3	3.8	3.3	4.3	4.3	4.5	7.3	6.5	7.5	12	8.0	6.0	6.5	7.3	7.3	7.5	6.8	7.0	7.3	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	10															
2	4.8	5.8	4.5	5.8	5.0	5.0	7.3	6.5	7.3	2	8.8	9.0	7.0	8.0	7.3	8.3	7.0	7.3	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	2															
1	3.3	3.0	3.5	4.3	4.0	4.8	7.3	6.5	7.3	1	8.0	6.3	6.8	7.3	7.5	8.5	7.3	7.3	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	6															
3	4.5	4.0	4.3	4.8	4.5	4.5	7.5	6.8	7.3	3	7.5	6.0	7.0	7.8	8.3	8.3	7.0	7.3	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	9															
10	4.5	4.5	3.5	4.5	4.0	4.3	7.5	6.8	6.3	10	7.5	5.8	6.0	7.3	7.5	7.3	6.5	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	11															
6	4.0	3.0	3.0	3.8	4.7	5.0	7.8	6.8	7.3	6	8.0	6.3	8.8	9.0	8.8	8.5	8.0	8.0	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	7															
8	7.0	7.0	5.5	5.0	4.3	4.3	8.0	5.8	7.3	8	7.8	6.0	9.0	8.8	8.5	9.0	8.8	8.3	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8															
5	7.0	5.3	6.5	6.5	6.8	6.8	8.5	5.8	5.8	5	8.0	6.3	8.3	8.0	8.8	8.8	7.3	7.3	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	5															

TABLE #9

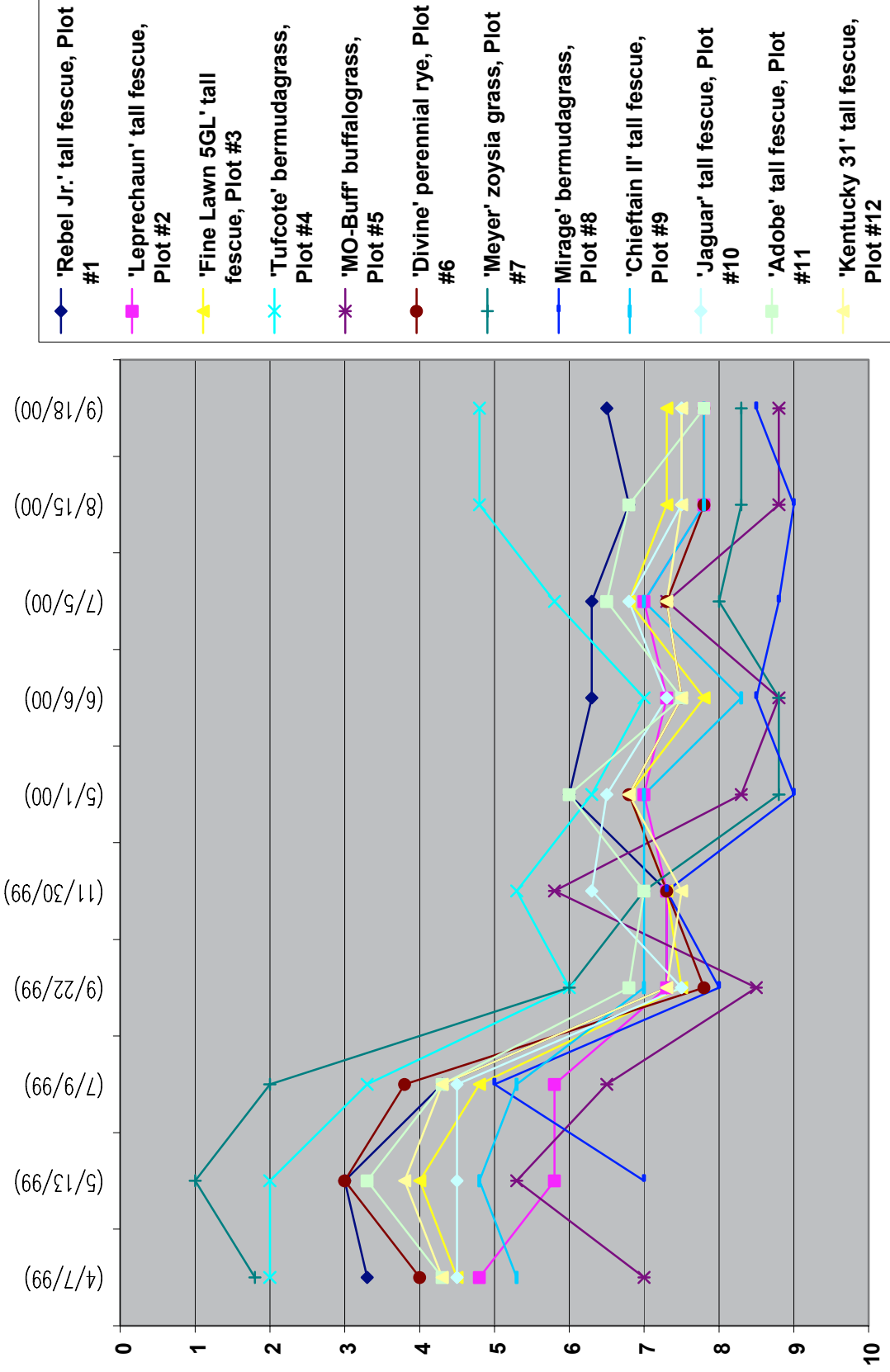
Plot #	Site #1 Barracks										Plant Density										(1=High 9=Bare Ground)										Plot #
							2nd Traffic																								
	4/7/99	5/13/99	6/9/99	7/9/99	7/30/99	8/12/99	9/22/99	10/20/99	11/30/99			3/14/00	4/19/00	5/1/00	5/17/00	6/6/00	6/20/00	7/5/00	8/2/00	8/15/00	8/30/00	9/18/00	9/25/00								
												6.8	3.5	4.5	5.8	5.8	6.8	6.5	5.3	5.3	5.3	5.3	5.5	4							
												3.0	5.5	5.3	6.8	6.8	7.3	6.8	7.5	7.8	7.5	7.5	8.5	3							
												2.3	4.8	4.5	6.0	6.3	7.0	6.8	7.3	7.5	7.5	7.5	8.5	12							
												6.3	4.8	4.5	6.8	7.0	7.0	7.5	7.5	7.8	7.5	7.5	8.3	1							
												5.3	4.0	5.3	6.8	7.0	6.8	6.5	7.0	7.5	7.5	7.5	8.3	11							
												6.8	4.5	8.3	7.5	7.5	8.0	7.5	7.0	7.8	7.8	7.8	8.3	8							
												6.3	4.0	5.0	6.8	7.0	7.5	6.3	7.5	7.8	7.8	7.8	8.3	9							
												6.3	3.5	5.8	7.5	7.5	7.0	6.8	7.5	7.8	7.8	7.8	8.0	10							
												5.5	5.8	5.8	7.3	6.8	7.5	7.0	7.5	8.0	8.0	8.0	8.5	2							
												6.3	4.8	5.0	6.5	7.5	8.0	6.8	7.8	7.8	7.5	8.0	8.3	6							
												6.5	4.5	7.0	8.3	8.3	7.8	8.0	8.3	8.5	8.5	8.5	8.3	7							
												5.5	6.8	5.8	7.5	7.3	8.3	7.0	8.5	9.0	8.5	9.0	8.8	5							

**SITE #1 BARRACKS - PLANT DENSITY - NO TRAFFIC**  
 1=High Density, 9=Bare Ground





**SITE #1 BARRACKS - PLANT DENSITY -1ST YEAR TRAFFIC**  
**1-High Density, 9=Bare Ground**



**SITE #1 BARRACKS - PLANT DENSITY - 2ND YEAR TRAFFIC**  
 1=High Density, 9=Bare Ground

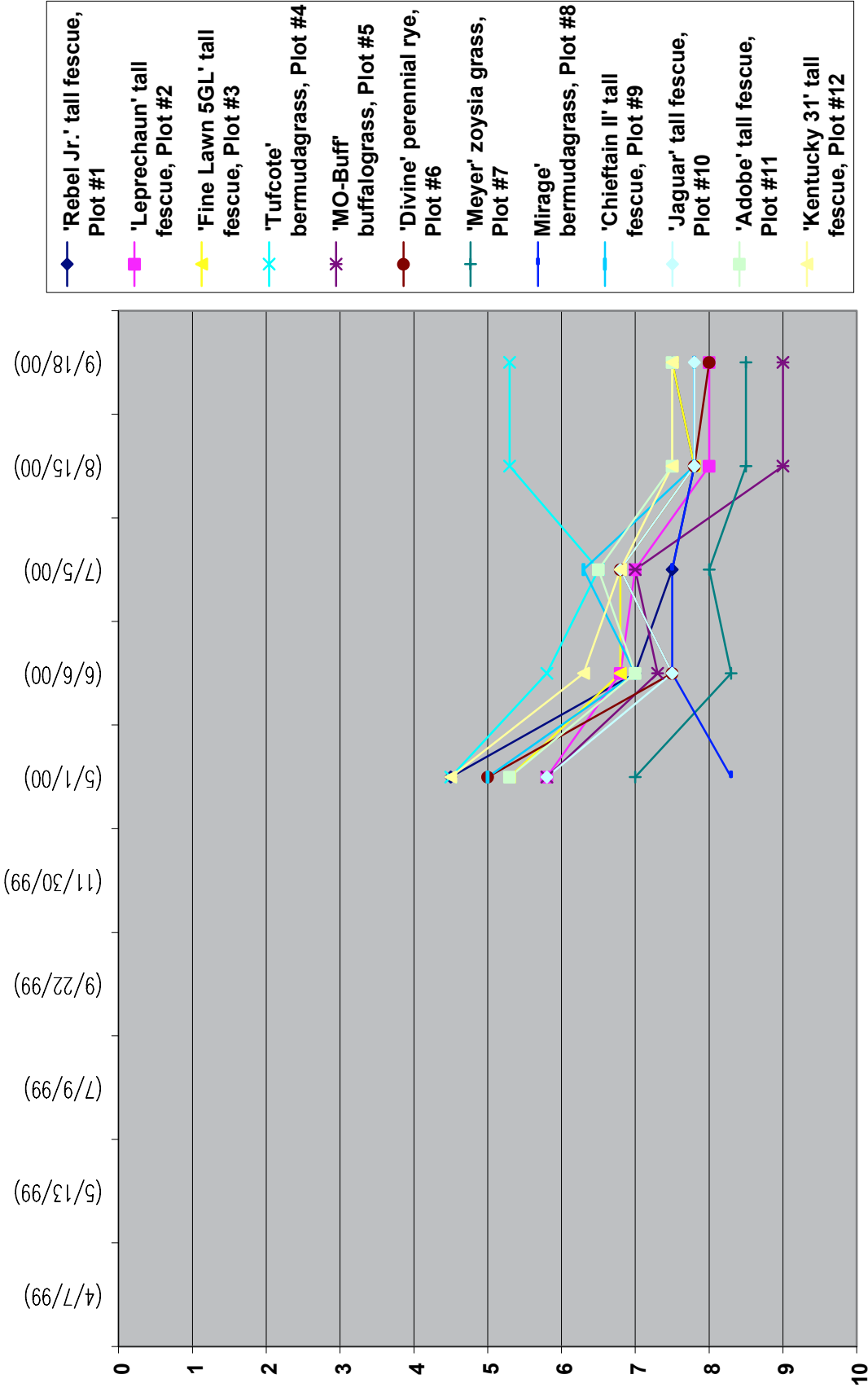


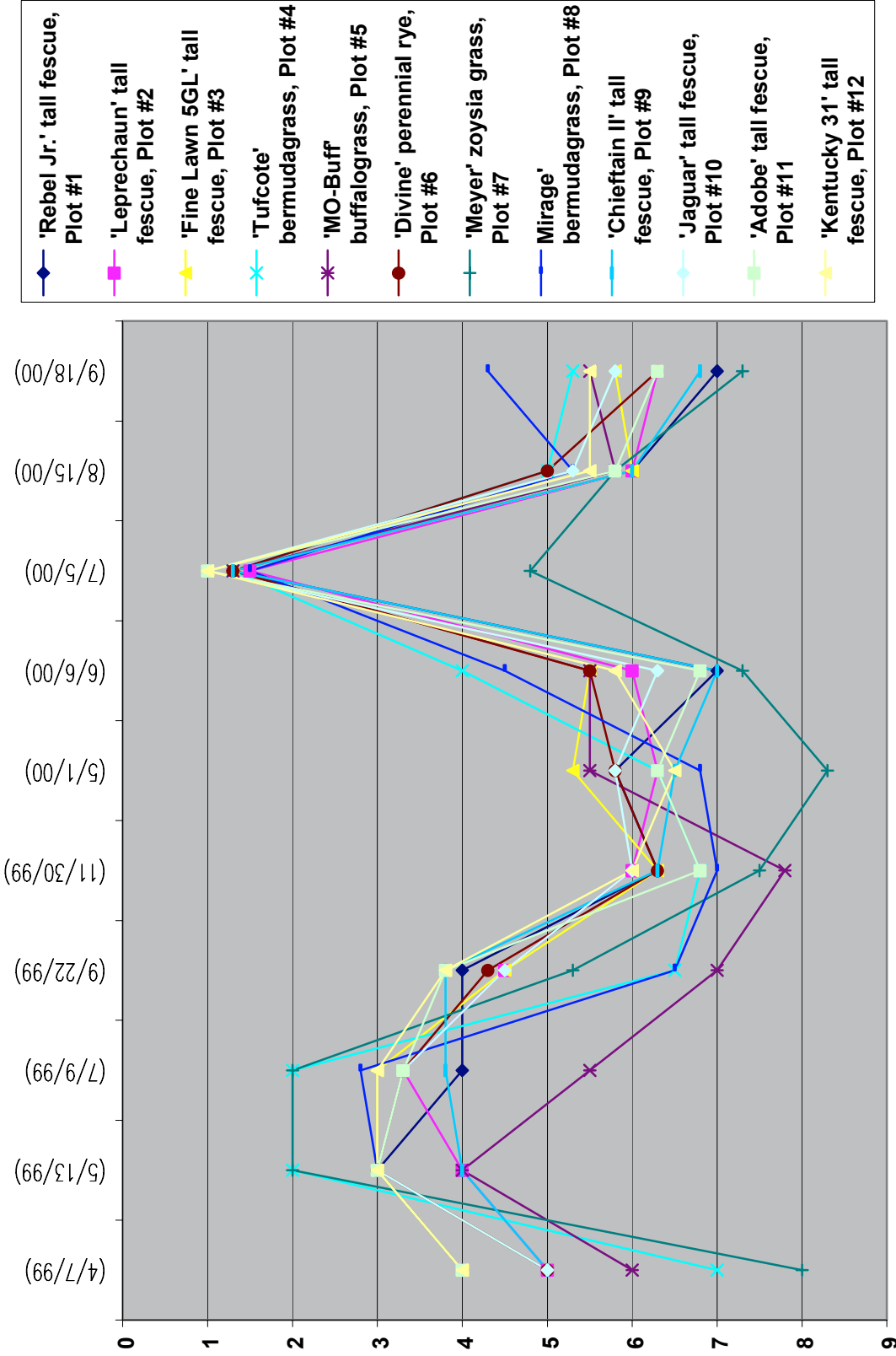
TABLE #10

		SITE #1 Barracks												Vigor (1=Excellent 9=Poor)											
Plot #	4/7/99	5/13/99	6/9/99	7/9/99	7/30/99	8/12/99	9/22/99	No Traffic		11/30/99 #	Plot	3/14/00	4/19/00	5/1/00	5/17/00	6/6/00	6/20/00	7/5/00	8/2/00	8/15/00	8/30/00	9/18/00	9/25/00 #		
								10/20/99	10/20/99																
		1st Traffic												Vigor (1=Excellent 9=Poor)											
Plot #	4/7/99	5/13/99	6/9/99	7/9/99	7/30/99	8/12/99	9/22/99	1st Traffic		11/30/99 #	Plot	3/14/00	4/19/00	5/1/00	5/17/00	6/6/00	6/20/00	7/5/00	8/2/00	8/15/00	8/30/00	9/18/00	9/25/00 #		
								10/20/99	10/20/99																
11	4.0	3.0	3.0	3.3	4.5	4.3	3.8	5.8	6.8	11	9.0	7.3	6.8	6.0	4.5	1.8	1.5	5.5	5.3	4.3	4.5	4.5	8		
9	5.0	4.0	4.0	3.8	4.0	4.3	3.8	5.8	6.3	9	9.0	6.5	6.3	5.5	4.0	1.3	1.3	6.3	5.0	5.3	5.3	5.3	4		
12	4.0	3.0	3.0	3.0	3.5	4.5	3.8	6.0	6.0	12	8.5	6.3	5.5	7.5	5.5	2.0	1.3	3.5	5.8	5.5	5.5	5.5	5		
1	4.0	3.0	3.0	4.0	4.3	3.8	4.0	5.8	6.3	1	5.0	3.0	6.5	8.0	5.8	2.5	1.0	3.8	5.5	6.3	5.5	5.5	12		
6	5.0	3.0	3.0	3.3	4.5	4.5	4.3	5.8	6.3	6	4.8	3.0	5.3	8.0	5.5	1.8	1.3	4.0	6.0	6.0	6.5	5.8	3		
3	4.0	3.0	3.0	3.0	4.0	4.0	4.5	6.0	6.3	3	4.8	3.0	5.8	7.8	6.3	1.8	1.0	4.0	5.3	7.0	5.8	5.8	10		
2	5.0	4.0	4.0	3.3	4.0	4.3	4.5	6.0	6.0	2	5.5	2.5	6.3	8.0	6.0	2.0	1.5	4.3	6.0	7.3	6.3	6.3	2		
10	5.0	3.0	3.0	3.3	4.3	4.3	4.5	6.0	6.0	10	5.3	3.0	5.8	7.3	5.5	1.8	1.3	4.0	5.0	7.0	6.3	6.3	6		
7	8.0	2.0	3.0	2.0	2.5	2.3	5.3	5.8	7.5	7	5.3	2.8	6.3	8.0	6.8	2.5	1.0	4.0	5.8	7.3	6.3	6.3	5.0	11	
8	-	3.0	2.0	2.8	2.8	3.0	6.5	5.8	7.0	8	4.8	3.3	6.5	8.0	7.0	1.8	1.3	4.0	6.0	7.5	6.8	6.8	9		
4	7.0	2.0	2.0	2.0	2.3	2.8	6.5	6.0	6.8	4	5.0	3.3	5.8	8.0	7.0	3.0	1.3	4.3	6.0	7.5	7.0	7.0	1		
5	6.0	4.0	5.0	5.5	5.5	5.5	7.0	5.8	7.8	5	9.0	7.8	8.3	8.0	7.3	3.8	3.8	3.8	5.8	7.5	7.3	7.3	7		
		1st Traffic												Vigor (1=Excellent 9=Poor)											
Plot #	4/7/99	5/13/99	6/9/99	7/9/99	7/30/99	8/12/99	9/22/99	10/20/99	10/20/99	11/30/99 #	Plot	3/14/00	4/19/00	5/1/00	5/17/00	6/6/00	6/20/00	7/5/00	8/2/00	8/15/00	8/30/00	9/18/00	9/25/00 #		
6	5.0	3.0	3.0	3.3	4.8	4.8	5.8	7.0	7.5	6	8.8	6.8	5.3	5.8	6.3	2.5	3.3	3.5	6.5	6.8	6.3	7.5	4		
11	4.0	3.0	3.0	4.0	5.3	4.5	6.5	6.3	7.3	11	9.0	9.0	7.3	8.0	7.5	4.3	7.0	5.3	7.5	7.0	6.8	8.0	8		
12	4.0	3.0	3.0	3.8	5.0	4.8	6.5	6.3	7.3	12	8.5	7.8	7.5	8.0	7.5	5.0	5.8	6.3	7.3	7.3	6.8	7.8	5		
3	4.0	3.0	3.0	3.8	4.5	4.5	7.0	6.0	7.3	3	7.0	6.3	5.5	6.8	6.8	4.5	5.5	4.8	7.0	7.5	7.0	8.5	12		
9	5.0	4.0	4.0	4.3	4.5	4.3	7.0	6.3	7.3	9	6.5	4.8	5.5	7.0	6.5	4.0	5.3	5.5	7.5	8.3	7.0	8.0	1		
1	4.0	3.0	3.0	3.3	5.3	4.8	7.3	6.5	7.5	1	7.0	5.5	5.8	7.3	6.8	3.5	5.8	5.8	6.8	7.8	7.0	8.0	9		
2	5.0	4.0	4.0	4.8	4.5	4.8	7.3	5.8	7.0	2	7.0	5.3	5.0	6.5	6.5	3.8	5.3	5.3	7.0	7.8	7.3	8.5	3		
10	5.0	3.0	3.0	3.5	4.8	4.3	7.3	6.3	7.0	10	6.8	5.3	5.3	7.0	7.0	7.0	5.8	5.5	6.8	8.0	7.3	8.0	10		
4	7.0	2.0	2.0	3.5	2.3	2.8	7.5	6.0	7.5	4	6.8	4.8	5.3	6.8	6.8	3.3	5.3	5.5	6.8	8.0	7.3	8.0	11		
7	8.0	2.0	3.0	2.8	2.8	2.5	7.8	7.3	7.8	7	7.0	5.8	5.8	6.8	7.0	3.5	6.0	5.5	7.3	8.0	7.5	8.5	2		
5	6.0	4.0	5.0	5.0	5.5	5.8	8.0	6.5	7.5	5	9.0	8.0	7.5	7.8	7.5	6.3	6.3	6.3	7.0	7.5	7.5	8.3	7		
8	-	3.0	3.0	3.3	3.8	3.0	8.0	6.0	7.5	8	6.8	4.8	5.3	7.0	7.0	3.8	3.8	4.3	7.3	7.8	7.8	8.3	6		
		1st Traffic												Vigor (1=Excellent 9=Poor)											
		SITE #1 Barracks												Vigor (1=Excellent 9=Poor)											
Plot #	4/7/99	5/13/99	6/9/99	7/9/99	7/30/99	8/12/99	9/22/99	10/20/99	10/20/99	11/30/99 #	Plot	3/14/00	4/19/00	5/1/00	5/17/00	6/6/00	6/20/00	7/5/00	8/2/00	8/15/00	8/30/00	9/18/00	9/25/00 #		

