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HERBAGE DYNAMICS OF AN OKLAHOMA TALLGRASS PRAIRIE, OSAGE, 1972

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ABSTRACT

These reported results represent abiotic and producer data collected on the Osage Comprehensive Network Site, a tallgrass prairie, during the 1972 sample season. Producer biomass data are presented for both aboveground and belowground compartments of the system. Those components of the aboveground compartment sampled during 1972 included live, old dead, recent dead, crowns, litter, seeds and litter accumulation. The belowground compartment included only live plus dead roots as estimated from washed soil cores. Abiotic variables which were monitored included air and soil temperature, air humidity, maximum and minimum air temperatures, precipitation, soil water, and solar radiation. A single estimate of soil compaction was also made on both treatments. Additional soil cores were taken for determinations of soil pH, texture, soil water release curves, and chemical composition. Replicate composites of each aboveground component were also analyzed for nutrient content and litter samples were analyzed for species composition.

INTRODUCTION

The primary objective of this study is quantification of the various structural and functional characteristics of a tallgrass prairie ecosystem, particularly the Osage Comprehensive Network Site of the U.S. International Biological Program Grassland Biome. Data collections across a number of functional levels in this system were accomplished through the coordinated efforts of Dr. H. Derrick Blocker of Kansas State University, invertebrates; Dr. John A. Wiens of Oregon State University, birds; Dr. Elmer C. Birney of the University of Minnesota, mammals; Mr. S. W. May of the University of Oklahoma, decomposers; and the authors, abiotic and producers.

This report will consider only the 1972 data relating to the abiotic variables and the primary producer compartment on this grassland site. Data pertaining to the geographical location, topography, long-term climate, soils, and description of experimental treatments on the Osage Site have been outlined (Risser 1970, Risser and Kennedy 1972).

An intrasite data analysis and synthesis covering the 1970 through 1972 sampling seasons will be presented in a separate publication.

METHODOLOGY

Abiotic

Meteorological measurement commenced on 22 April 1972 using the instrument stations which had been established during the 1970 season on the ungrazed treatment. A list of the meteorological equipment used and the location of sensors appears in Table 1. All measurements of abiotic factors were on the ungrazed treatment except soil water and precipitation. Soil water determinations were made from two 4.5 cm diameter cores per replicate on each biomass sampling date at depths of 0 to 5, 5 to 10, 10 to 20, and 20 to 50 cm. These particular sample depths were chosen to correspond to root and soil invertebrate sample depths. Precipitation was measured in each replicate on both treatments using a Taylor Clear-Vue rain gage mounted at 76 cm above the soil surface.

An automatic data recording system for a number of meteorological sensors was reestablished during the middle of the 1972 growing season. As of this date only one data set has been processed, though the system is apparently generating high quality data.

Primary Producer

The sampling methods used during the 1972 season for the primary producers compartment are essentially those outlined by Swift and French (1972) and Swift and Bokhari (1972). Any deviations from these outlined procedures will be documented in the following text.

Table 1. Meteorological equipment. Abiotic factors were measured on the ungrazed treatment (except soil water and precipitation which were taken in both treatments).

Factor	Equipment	Sensor Location (Respective to soil surface)
Solar radiation	Belfort Instrument Co. Recording Pyranometer	76 cm above
Maximum-Minimum air temperature	Taylor Max-Min Thermometer	153 cm above
Continuous air temperature	Friez-Bendix Instruments Recording Hygro-thermograph	153 and 31 cm above
Continuous air humidity	Friez-Bendix Instruments Recording Hygro-thermograph	153 and 31 cm above
Continuous soil temperature	Friez-Bendix Instruments thermograph	25.0 and 2.5 cm below
Precipitation	Taylor Clear-Vue Rain Gage	76 cm above, one gage/ replicate
Soil water	Gravimetric Method	Two 4.5 cm diameter cores/replicate on each biomass sampling date at depths of 0 to 5, 5 to 10, 10 to 20, and 20 to 50 cm

RESULTS

Abiotic

Air temperature average weekly maximum at 1.5 m (Table 2) reached 90°F during August 1972, while at 0.3 m it was slightly higher, 93°F. The data from the 0.3 m instrument contained several gaps due to small mammal interference with its operation. Seasonal patterns of air temperature indicate a relatively warm spring and normal summer during the 1972 season. Soil temperatures were generally lower than air temperature (Table 3), had fewer fluctuations throughout the season, and had much less variation between maximum-minimum means. Soil temperature average weekly maximum was consistently lower throughout the season at the 25.0 cm depth as compared to 2.5 cm. Soil temperatures also peaked during August at both sensor levels.

No data is currently available for average wind speed at the site due to a continuously malfunctioning totalizing anemometer; however, this data should be available when reduction and analysis of data from the automatic data recording station is completed.

During July solar radiation reached its maximum value of 1.40 cal cm^{-2} m^{-1} (Table 4). Table 4 also presents the interval and accumulation of precipitation during the 1972 growing season. The seasonal precipitation pattern indicates a relatively dry spring, normal summer, and wet fall. The accumulated precipitation to date is similar to the 1971 season total; however, the distribution is quite dissimilar. A preliminary analysis of seasonal climate patterns on the Osage Site is presented in Tables 5 and 6. Nine climate classes were used involving basic precipitation-temperature interactions (Table 5). The year was divided into

Table 2. Air temperature at 1.5 and 0.3 m for the 1972 sample season (°F).