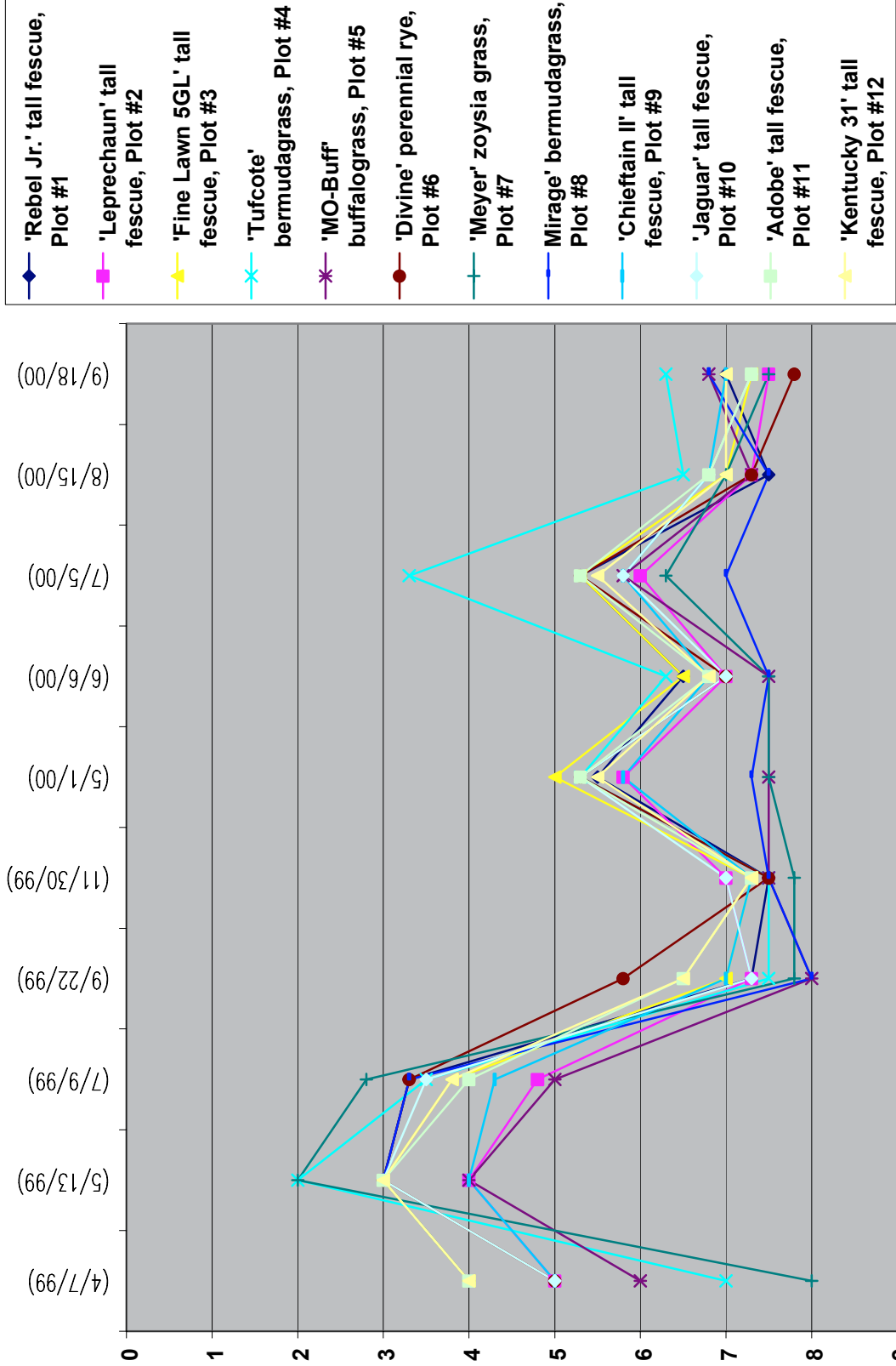
TABLE #10

Plot #	2nd Traffic		Plot #	Plot																				
	4/7/99	5/13/99		6/9/99	7/9/99	7/30/99	8/12/99	9/22/99	10/20/99	11/30/99	3/14/00	4/19/00	5/1/00	5/17/00	6/6/00	6/20/00	7/5/00	8/2/00	8/15/00	8/30/00	9/18/00	9/25/00	Plot #	

**SITE #1 BARRACKS - VIGOR - NO TRAFFIC**  
 1=High Vigor, 9=Low Vigor



**SITE #1 BARRACKS - VIGOR - 1ST YEAR TRAFFIC**  
 1=High Vigor, 9=Low Vigor



**SITE #1 BARRACKS - VIGOR - 2ND YEAR TRAFFIC**  
**1=High Vigor, 9=Low Vigor**

GRAPH #9

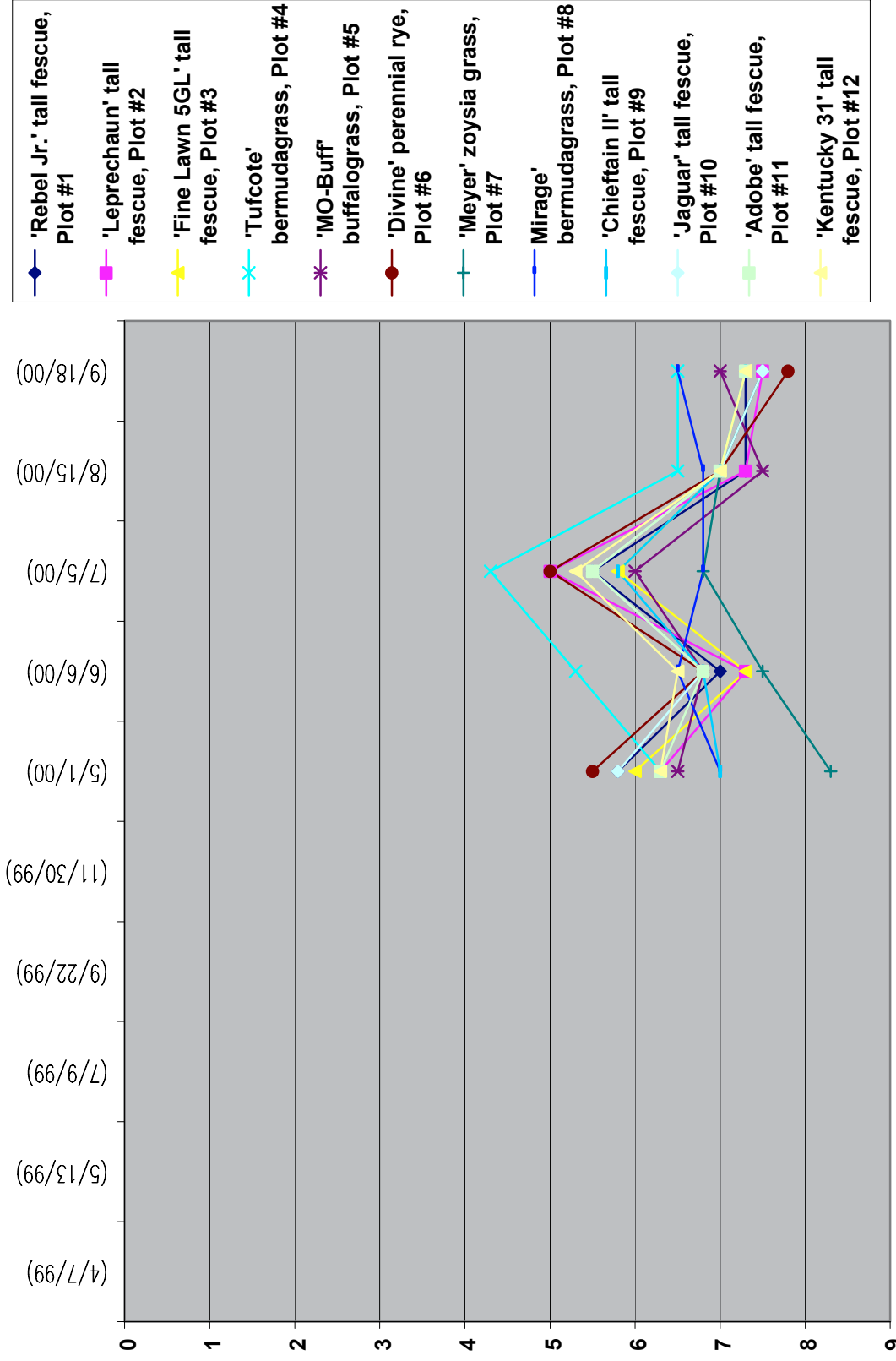






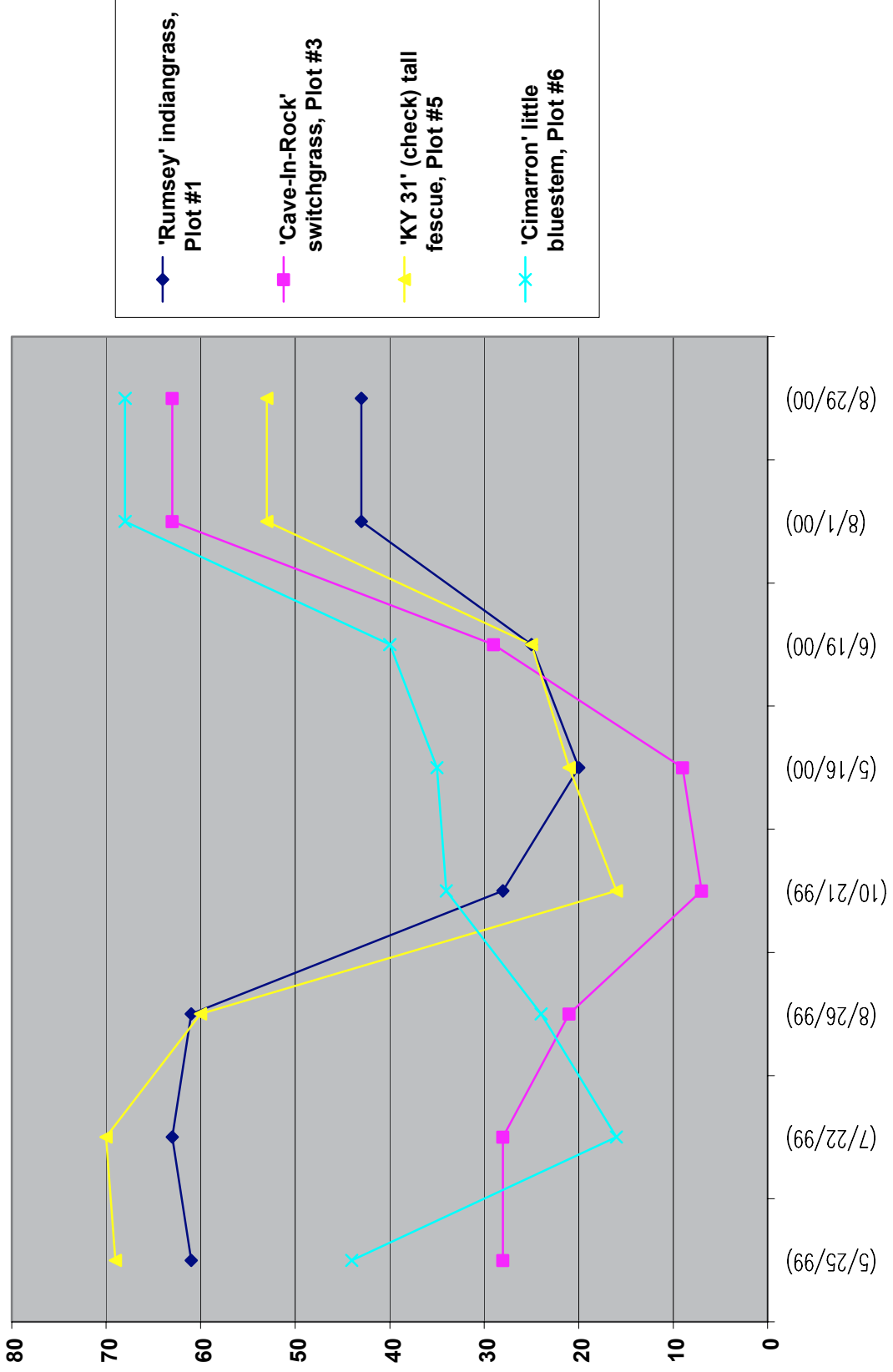
TABLE #11

Plot #1/	SITE #2 TA-244									Percent Cover					8/21 2000	8/22 2000	8/23 2000	8/24 2000	8/25 2000	8/26 2000
	4/7 1999	5/25 1999	6/18 1999	7/22 1999	8/26 1999	8/27 1999	10/21 1999	4/18 2000	5/16 2000	5/17 2000	6/19 2000	6/20 2000	8/1 2000	8/2 2000						
6	2	48	18	19	35	30	31	24	30	14	18	10	15	12	11	12	6			
5	30	55	59	63	46	46	12	14	15	9	8	Event	25	21	Event	10	10	5		
1		63	61	75	70	70	24	18	18	13	13	3rd	6	11	4th	8	8	1		
3	43	41	41	49	41	39	3	3	3	Traffic	1	9	Traffic	3	14	Traffic	6	6	3	
3		28	26	31	38	38	7	6	9	2	4	3	18	3	1	1	3			
5	18	34	35	48	40	39	8	13	13	8	9	5	13	0	1	1	5			
6	5	51	28	30	36	36	31	26	31	9	14	6	3	1	1	1	6			
1		38	40	44	44	41	12	6	20	10	8	1	8	0	0	0	1			
5	33	45	43	44	39	79	9	10	11	5	4	3	9	3	2	2	5			
3		41	43	37	51	44	5	7	8	1	4	0	9	1	1	1	3			
1		44	49	49	91	46	11	8	21	3	5	0	4	0	0	1	1			
6	8	46	24	29	36	35	31	34	35	8	16	1	3	0	0	0	6			
6	1	44	11	16	24	24	34	38	35	35	40	40	68	68	68	68	6			
3		28	29	28	21	21	7	6	9	9	29	29	63	63	63	63	3			
5	40	69	69	70	60	58	16	21	21	21	25	25	53	53	53	53	5			
1		61	63	63	61	61	28	25	20	20	25	25	43	43	43	43	1			

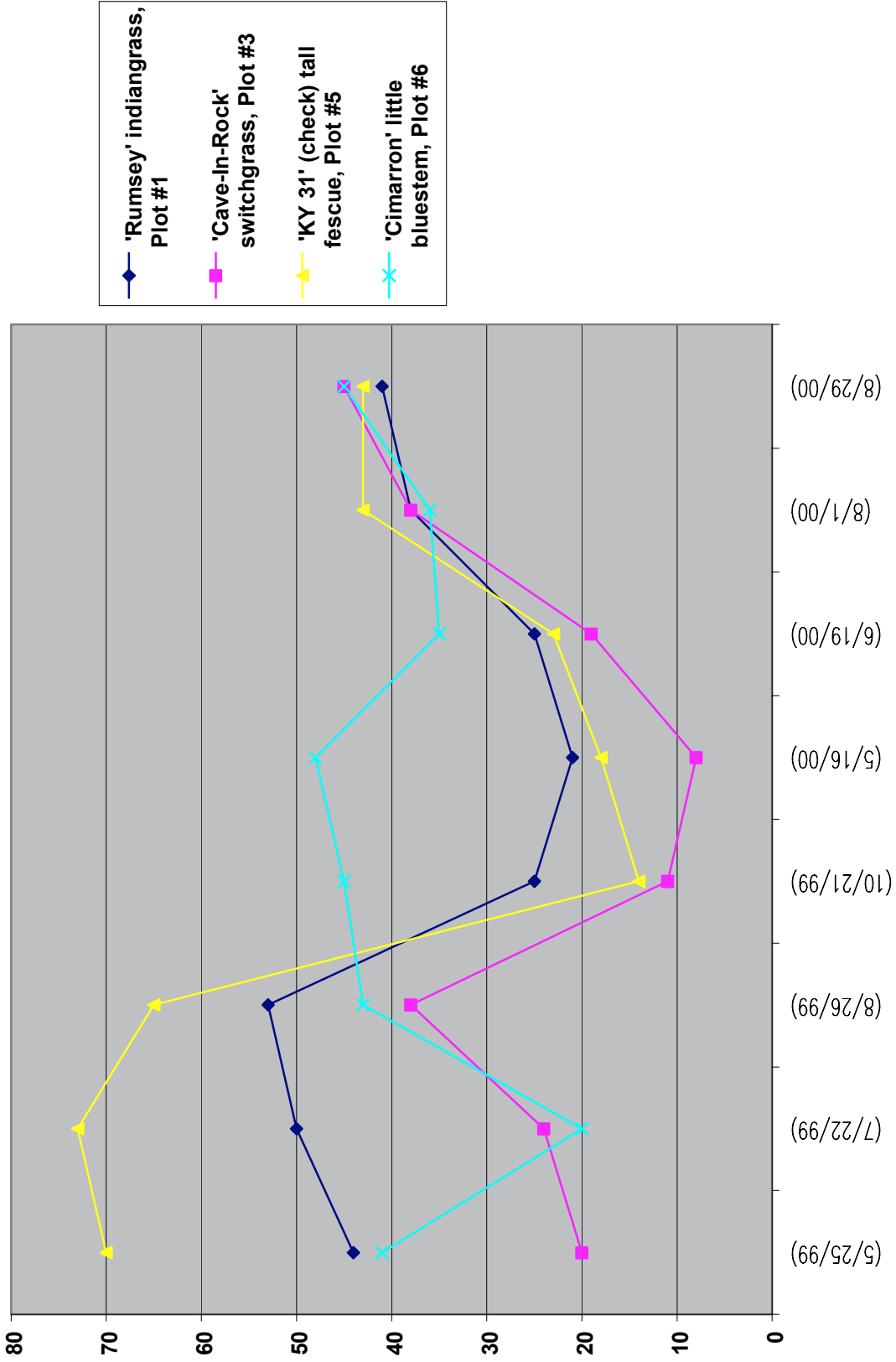
1/Plots are ranked best to worst for the late season percent ground cover evaluation taken 8/29/00.

Plot #1=indiangrass  
 Plot #3=switchgrass  
 Plot #5=tall fescue  
 Plot #6=little bluestem

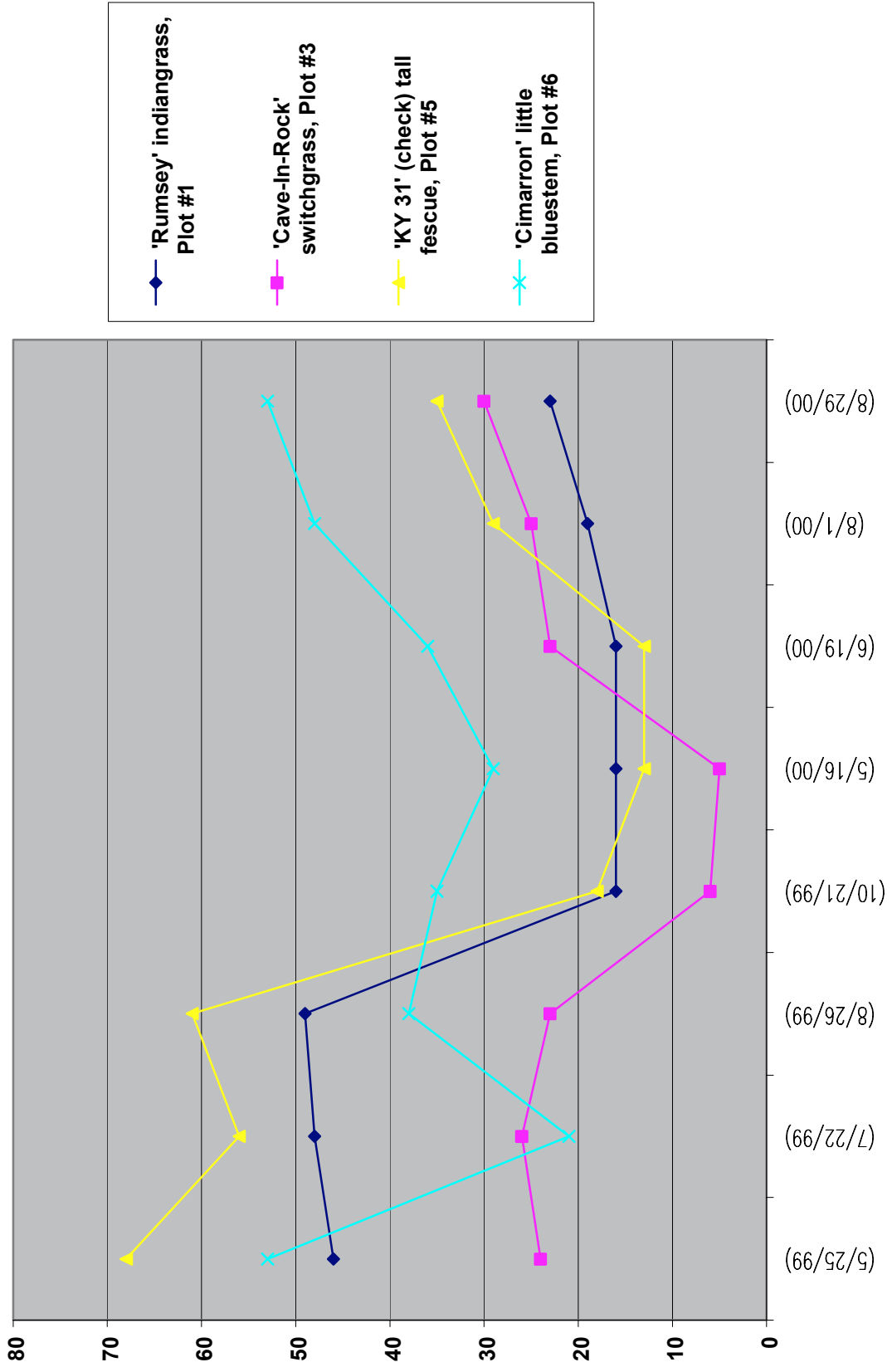
**SITE #2 TA-244 PERCENT COVER - NO TRAFFIC (CHECK)**



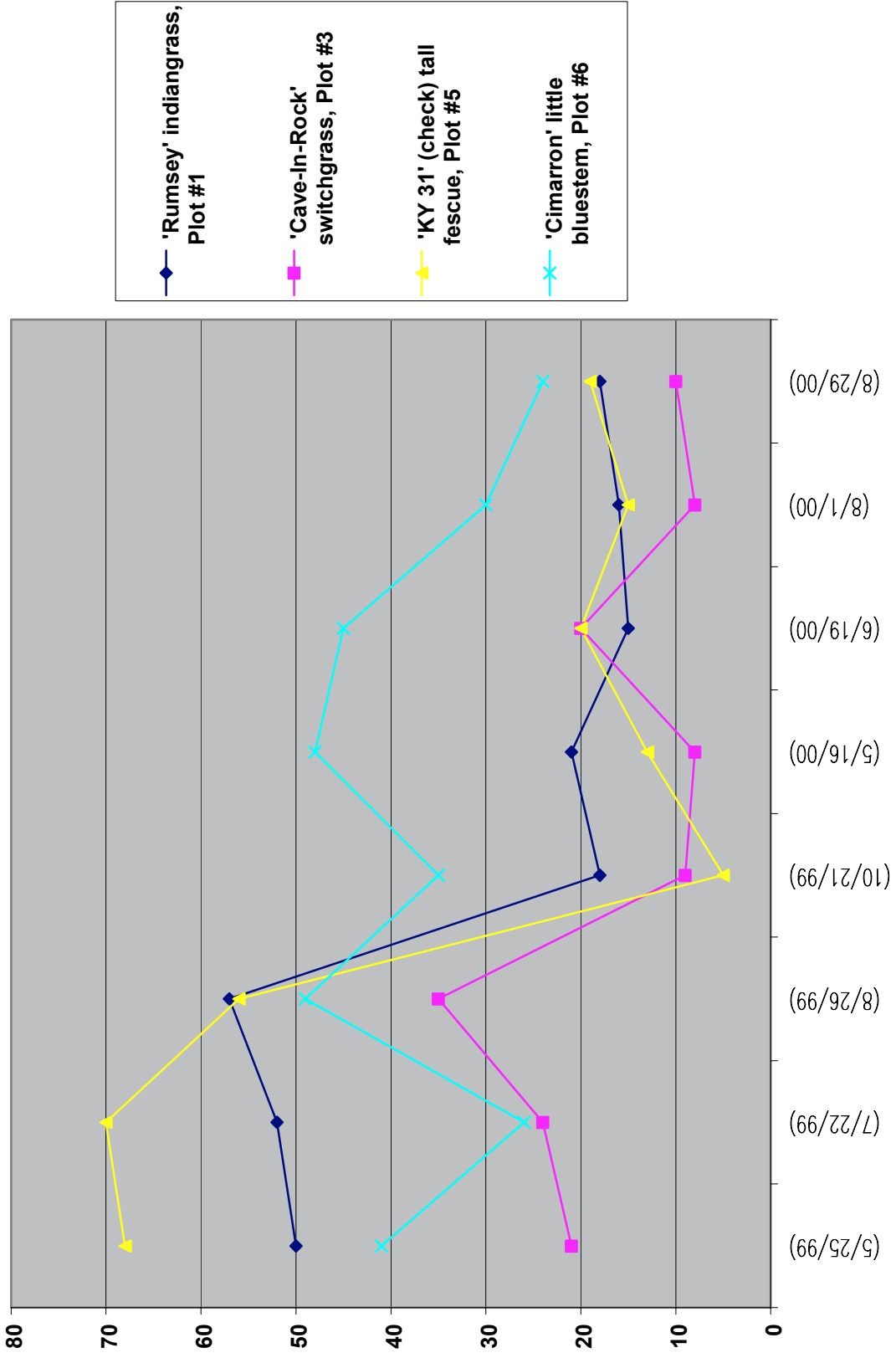
SITE #2 TA-244 PERCENT COVER - LOW TIRE TRAFFIC



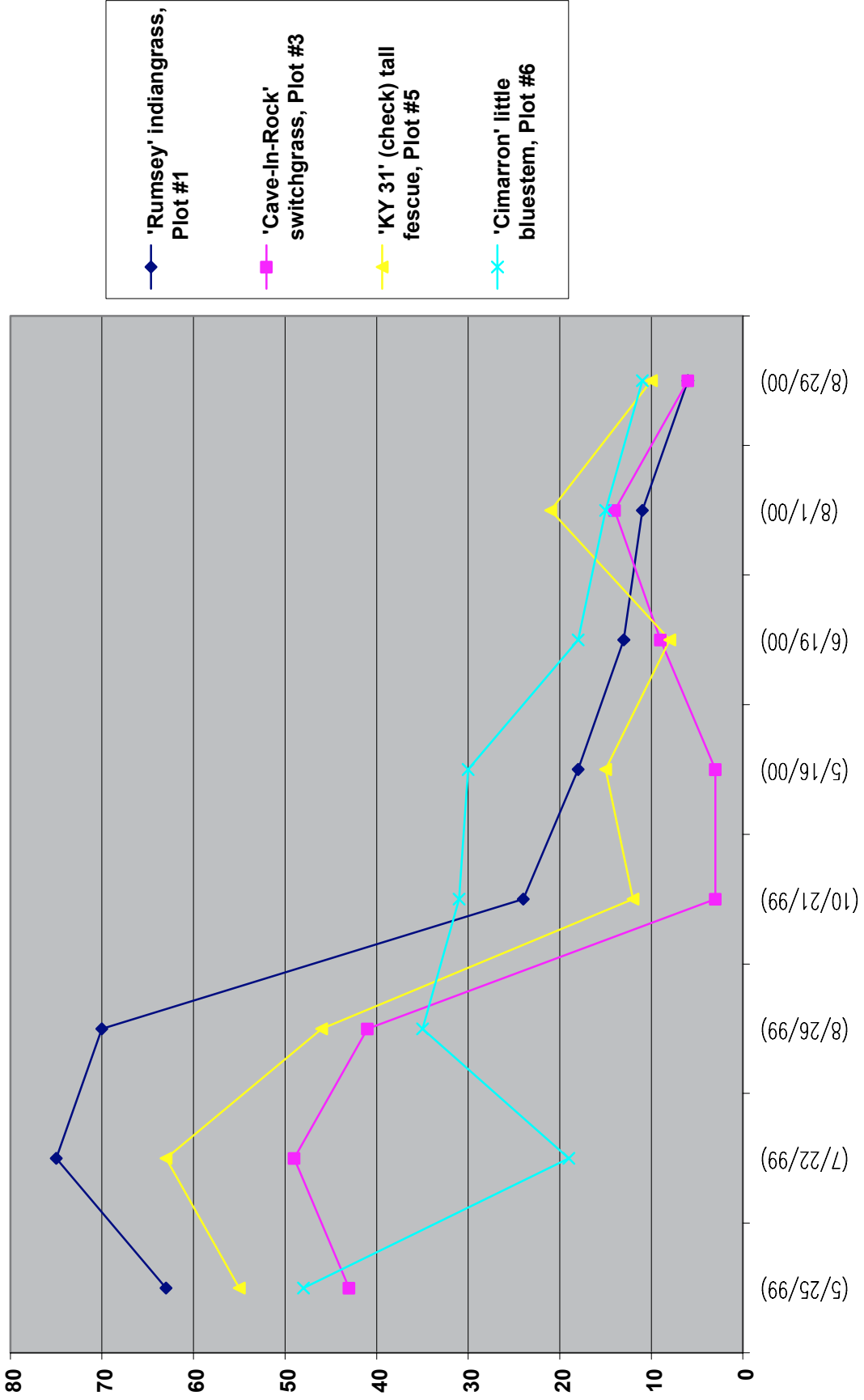
SITE #2 TA-244 PERCENT COVER - MEDIUM TIRE TRAFFIC



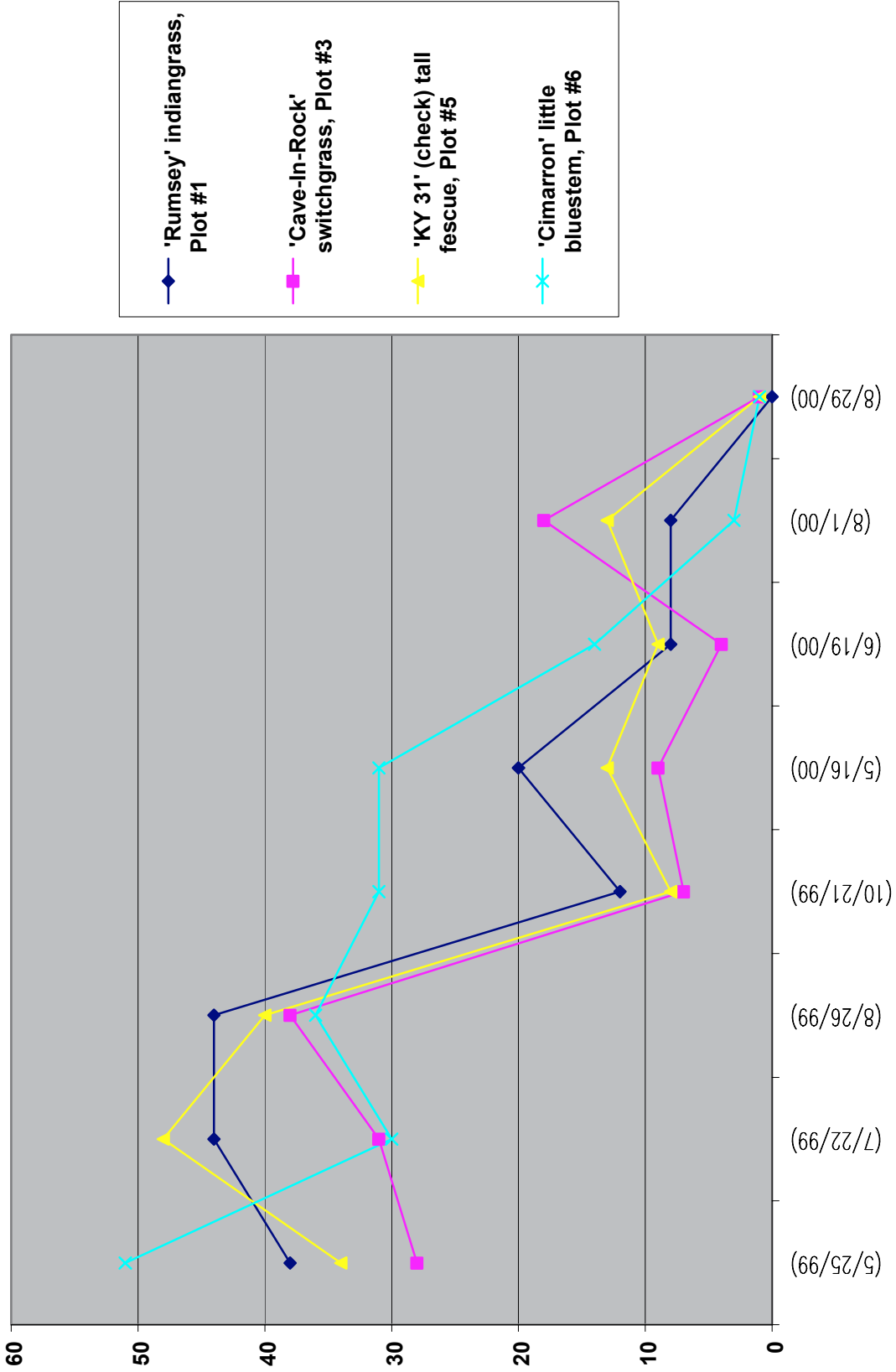
SITE #2 TA-244 PERCENT COVER - HIGH TIRE TRAFFIC



SITE #2 TA-244 PERCENT COVER - LOW TRACK TRAFFIC



SITE #2 TA-244 PERCENT COVER - MEDIUM TRACK TRAFFIC



SITE #2 TA-244 PERCENT COVER - HIGH TRACK TRAFFIC

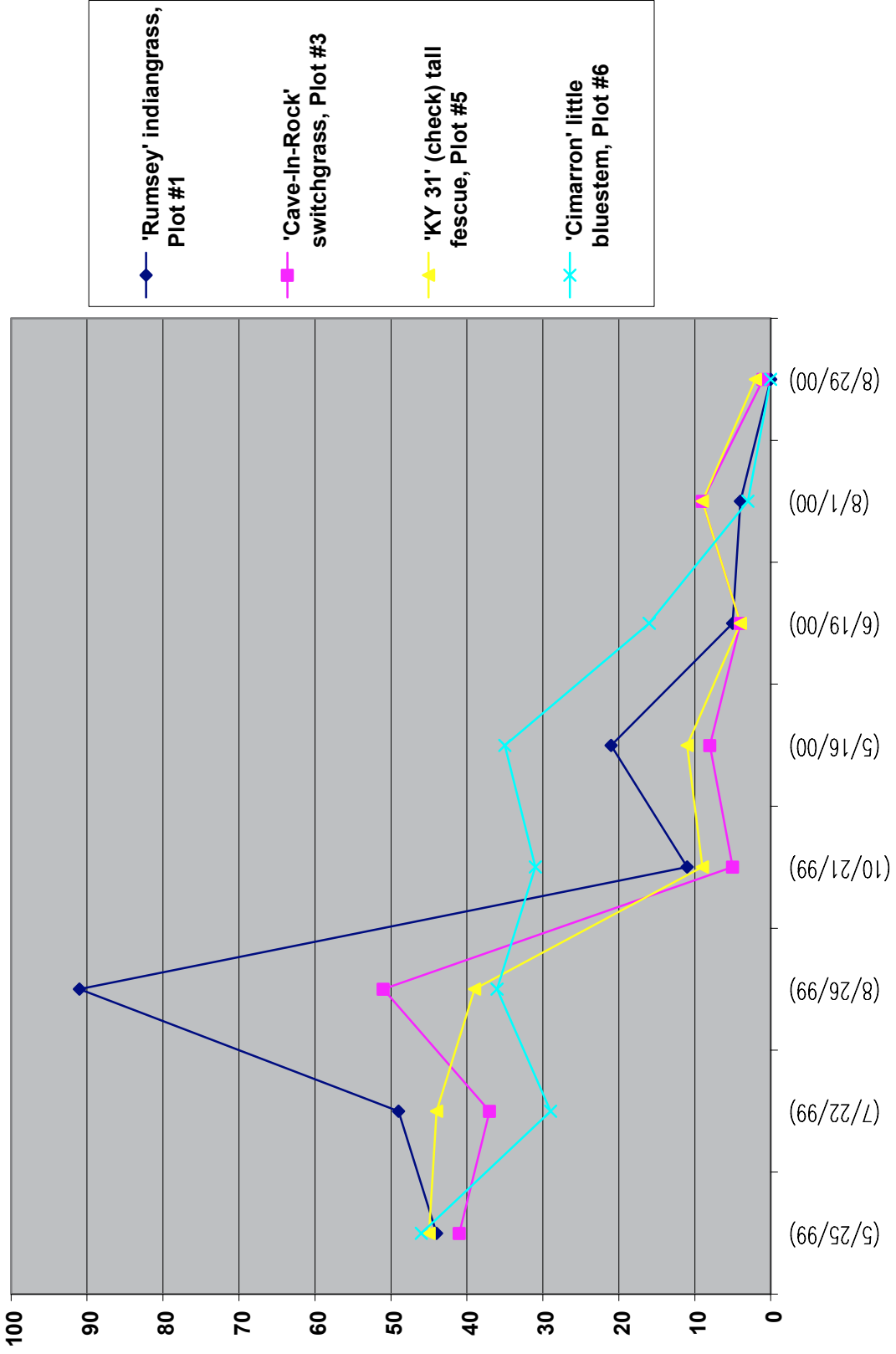




TABLE #12

SITE #2 TA-244		Plant Density				Rating 1-9 (1=Best 9=Worst)																	
Plot #	5/25/99	6/18/99	7/22/99	8/26/99	8/27/99	10/21/99	4/18/00	5/16/00	5/17/00	6/19/00	6/20/00	8/1/00	8/2/00	8/29/00	9/25/00	Plot #							
1/					↑	Low Tire Traffic										1/							
1	6.5	6.8	7.3	7.3	↑	6.3	7.5	7.3	7.3	7.0	7.3	6.5	7.0	7.5	7.5	1							
3	7.8	7.3	6.3	6.3		7.5	7.5	8.0	8.0	8.0	8.0	7.5	7.7	8.3	8.3	3							
5	4.5	5.8	6.0	6.5	↓	6.8	8.0	7.5	7.5	7.3	7.0	6.8	7.8	7.8	7.8	5							
6	7.8	8.0	7.5	7.5	↓	7.5	7.3	6.3	6.3	6.8	6.0	6.5	7.3	7.3	7.3	6							
						Medium Tire Traffic																	
1	6.5	7.0	7.3	7.8		7.3	8.0	7.8	7.0	7.8	8.5	7.8	8.5	8.5	8.5	1							
3	7.3	7.0	7.0	7.5		7.3	8.0	8.3	8.0	8.3	8.0	8.3	8.0	8.8	8.8	3							
5	4.8	5.5	5.3	7.0		7.0	8.3	8.0	7.8	7.8	7.8	8.0	7.7	8.0	8.0	5							
6	7.3	7.8	7.3	7.5		7.5	7.5	7.3	6.3	7.3	6.8	7.0	7.7	8.0	8.0	6							
						High Tire Traffic																	
1	6.0	6.5	5.8	7.3		6.5	8.0	7.8	7.5	7.8	8.5	7.3	8.3	8.3	8.3	1							
3	7.0	7.3	7.3	6.3		7.3	8.0	8.0	8.0	8.0	8.5	8.5	8.0	8.8	8.8	3							
5	4.8	5.8	5.3	7.3		7.0	8.0	8.3	7.8	7.8	7.8	8.3	8.0	8.0	8.0	5							
6	7.8	7.8	8.0	6.8		7.0	7.5	6.8	6.5	6.3	7.0	6.5	7.8	8.0	8.0	6							
						Check																	
1	5.8	6.3	5.8	8.3		6.5	7.5	7.5	5.8	7.3	7.3	4.8	4.8	4.8	4.8	1							
3	7.0	7.0	7.0	6.5		7.8	8.3	8.0	8.0	7.3	7.3	4.5	4.5	4.5	4.5	3							
5	4.8	6.0	6.0	7.5		7.3	8.0	7.5	7.3	7.0	7.0	6.3	6.3	7.8	6.3	5							
6	8.0	8.0	8.0	8.3		7.8	7.3	7.0	6.8	6.5	6.5	5.5	5.5	6.0	5.5	6							
1/Plots are ranked best to worst for the late season percent density evaluation taken 8/29/00.																							
SITE #2 TA-244								Plant Density								Rating 1-9 (1=Best 9=Worst)							

Plot #1=indiangrass  
Plot #3=switchgrass

Plot #5 = tall fescue  
Plot #6=little bluestem

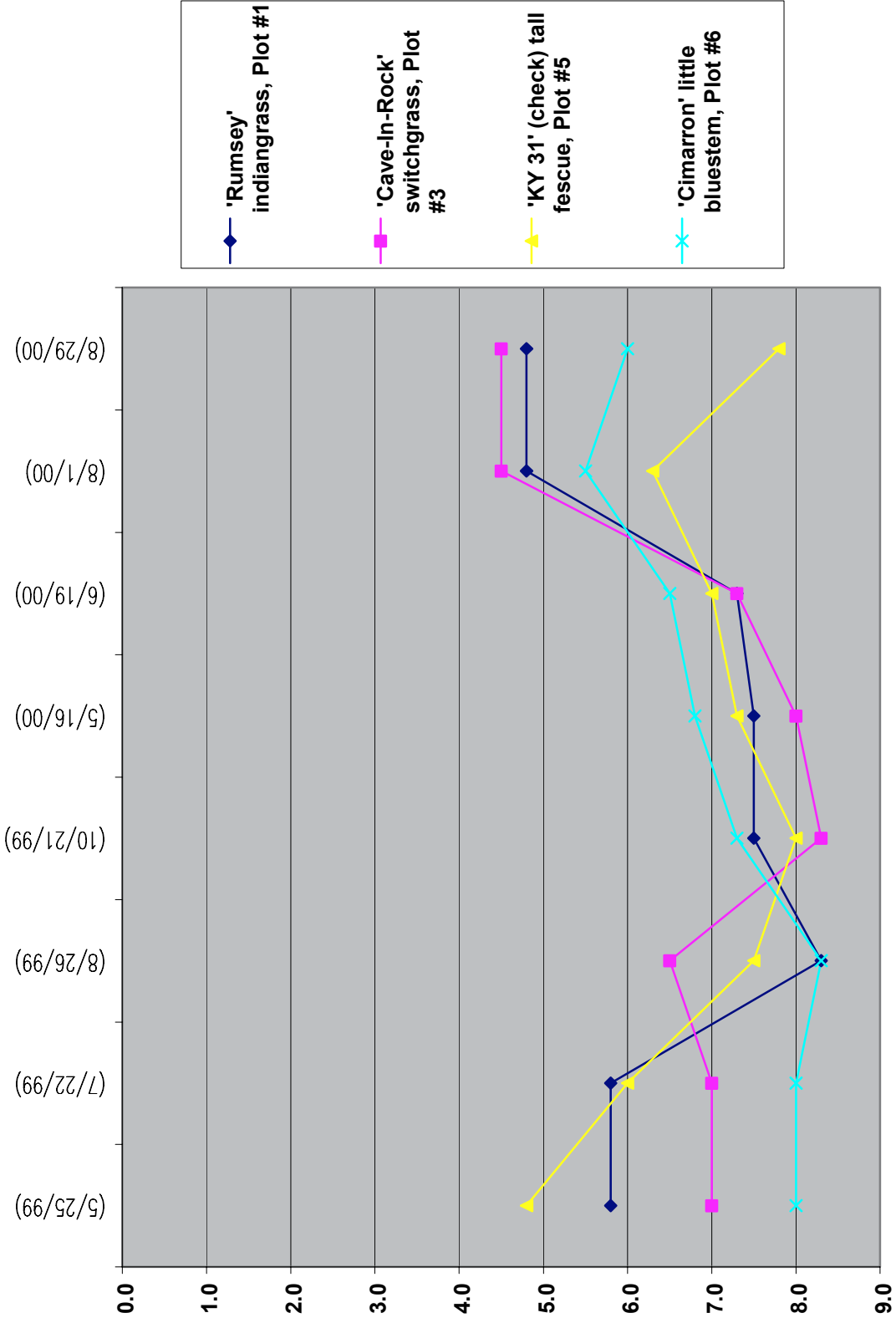
**TABLE #12**

Plot #	5/25/99	6/18/99	7/22/99	8/26/99	8/27/99	10/21/99	4/18/00	5/16/00	5/17/00	6/19/00	6/20/00	8/1/00	8/2/00	8/29/00	9/25/00	Plot #
1/ 1/																1/ 1/
					Low Track Traffic											
1	5.3	5.8	6.0	7.3	7.3	8.0	7.8	7.5	7.7	7.8	8.3	7.8	8.3	8.5	8.3	1
3	5.5	6.3	6.5	6.5	7.5	8.5	8.5	8.5	8.0	8.3	8.5	8.5	8.0	8.0	8.5	3
5	5.5	5.3	6.3	7.5	8.0	8.0	8.3	7.8	7.3	8.3	7.8	8.5	8.0	8.5	8.5	5
6	7.5	7.5	7.5	7.5	7.5	7.5	7.0	7.3	7.5	7.5	8.0	8.3	8.0	8.8	8.5	6
					Medium Track Traffic											
1	6.8	6.8	6.5	7.8	8.0	8.5	8.3	7.3	8.0	8.0	8.8	8.8	9.0	9.0	9.0	1
3	7.3	7.0	7.3	7.0	7.5	8.3	8.0	7.8	8.0	8.0	8.5	8.3	8.0	9.0	9.0	3
5	6.8	6.8	6.5	8.0	8.0	8.3	8.3	8.3	7.0	8.3	8.8	8.0	9.0	9.0	9.0	5
6	7.3	7.5	7.0	7.0	7.3	7.5	7.3	7.3	7.3	7.8	8.3	8.3	8.0	9.0	9.0	6
1	6.3	6.8	6.0	7.5	8.0	8.3	8.3	7.5	8.0	8.3	9.0	8.8	9.0	9.0	8.3	1
3	6.0	6.5	6.3	8.0	8.3	8.3	8.0	8.3	8.0	8.3	9.0	8.8	9.0	9.0	9.0	3
5	6.3	7.3	6.0	7.8	7.8	8.5	8.3	8.0	7.5	8.5	8.5	8.5	9.0	9.0	9.0	5
6	7.3	7.3	7.0	7.0	7.0	7.5	6.8	7.0	7.3	7.5	8.8	9.0	9.0	9.0	9.0	6
1	5.8	6.3	5.8	8.3	6.5	7.5	7.5	7.5	5.8	7.3	7.3	4.8	4.8	4.8	4.8	1
3	7.0	7.0	7.0	6.5	7.8	8.3	8.0	8.0	8.0	7.3	7.3	4.5	4.5	4.5	4.5	3
5	4.8	6.0	6.0	7.5	7.3	8.0	7.5	7.3	7.3	7.0	7.0	6.3	6.3	7.8	6.3	5
6	8.0	8.0	8.0	8.3	7.8	7.3	7.0	6.8	6.8	6.5	6.5	5.5	5.5	6.0	5.5	6
1/Plots are ranked best to worst for the late season percent density evaluation taken 8/29/00.																

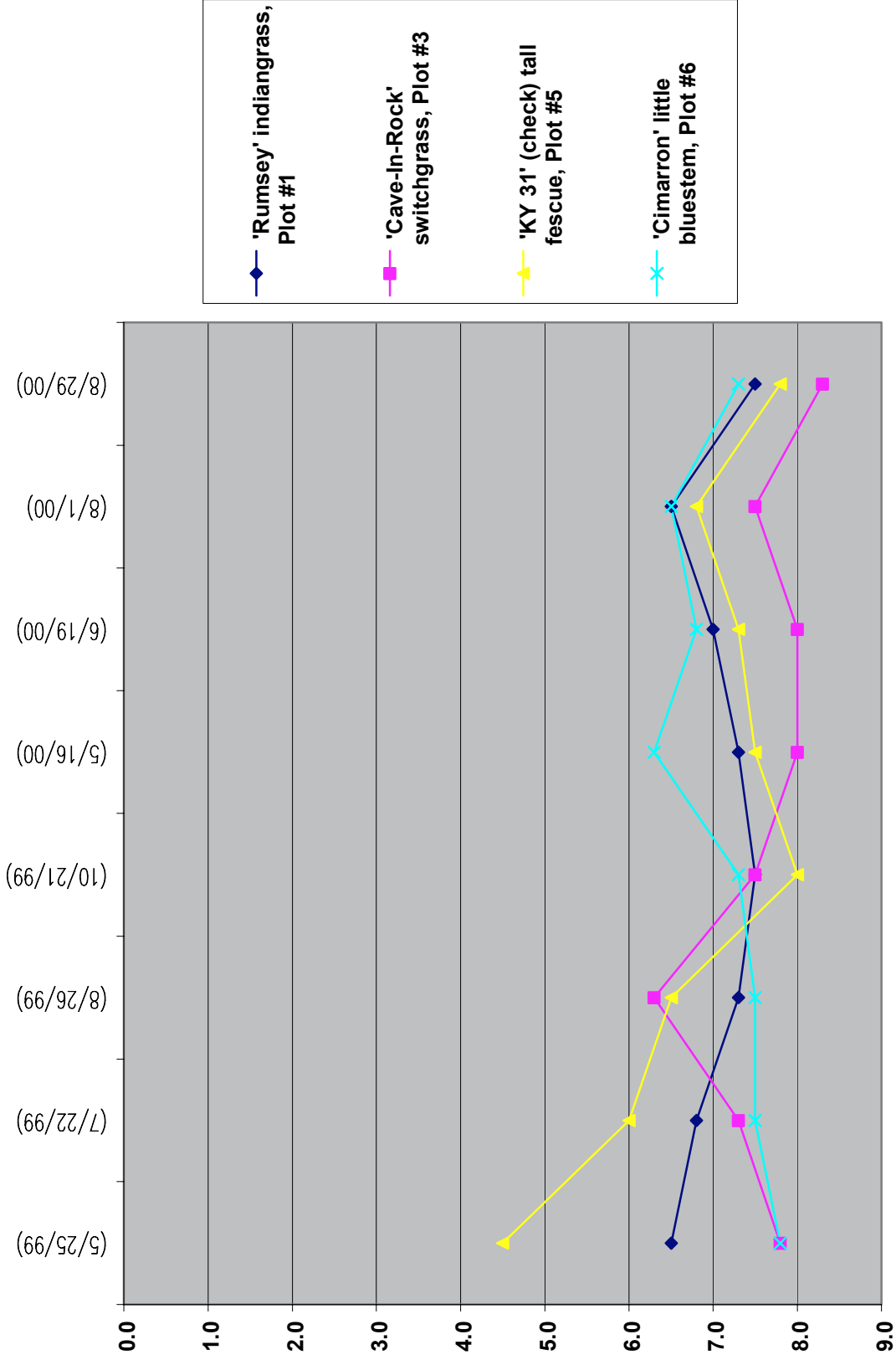
Plot #1=indiangrass  
Plot #3=switchgrass

Plot #5 = tall fescue  
Plot #6= little bluestem

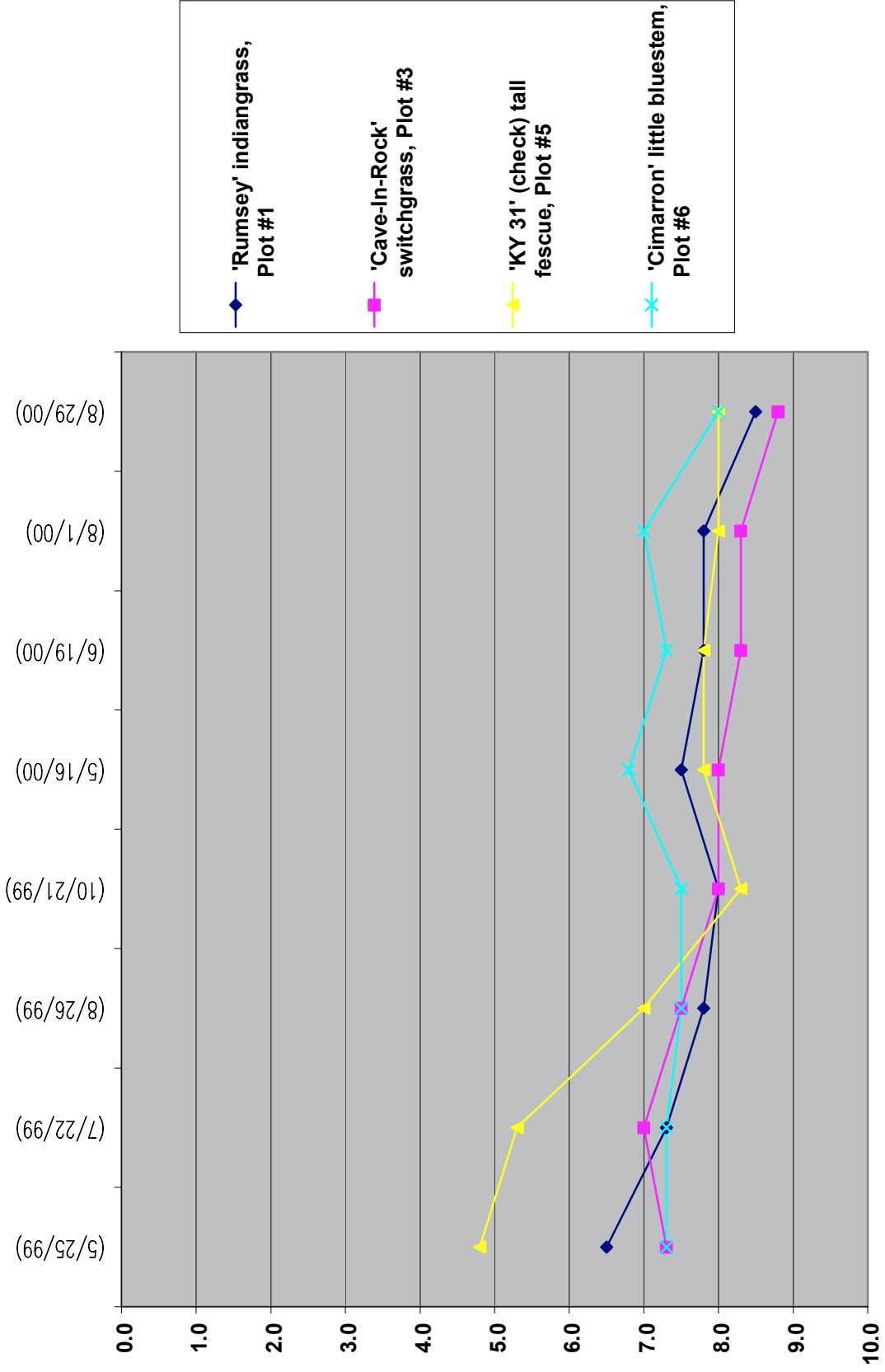
**SITE #2 TA-244 PLANT DENSITY - NO TRAFFIC (CHECK)**  
**1=High Vigor, 9-Bare Ground**



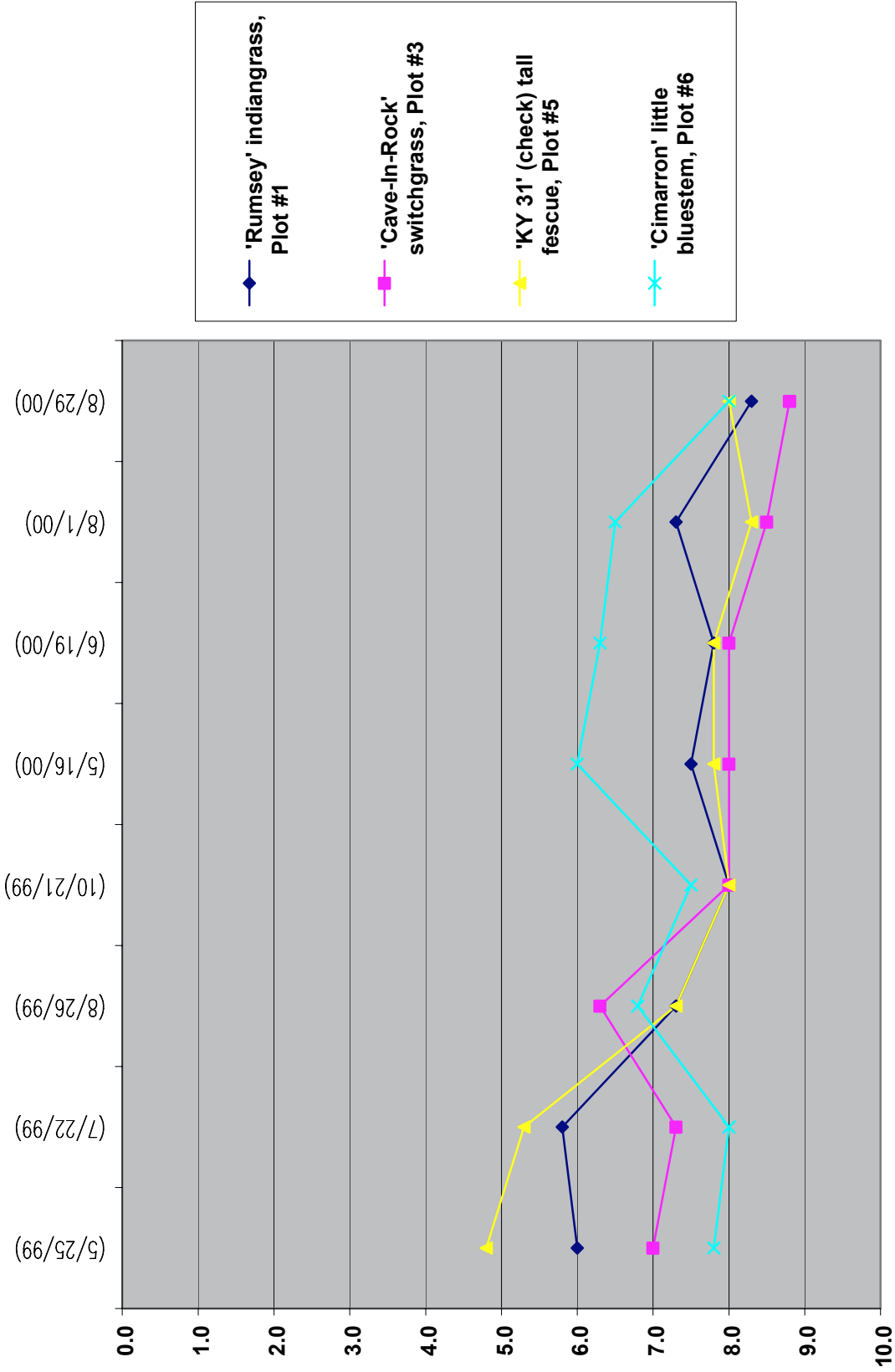
**SITE #2 TA-244 PLANT DENSITY - LOW TIRE TRAFFIC**  
**1=High Density, 9=Bare Ground**



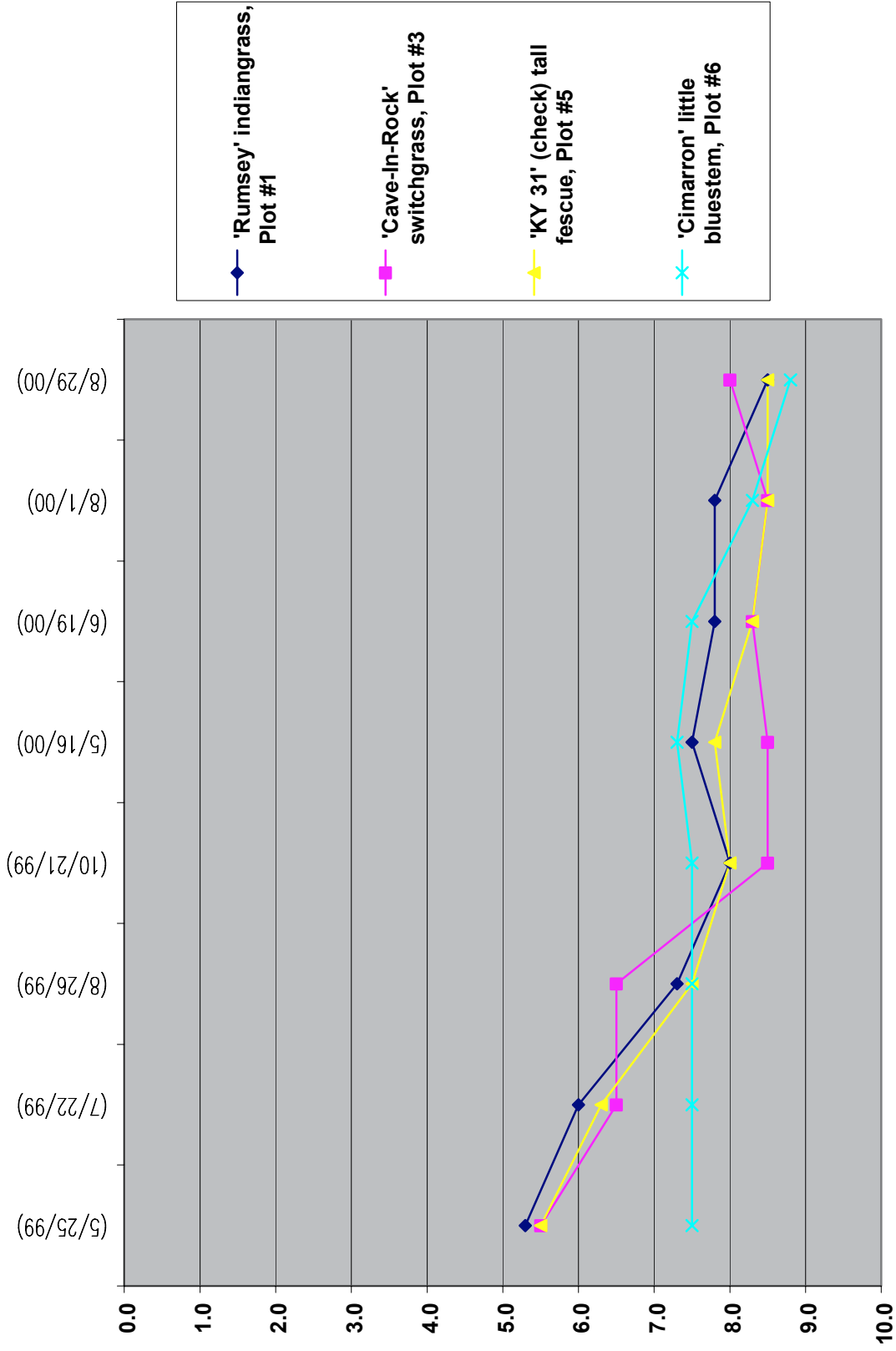
**SITE #2 TA-244 PLANT DENSITY - MEDIUM TIRE TRAFFIC**  
**1=High Density, 9=Bare Ground**



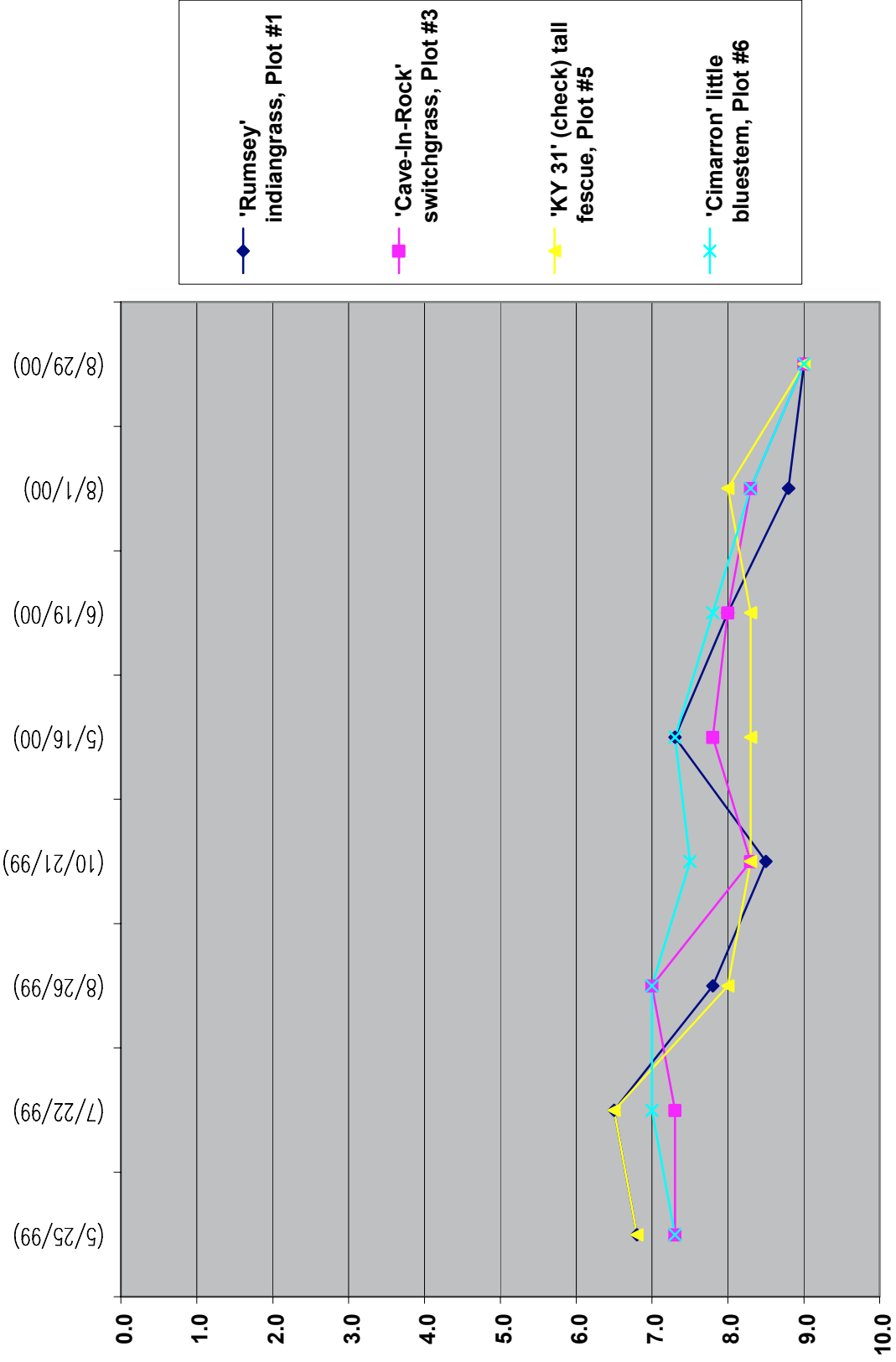
**SITE #2 TA-244 PLANT DENSITY - HIGH TIRE TRAFFIC**  
**1=High Density, 9=Bare Ground**



**SITE #2 TA-244 PLANT DENSITY - LOW TRACK TRAFFIC**  
 1=High Density, 9=Bare Ground

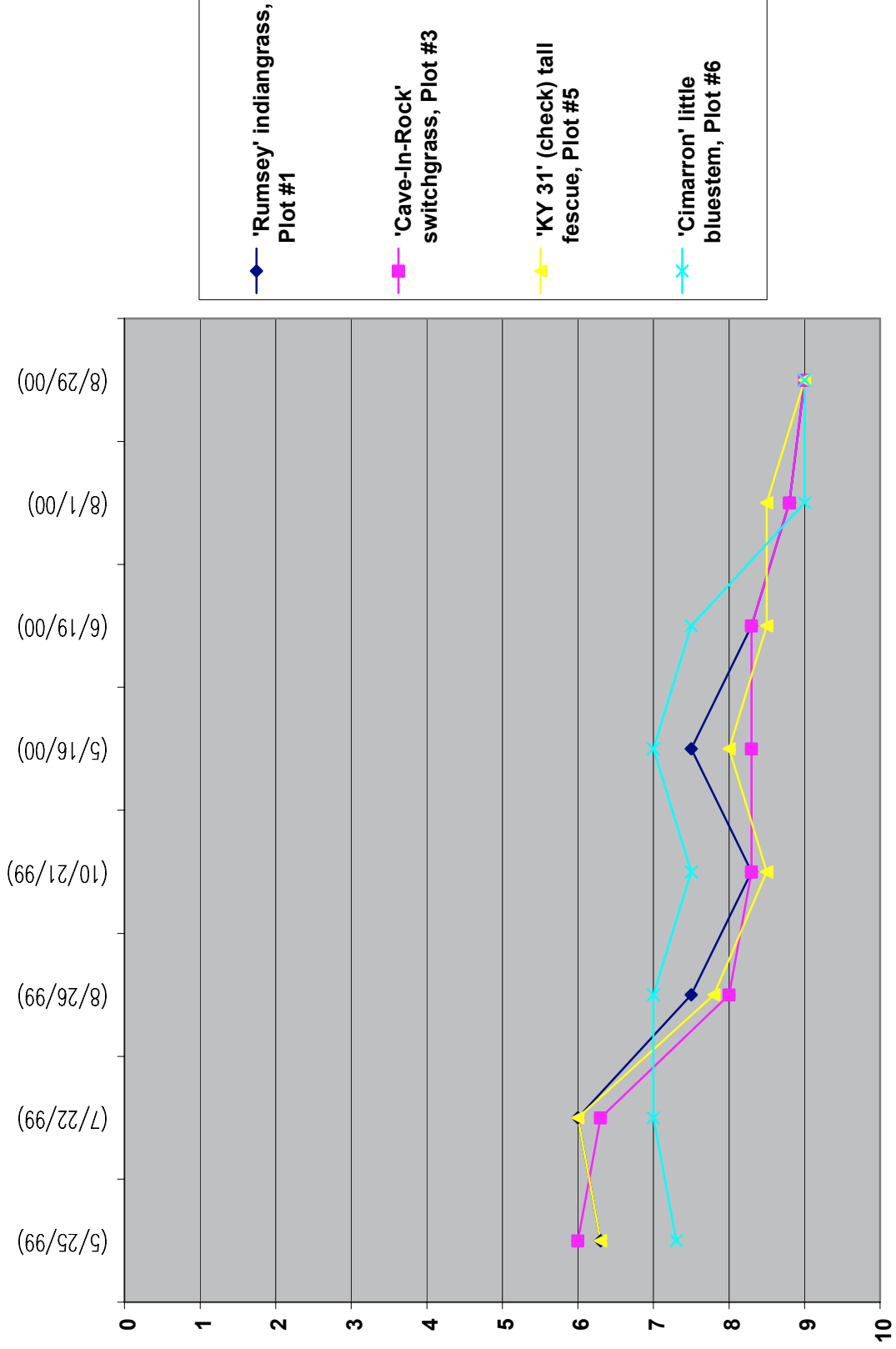


**SITE #2 TA-244 PLANT DENSITY - MEDIUM TRACK TRAFFIC**  
**1=High Density, 9=Bare Ground**





SITE #2 TA-244 PLANT DENSITY - HIGH TRACK TRAFFIC



**TABLE # 13**

		<b>SITE #2 TA-244</b>									<b>Rating 1-9 (1=Best 9=Worst)</b>						
		<b>8/27/99</b>	<b>10/21/99</b>	<b>4/18/00</b>	<b>5/16/00</b>	<b>5/17/00</b>	<b>6/19/00</b>	<b>6/20/00</b>	<b>8/1/00</b>	<b>8/2/00</b>	<b>8/29/00</b>	<b>9/25/00</b>	<b>Plot #</b>				
<b>Plot #</b>	<b>5/25/99</b>	<b>6/18/99</b>	<b>7/22/99</b>	<b>8/26/99</b>									<b>1/</b>				
			↑														
			Low Tire Traffic														
<b>6</b>	6.5	6.5	5.5	5.5	1st	5.0	7.3	5.3	2.3	1.0	3rd	4.8	4.3	4th	6.0	7.3	7.0
<b>1</b>	3.5	4.3	4.3	5.0	Traffic	4.8	7.0	5.7	3.8	3.5	Traffic	6.3	4.3	Traffic	6.0	7.3	6.8
<b>5</b>	3.3	3.8	3.8	6.0	Event	6.0	7.8	5.0	3.0	4.3	Event	6.5	4.5	Event	6.0	7.5	6.5
<b>3</b>	6.3	6.3	5.5	5.8		5.8	7.8	7.7	5.0	4.5		6.5	4.3		6.0	8.0	8.0
			↓														
			Medium Tire Traffic														
<b>6</b>	6.0	5.8	6.5	5.5		5.3	7.5	5.8	3.0	2.8		6.5	5.0		6.0	7.7	7.0
<b>1</b>	4.0	4.3	4.8	5.0		5.0	8.0	6.7	3.3	4.5		8.5	4.5		6.0	8.0	7.5
<b>3</b>	6.3	6.5	5.8	6.3		6.3	8.0	7.0	4.5	4.8		7.7	4.0		6.0	8.0	8.0
<b>5</b>	3.5	4.0	4.0	5.8		5.8	7.8	4.3	4.3	4.3		7.3	5.0		6.3	8.0	7.7
<b>5</b>	3.5	4.0	3.8	6.5		6.5	7.8	5.7	4.3	5.3		7.0	5.5		6.3	7.5	6.8
<b>6</b>	5.8	6.3	6.3	4.8		5.0	7.5	5.3	1.8	1.8		6.3	5.0		6.0	7.5	7.3
<b>1</b>	5.5	4.5	5.3	5.0		5.0	7.3	5.8	4.8	4.8		8.5	4.0		6.0	8.0	7.5
<b>3</b>	6.5	6.8	6.0	5.5		5.5	7.5	5.7	4.0	3.5		8.0	5.0		6.0	8.0	8.0
<b>1</b>	4.3	3.3	3.8	4.5		4.5	7.5	6.3	3.5	1.5		1.5	1.3		1.3	6.8	7.3
<b>3</b>	6.3	6.3	6.5	7.0		7.0	7.8	6.3	3.3	2.8		2.8	1.5		1.5	6.8	7.3
<b>6</b>	6.5	7.3	7.3	5.3		5.3	7.3	5.0	2.8	1.0		1.0	1.5		1.5	6.8	7.0
<b>5</b>	3.5	4.0	4.0	6.8		6.8	8.3	5.0	3.3	2.8		2.8	2.8		2.8	7.3	6.3
<b>1/Plots are ranked best to worst for the late season vigor evaluation taken 8/29/00.</b>																	
								<b>Vigor</b>									
			<b>SITE #2 TA-244</b>											<b>Rating 1-9 (1=Best 9=Worst)</b>			

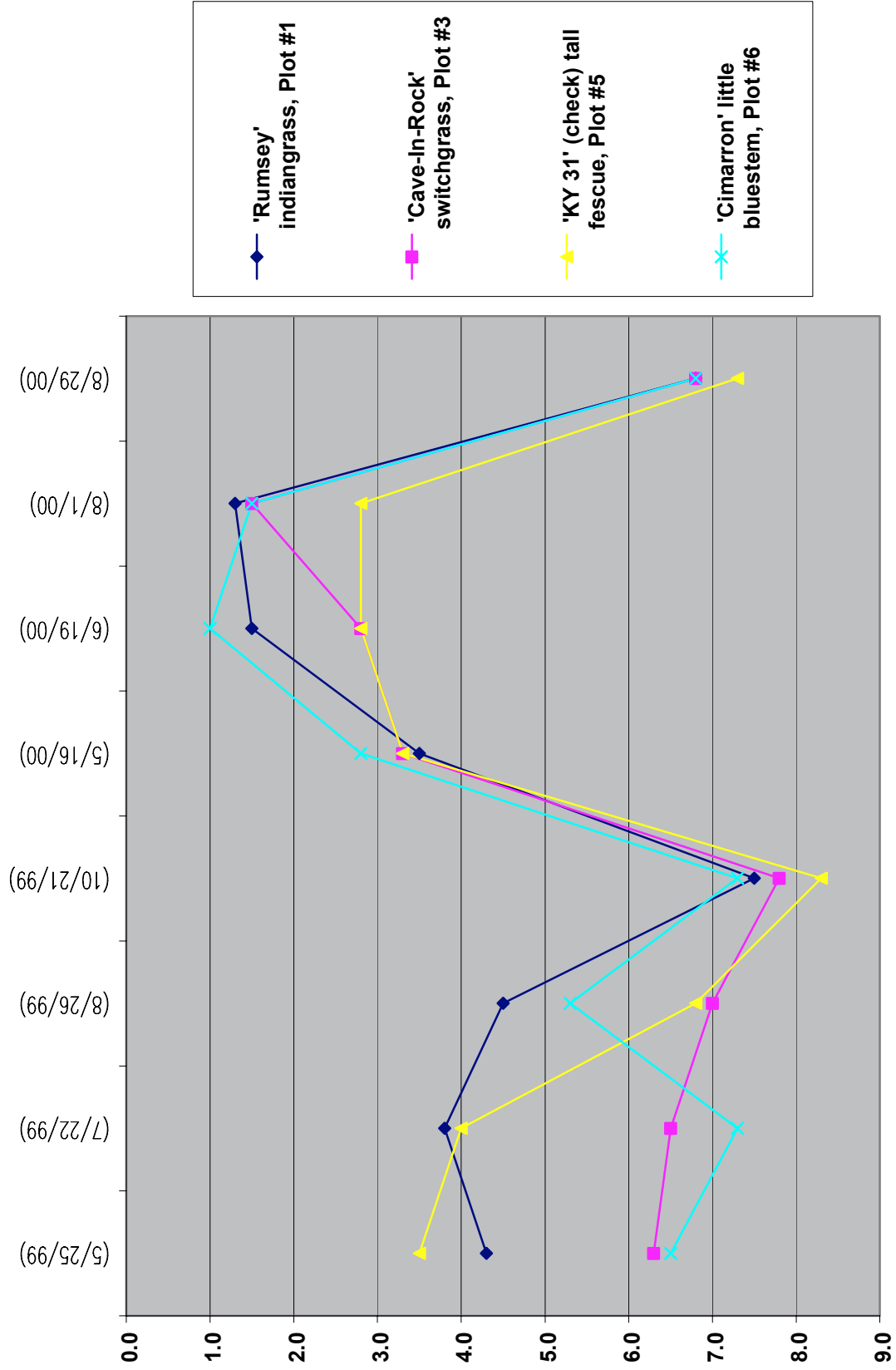
Plot #1=indiangrass  
 Plot #3=switchgrass  
 Plot #5=tall fescue  
 Plot #6=little bluestem

TABLE # 13

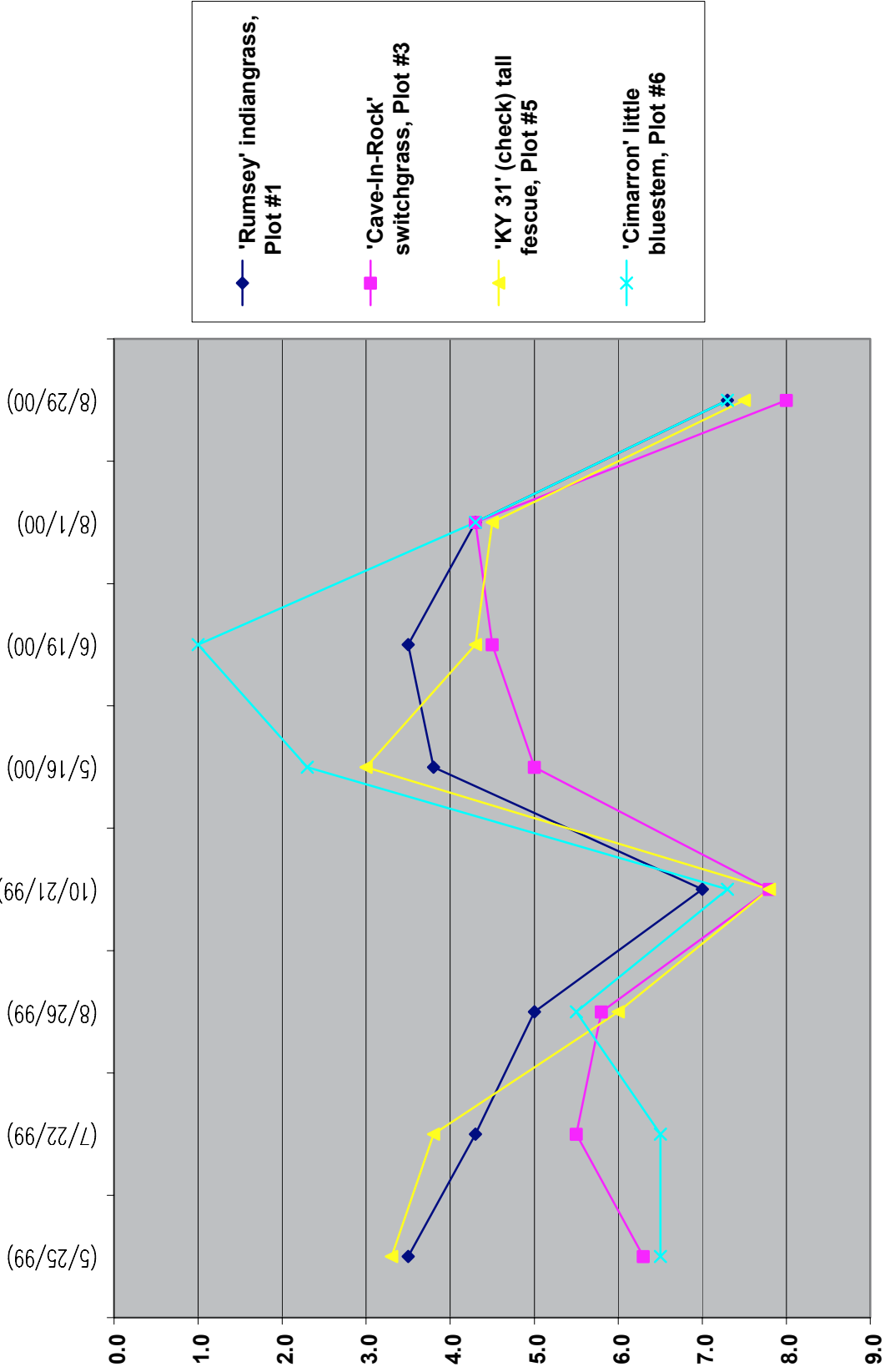
Plot #	5/25/99	6/18/99	7/22/99	8/26/99	8/27/99	10/21/99	5/16/00	5/17/00	6/19/00	6/20/00	8/1/00	8/2/00	8/29/00	9/25/00	Plot #
1/															1/
3	4.3	4.5	4.5	4.5	6.5	8.0	3.0	5.0	3.7	8.0	4.5	7.0	7.0	7.5	3
5	4.3	3.3	3.5	6.8	7.3	8.3	3.7	3.7	6.0	8.0	5.5	6.5	7.0	7.0	5
1	3.0	3.3	3.3	4.5	6.5	7.3	3.0	3.0	4.0	8.5	5.0	6.3	8.0	7.3	1
6	6.0	6.3	6.5	4.8	6.8	7.5	3.3	3.3	3.5	8.0	4.3	7.0	8.0	7.0	6
1	4.5	4.3	4.3	5.3	6.5	8.3	3.3	3.3	5.0	8.8	5.0				1
3	5.3	5.5	4.8	5.5	6.8	8.0	3.5	1.5	4.3	8.0	4.7	6.5		8.0	3
5	5.3	5.3	5.3	7.0	7.8	8.0	4.0	3.0	6.7	7.5	5.5				5
6	5.5	5.8	5.5	4.3	6.8	7.8	3.5	4.5	3.5	8.0	6.0	6.0			6
1	4.5	4.0	4.0	5.3	6.8	8.3			5.7		5.5				1
3	4.5	5.0	4.5	5.5	7.3	8.0	2.0	2.3	5.0		5.5			8.0	3
5	4.5	5.0	4.8	7.0	7.5	8.5	5.3	4.0	7.0	8.0	5.5				5
6	5.3	5.5	5.5	4.8	6.5	7.5	2.3	2.7	2.8	7.0	6.0				6
1	4.3	3.3	3.8	4.5	4.5	7.5	6.3	3.5	1.5	1.5	1.3	1.3	6.8	7.3	1
3	6.3	6.3	6.5	7.0	7.0	7.8	6.3	3.3	2.8	2.8	1.5	1.5	6.8	7.3	3
6	6.5	7.3	7.3	5.3	5.3	7.3	5.0	2.8	1.0	1.0	1.5	1.5	6.8	7.0	6
5	3.5	4.0	4.0	6.8	6.8	8.3	5.0	3.0	2.8	2.8	2.8	2.8	7.3	6.3	5
<b>1/Plots are ranked best to worst for the late season vigor evaluation taken 8/29/00.</b>															

Plot #1=indiangrass  
 Plot #3=switchgrass  
 Plot #5=tall fescue  
 Plot #6=little bluestem

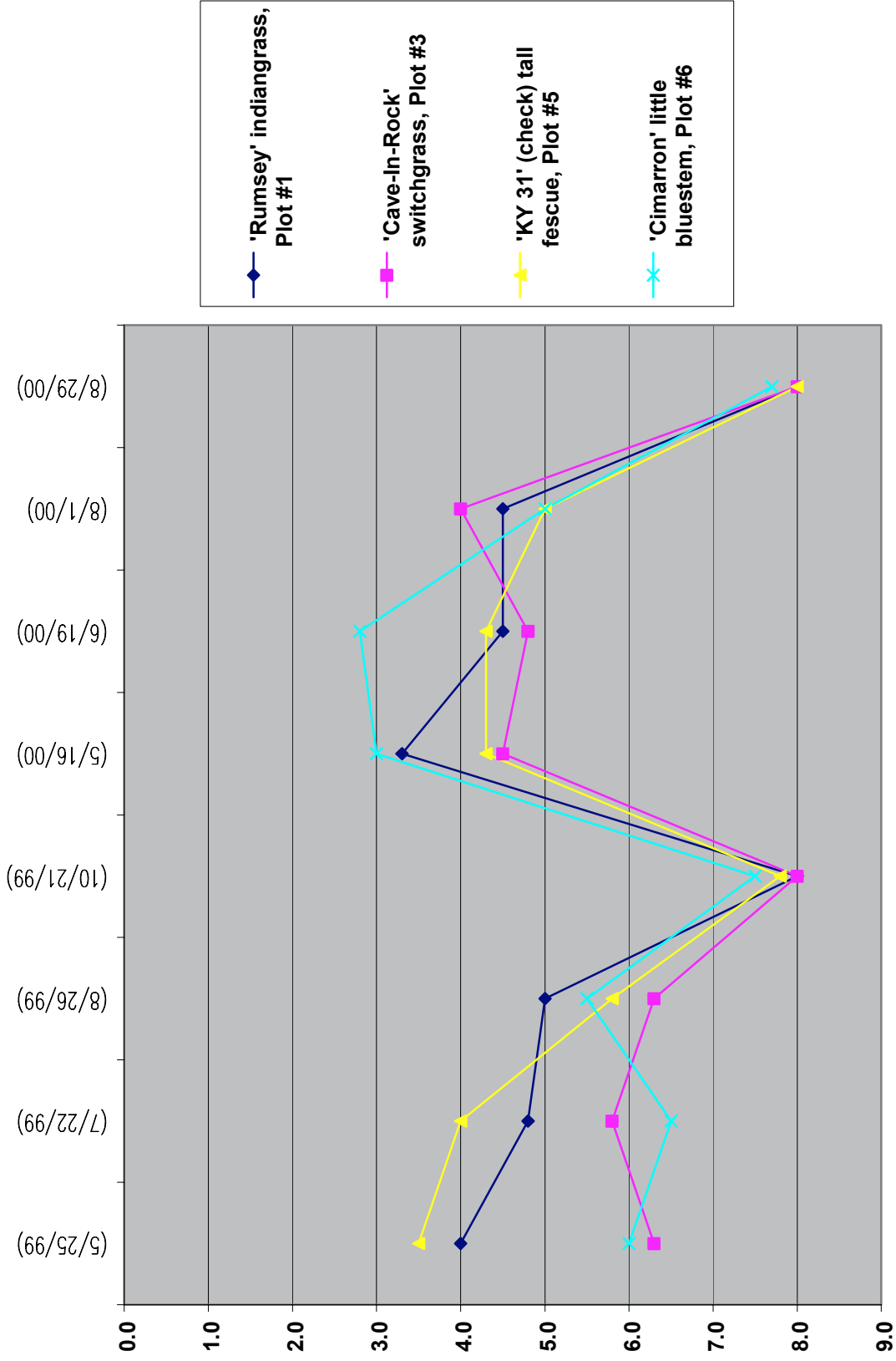
**SITE #2 TA-244 VIGOR - NO TRAFFIC (CHECK)**  
**1=High Vigor, 9=Low Vigor**



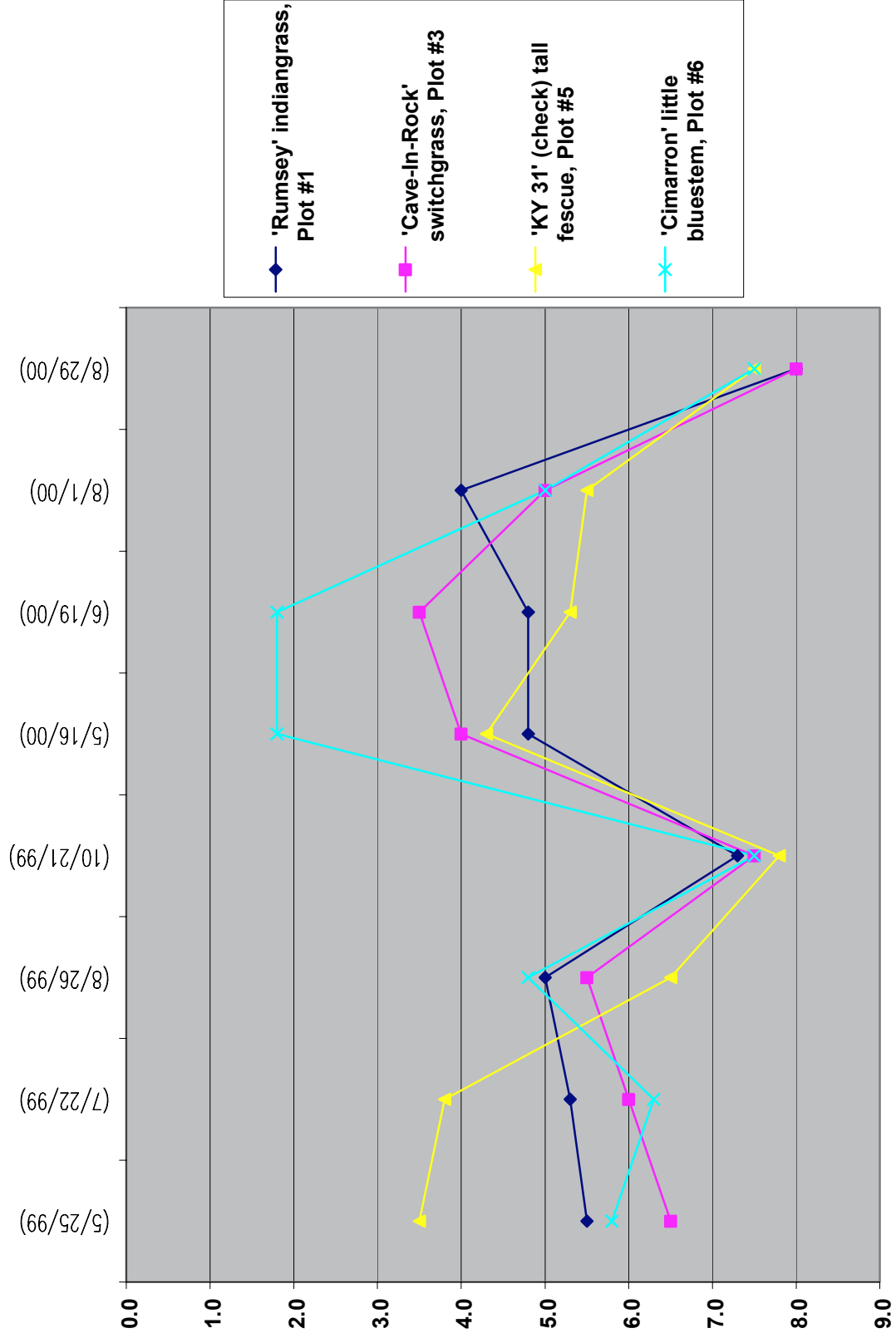
**SITE #2 TA-244 VIGOR - LOW TIRE TRAFFIC**  
**1=High Vigor, 9=Low Vigor**



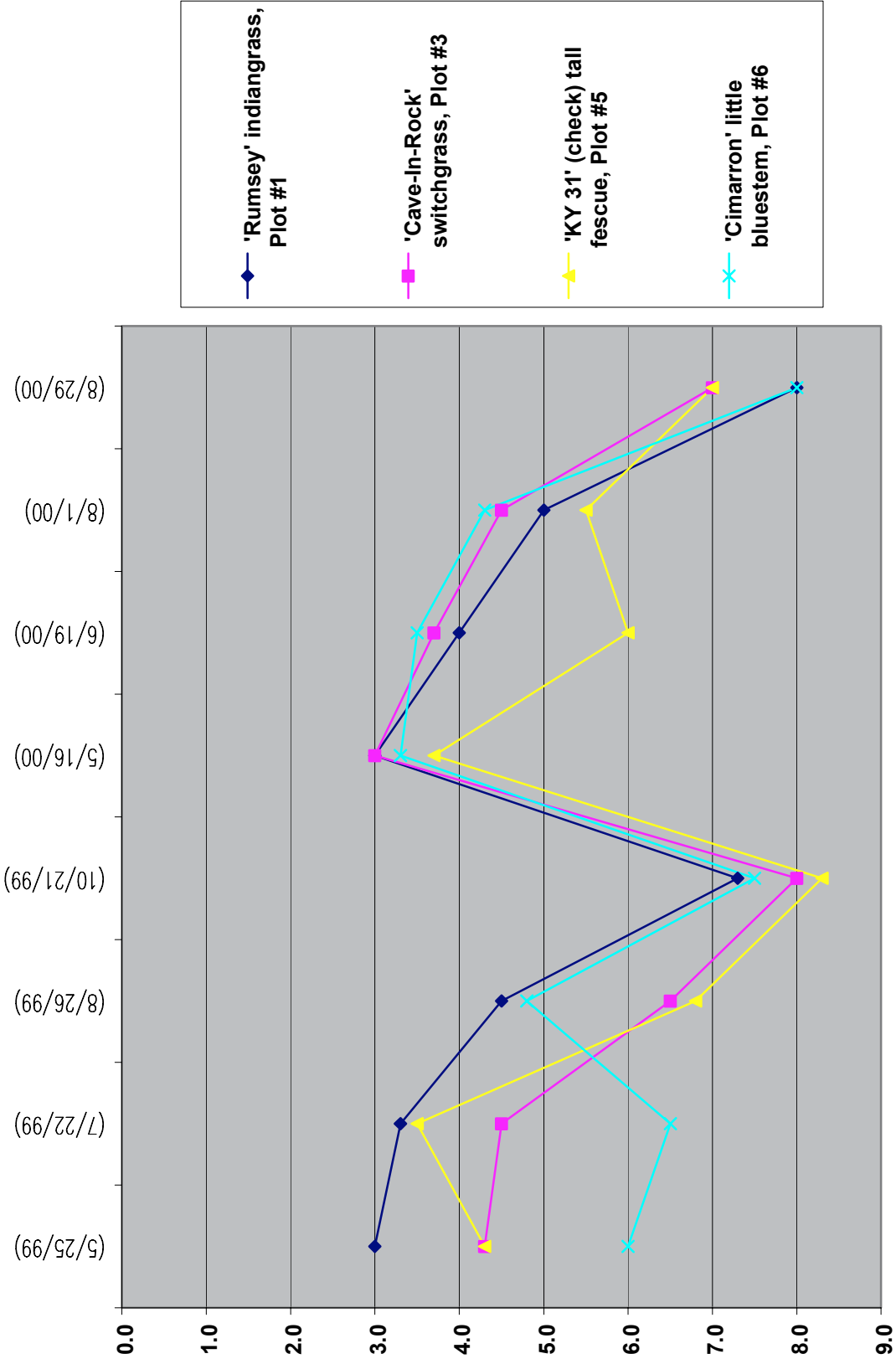
**SITE #2 TA-244 VIGOR - MEDIUM TIRE TRAFFIC**  
**1-High Vigor, 9=Low Vigor**



SITE #2 TA-244 VIGOR - HIGH TIRE TRAFFIC  
 1=High Vigor, 9=Low Vigor

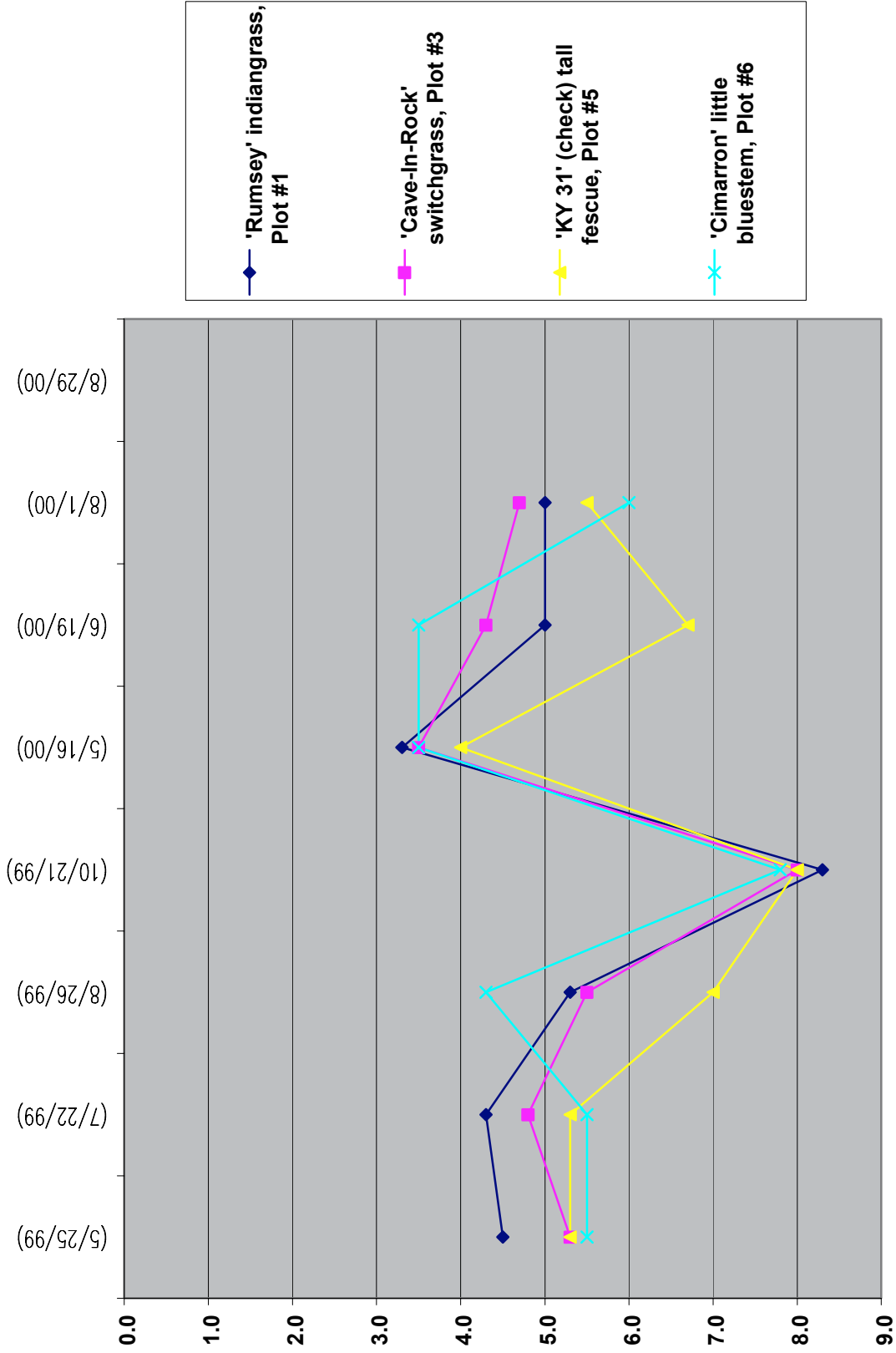


SITE #2 TA-244 VIGOR - LOW TRACK TRAFFIC  
1=High Vigor, 9=Low Vigor





**SITE #2 TA-244 VIGOR - MEDIUM TRACK TRAFFIC**  
**1=High Vigor, 9=Low Vigor**



**SITE #2 TA-244 VIGOR - HIGH TRACK TRAFFIC**  
 1=High Vigor, 9=Low Vigor

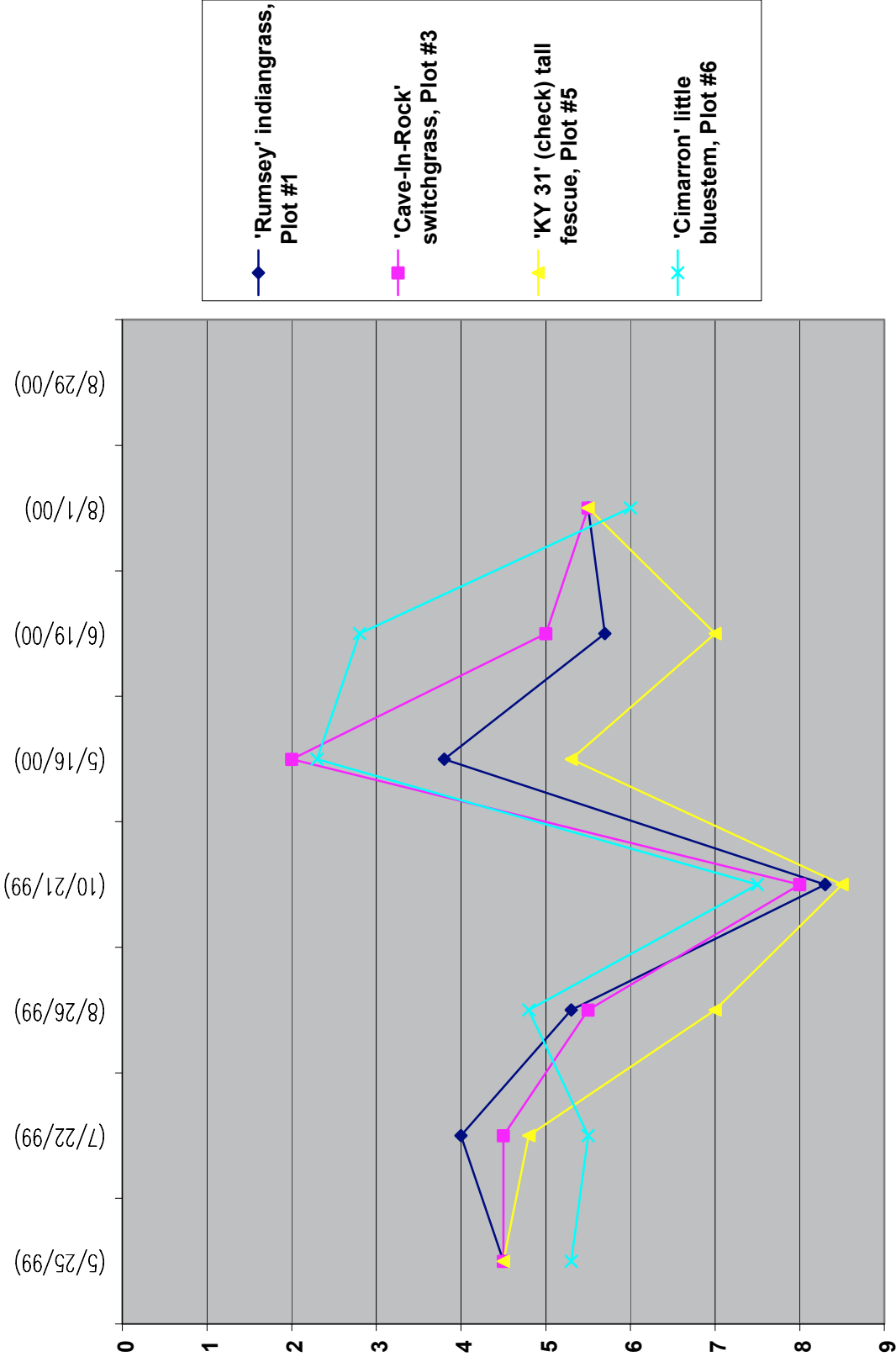


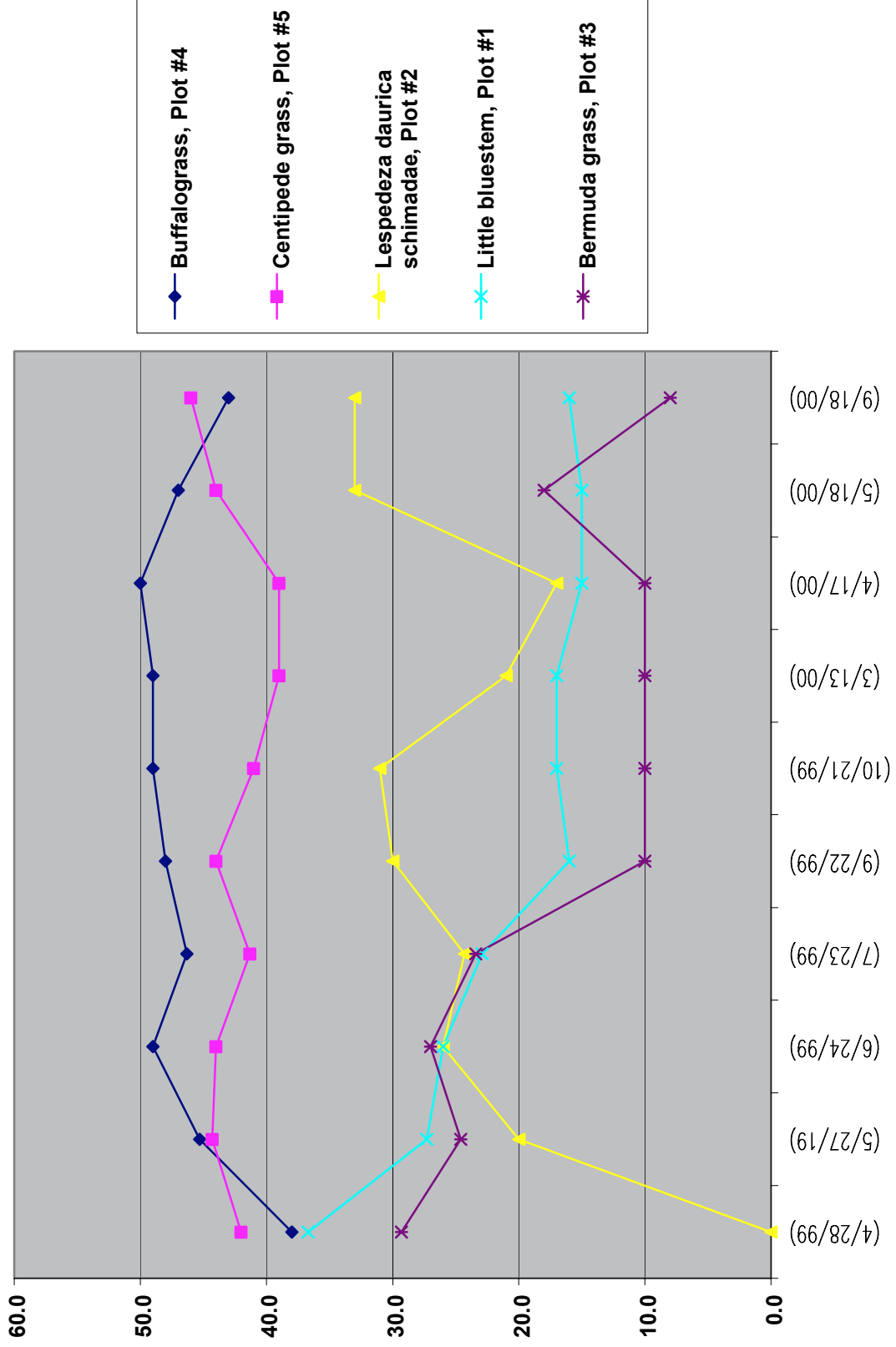
TABLE #14

Plot #	1/	Site #3 Shooting Range					4/17/00	5/18/00	9/18/00	Plot #	1/
		4/28/99	5/27/19	6/24/99	7/23/99	9/22/99					
4- <b>Buffalograss</b>	38.0	45.3	49.0	46.3	48.0	49.0	50.0	47.0	43.0	4- <b>Buffalograss</b>	
5- <b>Centipede grass</b>	42.0	44.3	44.0	41.3	44.0	41.0	39.0	44.0	46.0	5- <b>Centipede grass</b>	
2- <b>Lespedeza daurica schimadae</b>	-	20.0	26.0	24.3	30.0	31.0	17.0	33.0	33.0	2- <b>Lespedeza daurica schimadae</b>	
1- <b>Little bluestem</b>	36.7	27.3	26.0	22.9	16.0	17.0	15.0	15.0	16.0	1- <b>Little bluestem</b>	
3- <b>Bermuda grass</b>	29.3	24.6	27.0	23.4	10.0	10.0	10.0	18.0	8.0	3- <b>Bermuda grass</b>	
<b>Density</b>											
4/28/99	5/27/19	6/24/99	7/23/99	9/22/99	10/21/99	3/13/00	4/17/00	5/18/00	9/18/00		
-	6.7	7.3	7.7	7.1	7.8	9.0	5.8	4.4	6.0	2- <b>Lespedeza daurica schimadae</b>	
4.8	5.9	6.6	6.9	7.9	8.2	9.0	5.0	5.0	7.1	1- <b>Little bluestem</b>	
2.9	4.9	7.2	5.7	6.5	7.6	9.0	5.3	5.3	6.4	5- <b>Centipede grass</b>	
4.0	6.8	7.0	5.4	6.1	7.3	9.0	4.8	5.3	6.0	4- <b>Buffalograss</b>	
4.0	6.3	6.7	7.0	8.0	8.3	9.0	6.3	6.7	7.6	3- <b>Bermuda grass</b>	
<b>Vigor</b>											
4/28/99	5/27/19	6/24/99	7/23/99	9/22/99	10/21/99	3/13/00	4/17/00	5/18/00	9/18/00		
-	5.0	6.0	6.3	6.0	7.7	9.0	5.8	4.4	4.2	2- <b>Lespedeza daurica schimadae</b>	
4.8	4.6	5.3	6.0	6.0	8.0	9.0	5.0	5.0	5.6	1- <b>Little bluestem</b>	
2.9	3.9	4.8	7.5	7.0	7.4	9.0	5.3	5.3	5.3	5- <b>Centipede grass</b>	
4.0	4.1	4.4	5.3	7.0	8.0	9.0	4.8	5.3	6.0	4- <b>Buffalograss</b>	
4.0	4.8	6.1	6.3	7.9	8.0	9.0	6.3	6.7	6.4	3- <b>Bermuda grass</b>	
<b>1/Plots are ranked best to worst for the evaluation taken 5/18/00</b>											

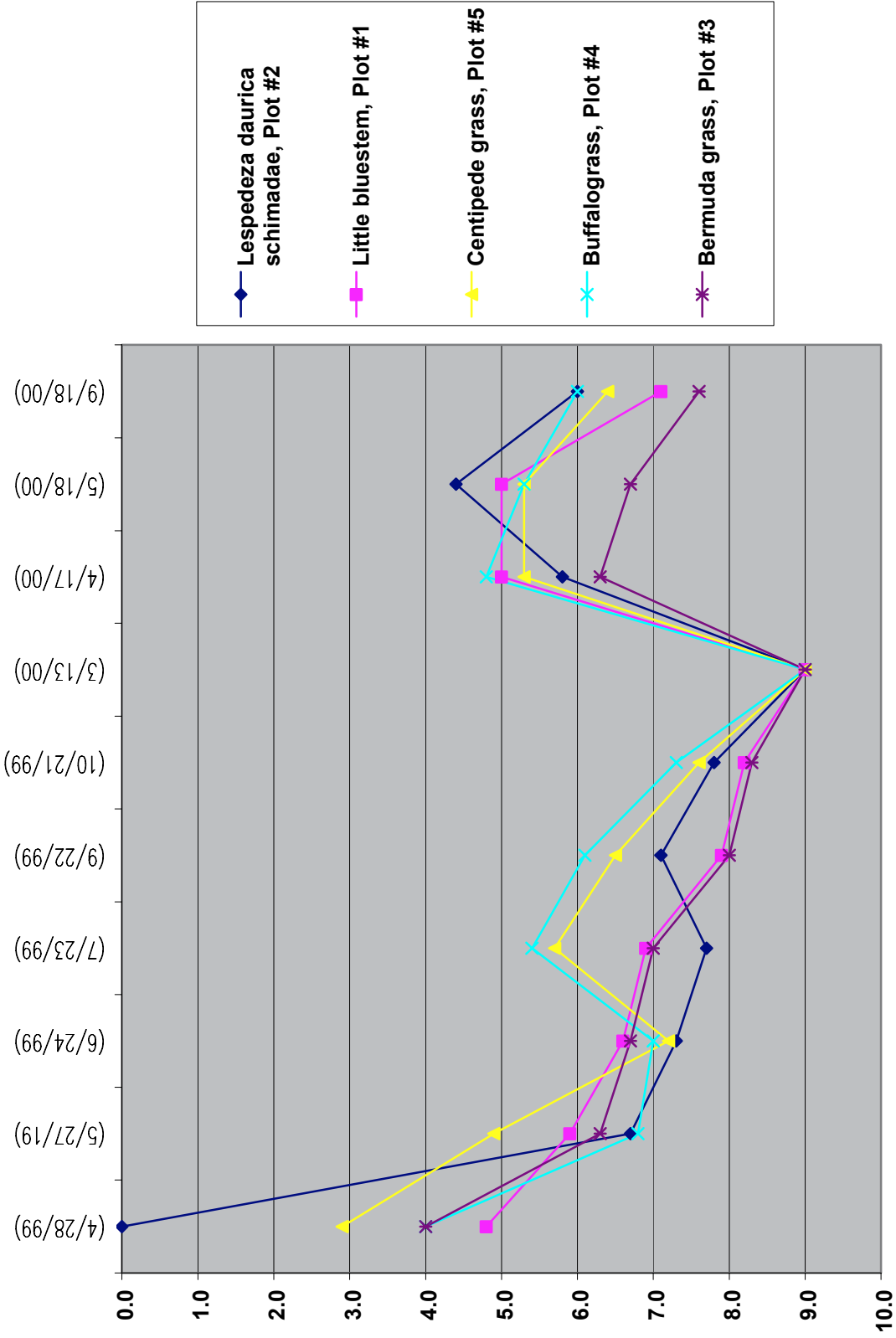
Plot #1 'Cimarron' little bluestem  
 Plot #2 Lespedeza daurica schimadae  
 Plot #3 'Guymon' bermudagrass

Plot #4 'Top Gun' buffalograss  
 Plot #5 'Tif Blair' centipede grass

SITE #3 SHOOTING RANGE - PERCENT GROUND COVER



**SITE #3 SHOOTING RANGE - DENSITY**  
**1=High Density, 9=Bare Ground**



**SITE #3 SHOOTING RANGE - VIGOR**  
**1=High Vigor, 9=Low Vigor**

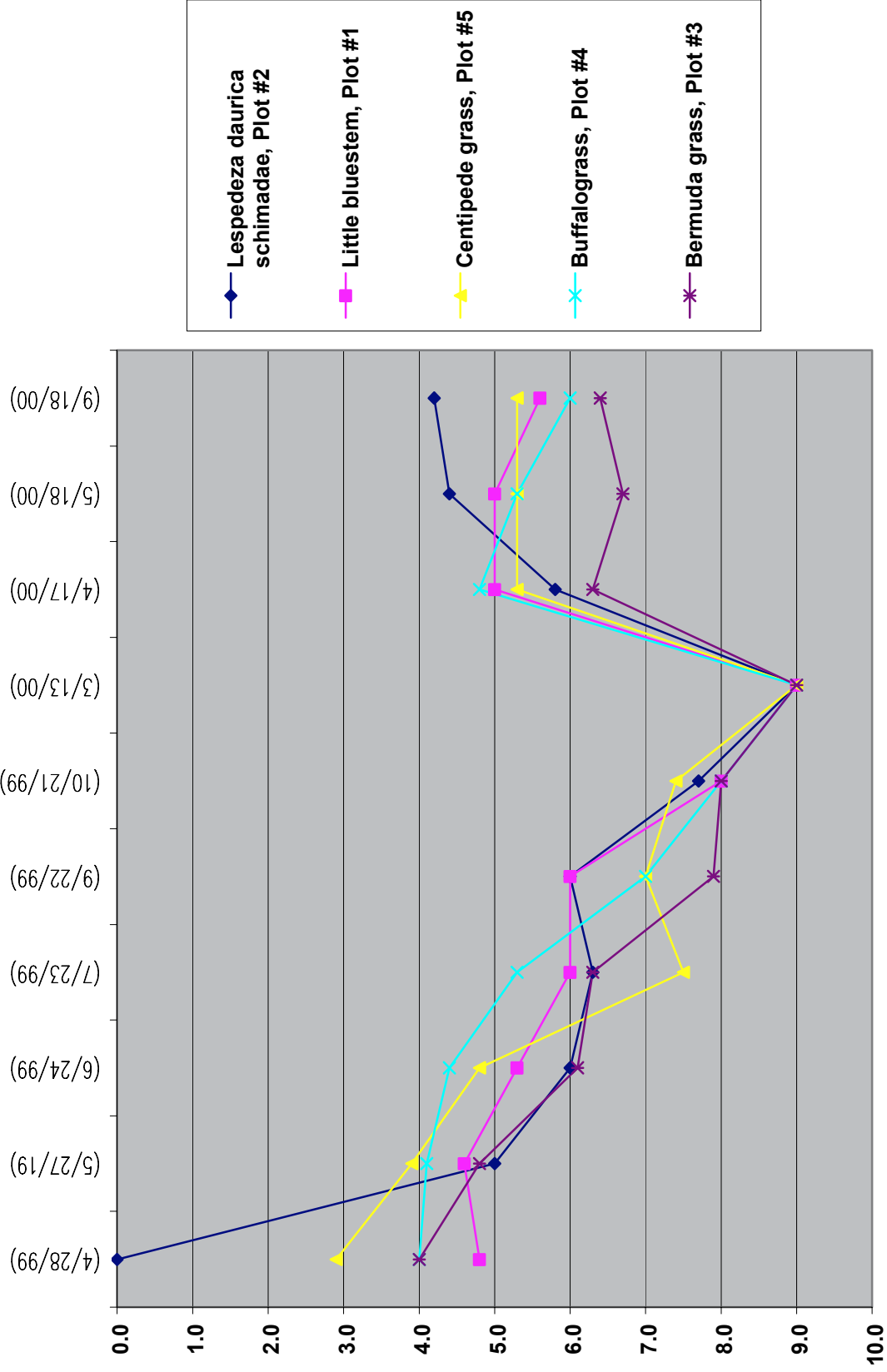


TABLE #15

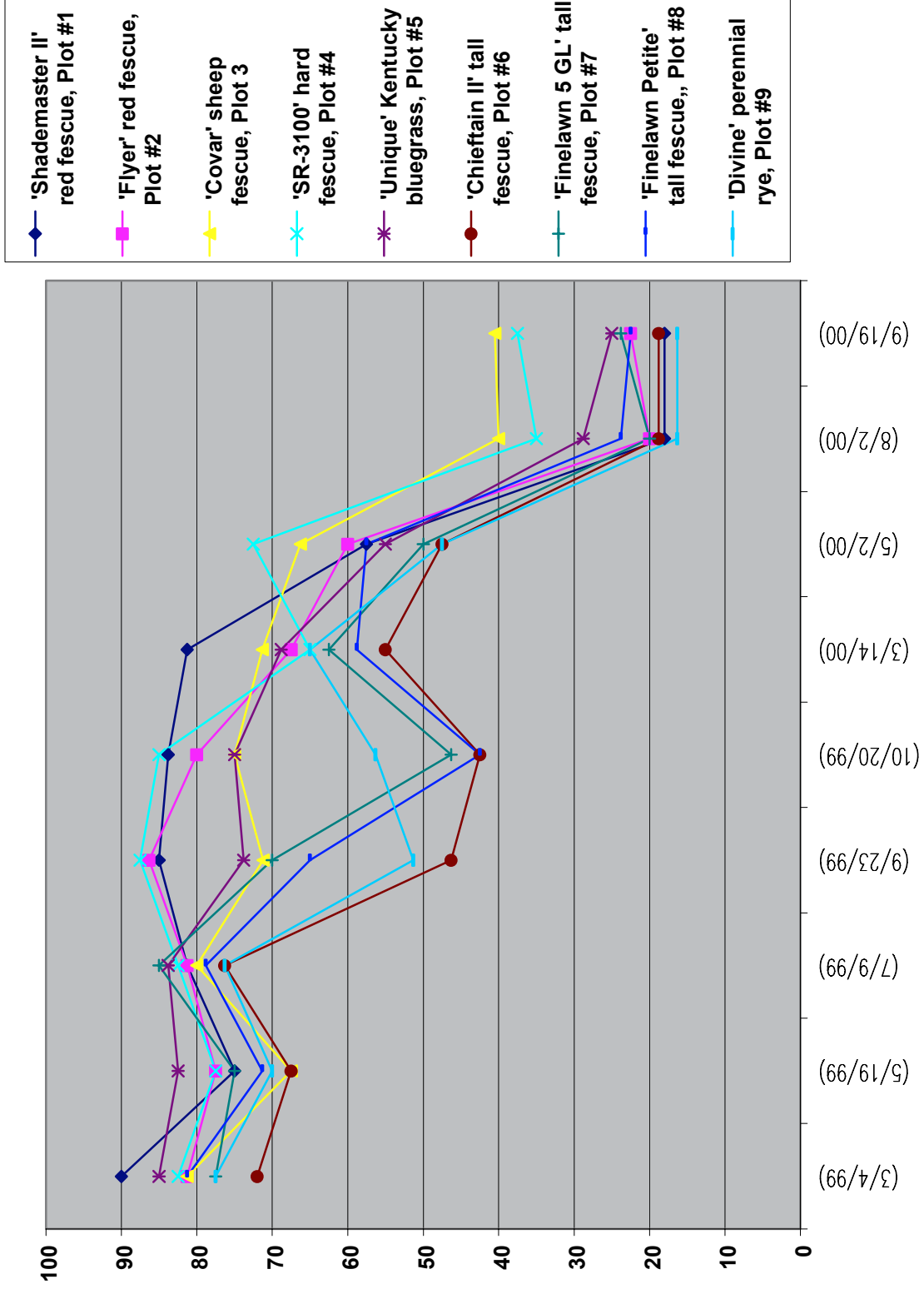
Percent Cover		SITE #4 Bivouac															
Plot #	3/4/99	4/21/99	5/19/99	6/10/99	7/9/99	8/5/99	9/23/99	10/20/99	Plot #	3/14/00	4/17/00	5/2/00	6/20/00	8/2/00	9/19/00	Plot #	
\1									\1							\1	
4	82.5	81.3	77.5	80.0	82.5	85.0	87.5	85.0	4	71.3	66.3	66.3	40.0	40.0	40.5	3	
2	81.3	82.5	77.5	77.5	81.3	83.5	86.3	80.0	2	65.0	73.8	72.5	37.5	35.0	37.5	4	
1	90.0	87.5	75.0	77.5	81.3	82.5	85.0	83.8	1	68.8	55.0	55.0	26.3	28.8	25.0	5	
5	85.0	82.5	82.5	77.5	83.8	80.0	73.8	75.0	5	62.5	50.0	50.0	25.0	20.0	23.8	7	
3	81.3	80.0	67.5	75.0	80.0	82.5	71.2	75.0	3	67.5	60.0	60.0	25.0	20.0	22.5	2	
7	77.5	81.3	75.0	80.0	85.0	82.3	70.0	46.3	7	58.8	57.5	57.5	23.8	23.8	22.5	8	
8	81.3	80.0	71.3	75.0	78.8	77.5	65.0	42.5	8	55.0	47.5	47.5	18.8	18.8	18.8	6	
9	77.5	72.5	70.0	75.0	76.3	68.8	51.3	56.3	9	81.3	52.5	57.5	18.0	18.0	18.0	1	
6	72.0	67.5	67.5	75.0	76.3	75.0	46.3	42.5	6	65.0	47.5	47.5	16.3	16.3	16.3	9	
Plant Density		(1=High Density 9=Bare Ground)															
Plot #	3/4/99	4/21/99	5/19/99	6/10/99	7/9/99	8/5/99	9/23/99	10/20/99	Plot #	3/14/00	4/17/00	5/2/00	6/20/00	8/2/00	9/19/00	Plot #	
\1									\1							\1	
4	3.3	4.0	4.0	3.8	3.5	3.0	3.0	4.5	4	5.1	6.5	5.5	7.3	7.3	7.3	3	
2	3.3	3.8	3.5	3.5	3.3	3.3	3.8	4.0	2	5.5	5.8	5.3	7.3	7.3	7.3	4	
1	3.0	3.8	4.0	3.5	3.3	2.8	3.8	4.3	1	6.0	7.3	7.0	6.8	7.3	7.5	7	
5	3.3	4.0	3.5	3.5	3.8	3.8	4.3	4.5	5	6.3	7.8	7.3	7.5	7.5	7.5	6	
3	3.5	3.5	4.5	4.3	3.5	3.5	4.5	5.0	3	5.5	7.0	6.3	7.5	7.5	7.8	8	
7	4.0	3.8	4.0	3.8	3.8	3.0	4.8	6.0	7	6.3	7.3	7.0	7.5	7.5	7.8	5	
8	3.5	3.8	4.0	3.8	3.8	3.5	5.3	6.3	8	6.3	6.3	6.0	8.0	7.3	8.0	1	
9	4.5	4.8	4.3	4.3	4.3	4.5	6.3	5.8	9	6.5	7.3	6.3	8.0	8.0	8.0	9	
6	4.5	5.3	4.5	4.0	3.8	4.3	6.3	7.3	6	5.5	6.5	6.0	7.8	7.8	9.0	2	
\1 Plots are arranged from high to low from ratings done 9/23/99 and 9/19/00.																	
Plot #1	Shademaster II' red fescue										Plot #4	SR-311' hard fescue			Plot #7	Finelawn 5 GL' tall fescue	
Plot #2	'Flyer' red fescue										Plot #5	'Unique' Kentucky bluegrass			Plot #8	'Finelawn Petite' tall fescue	
Plot #3	'Covar' sheep fescue										Plot #6	'Chieftain II' tall fescue			Plot #9	'Divine' perennial rye	
Plant Density		SITE #4 Bivouac															

TABLE #15

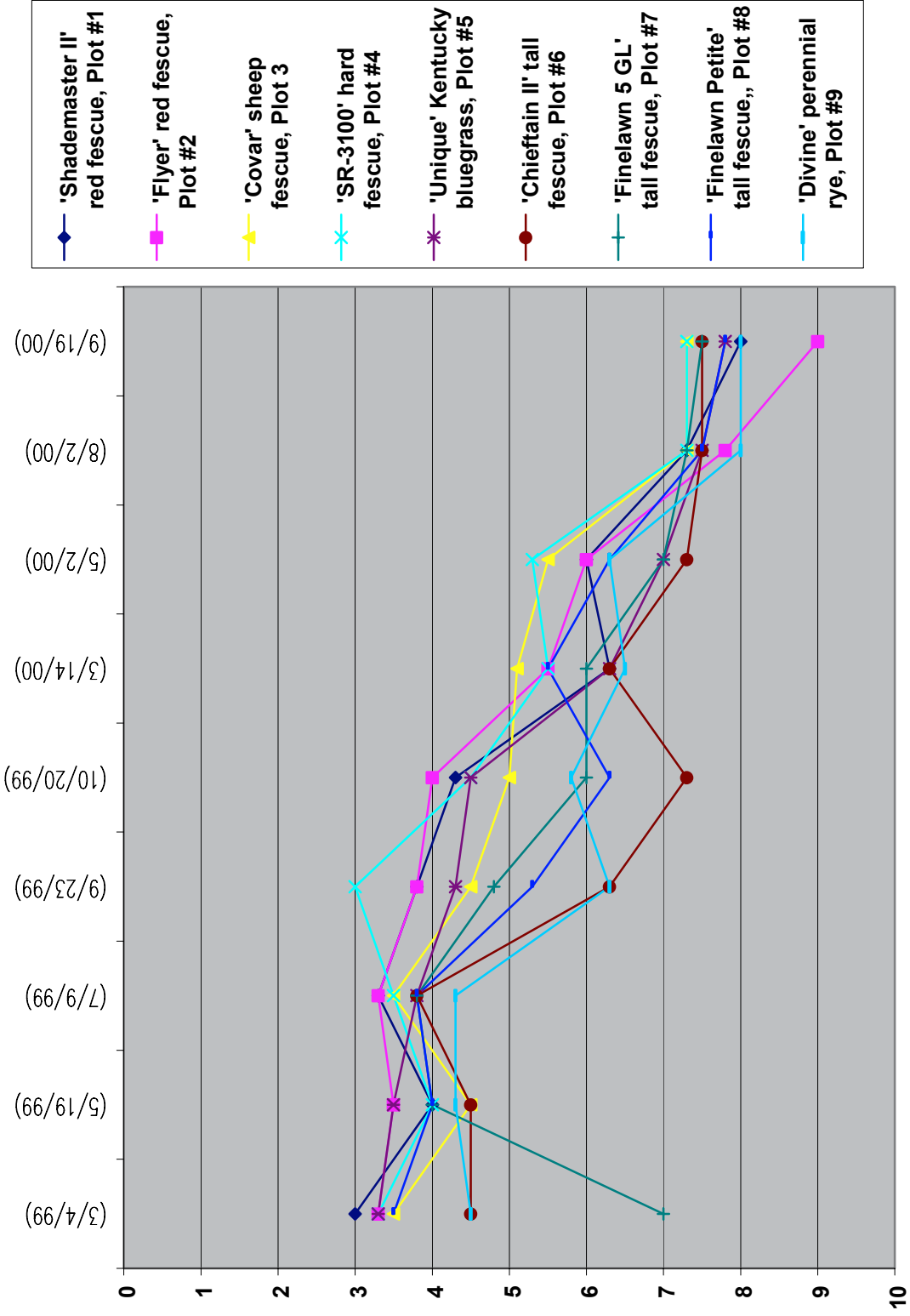
Vigor	(1= Excellent 9=Poor)															
	3/4/99	4/21/99	5/19/99	6/10/99	7/9/99	8/5/99	9/23/99	10/20/99	Plot #	3/14/00	4/17/00	5/2/00	6/20/00	8/2/00	9/19/00	Plot #
\1									\1						\1	
4	3.8	4.0	4.0	3.5	3.3	3.5	4.5	4.8	4	7.3	5.3	4.0	5.3	5.5	6.0	4
2	4.0	4.3	3.5	3.0	3.0	3.5	4.8	5.0	2	7.3	5.8	4.8	6.0	6.0	6.8	3
3	4.0	4.0	4.3	3.5	3.5	3.3	4.8	5.8	3	7.3	7.0	4.8	5.0	4.8	7.0	6
7	4.5	4.5	4.8	3.3	3.5	3.5	5.5	5.3	7	8.0	6.8	5.5	6.0	6.0	7.0	8
5	4.0	4.0	3.3	3.3	3.5	3.8	5.5	5.5	5	7.0	6.0	4.5	6.8	6.8	7.3	1
8	4.3	4.3	4.3	3.5	3.5	3.8	5.5	5.8	8	7.0	7.0	6.3	5.5	5.8	7.3	5
1	3.8	3.8	4.0	3.3	3.3	4.3	6.0	6.0	1	8.0	6.3	4.3	5.8	6.0	7.3	7
6	4.8	5.0	4.3	3.5	3.3	4.5	6.0	6.0	6	7.5	6.8	5.0	5.3	7.0	7.8	9
9	4.5	5.0	4.3	3.8	4.3	4.3	6.3	6.0	9	7.8	5.5	4.3	6.0	5.8	8.0	2
\1 Plots are arranged from high to low from ratings done 9/23/99 and 9/19/00.																
Plot #1 'Shademaster II' red fescue							Plot #4 'SR-311' hard fescue								Plot #7 'Finelawn 5 GL' tall fescue	
Plot #2 'Flyer' red fescue							Plot #5 'Unique' Kentucky bluegrass								Plot #8 'Finelawn Petite' tall fescue	
Plot #3 'Covar' sheep fescue							Plot #6 'Chieftain II' tall fescue								Plot #9 'Divine' perennial rye	



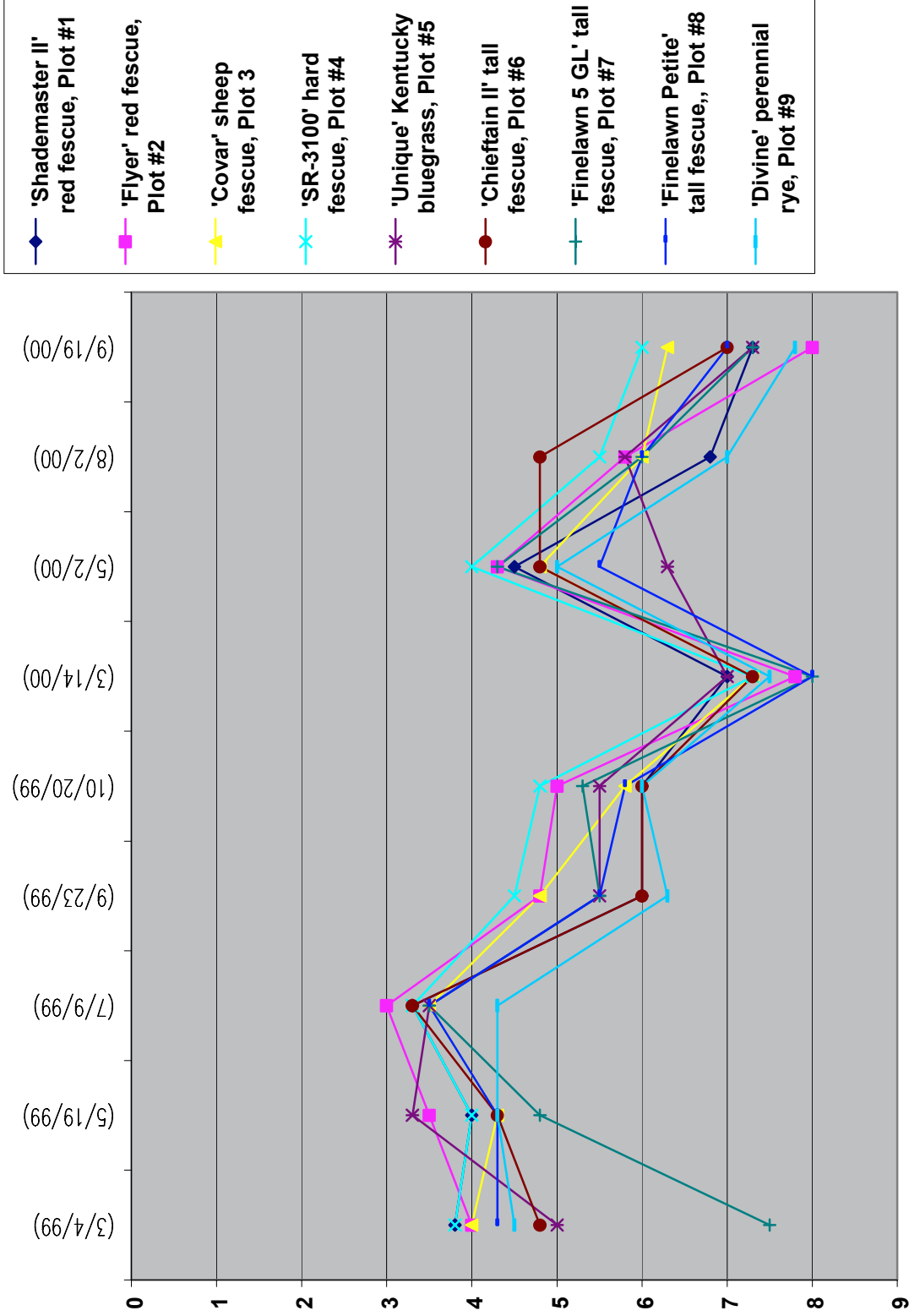
SITE #4 BIVOUAC - PERCENT GROUND COVER AT EVALUATION DATES



**SITE #4 BIVOUAC - DENSITY**  
**1=High Density, 9=Bare Ground**



**SITE #4 BIVOUAC - VIGOR**  
**1=High Vigor, 9=Low Vigor**



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