Interval Date	1.5 m		0.3 m	
	Max.	Min.	Max.	Min.
22 April				
15 May	66	45	--	--
6 June	85	62	--	--
5 July	82	61	92	66
8 August	81	65	--	--
2 September	90	66	93	67
14 November	74	57	85	61

Table 3. Soil temperature at 25.0 and 2.5 cm for the 1972 sample season (°F).

Interval Date	25.0 cm		2.5 cm	
	Max.	Min.	Max.	Min.
15 May				
6 June	63	62	66	62
5 July	70	68	74	67
8 August	70	70	73	68
2 September	74	72	78	71
14 November	70	68	71	66

Table 4. Solar radiation (ungrazed treatment), interval, and accumulated precipitation from replicate collections in both grazed and ungrazed treatments, Osage Site, 1972.

Interval Date	Precipitation (cm)				Solar Radiation (cal cm^{-2} m^{-1})
	Ungrazed		Grazed		
	Interval	Accumulation	Interval	Accumulation	$\bar{X}$ max
22 April					
15 May	4.9	4.9	4.6	4.6	1.14
6 June	1.5	6.4	1.1	5.7	1.31
5 July	10.1	16.5	11.1	16.8	1.24
8 August	11.2	27.7	11.1	27.9	1.40
2 September	6.7	34.4	6.5	34.4	1.23
14 November	23.8	58.2	24.0	58.4	1.07

Table 5. Probability of climate classes, Osage Site.

Climate Class	Probability of Occurrence In:		
	Spring	Summer	Fall and Winter
1. Dry-Warm	0.231	0.205	0.103
2. Dry-Normal	0.103	0.103	0.179
3. Dry-Cool	0.026	0.026	0.077
4. Normal-Warm	0.051	0.026	0.128
5. Normal-Normal	0.103	0.179	0.026
6. Normal-Cool	0.154	0.128	0.179
7. Wet-Warm	0.051	0.103	0.077
8. Wet-Normal	0.103	0.051	0.128
9. Wet-Cool	0.179	0.179	0.103

Table 6. Expected occurrence of sample years[a/], Osage Site.

Sample Time	Year	Class	Expected Occurrence
Fall-Winter	1969-1970	3	1/13
Spring	1970	5	1/10
Summer	1970	1	1/5
Fall-Winter	1970-1971	6	1/6
Spring	1971	2	1/10
Summer	1971	9	1/6
Fall-Winter	1971-1972	7	1/13
Spring	1972	1	1/4
Summer	1972	5	1/6

Probability of occurrence of year:

1970 = 1/615

1971 = 1/303

1972 = 1/314

[a/] Most probably year = 1/118, Least probably year = 1/56,896

three seasons and the probability of occurrence of each climate class was calculated for each season. Table 6 shows that the spring of 1972 was dry and warm (climate class 1) and was also the most likely occurring spring condition ($p = 0.231$). The 1972 summer (climate class 5) would be expected to occur 1 year in 6 and this climate class has the second highest probability of occurrence as a summer season ($p = 0.179$). The 1972 fall-winter season (climate class 7) is one of the least likely fall-winter patterns ($p = 0.077$) with an expected occurrence of once in 13 years. The probability of occurrence for the entire seasonal pattern observed in 1972 is 1/314; where the most probable year is 1/118 and the least probable is 1/56,896. Table 7 documents the expected number of new patterns in spring, summer, and fall-winter precipitation vs. years of sampling, and Fig. 1 presents the same information graphically. In 3 years of sampling on the Osage Site there have been three new patterns of spring and summer precipitation which is slightly better than expected. As is shown in Fig. 1, it takes nearly 15 sample years before the probability of occurrence of new patterns is equal to that of redundant patterns.

Soil water determinations on the Osage Site were done concomitantly with herbage sampling from each of two clipped quadrats in each replicate in both treatments. Table 8 presents percentage soil water by depth in the soil profile and soil water percentage as an accumulation percentage with depth. Generally, the percentages follow a rainfall pattern during the growing season as is evidenced by the relatively low values during June, July, and August when precipitation was also low. The high percentages in April and May reflect the previous wet fall-winter season. Although no data is yet available for November, the fact that approximately 45% of the

Table 7. Number of years of sampling vs. years of new type spring and summer precipitation patterns[a/], Osage Site.

Sample Years	New Patterns	Sample Years	New Patterns
1	1.00	16	7.62
2	1.94	17	7.79
3	2.65	18	7.84
4	3.47	19	8.18
5	4.11	20	8.19
6	4.57	21	8.29
7	5.06	22	8.36
8	5.44	23	8.42
9	5.82	24	8.51
10	6.26	25	8.62
11	6.53	26	8.55
12	6.74	27	8.65
13	7.12	28	8.61
14	7.36	29	8.75
15	7.61	30	8.78

[a/] Nine combinations of spring and summer rainfall (wet, normal, dry).

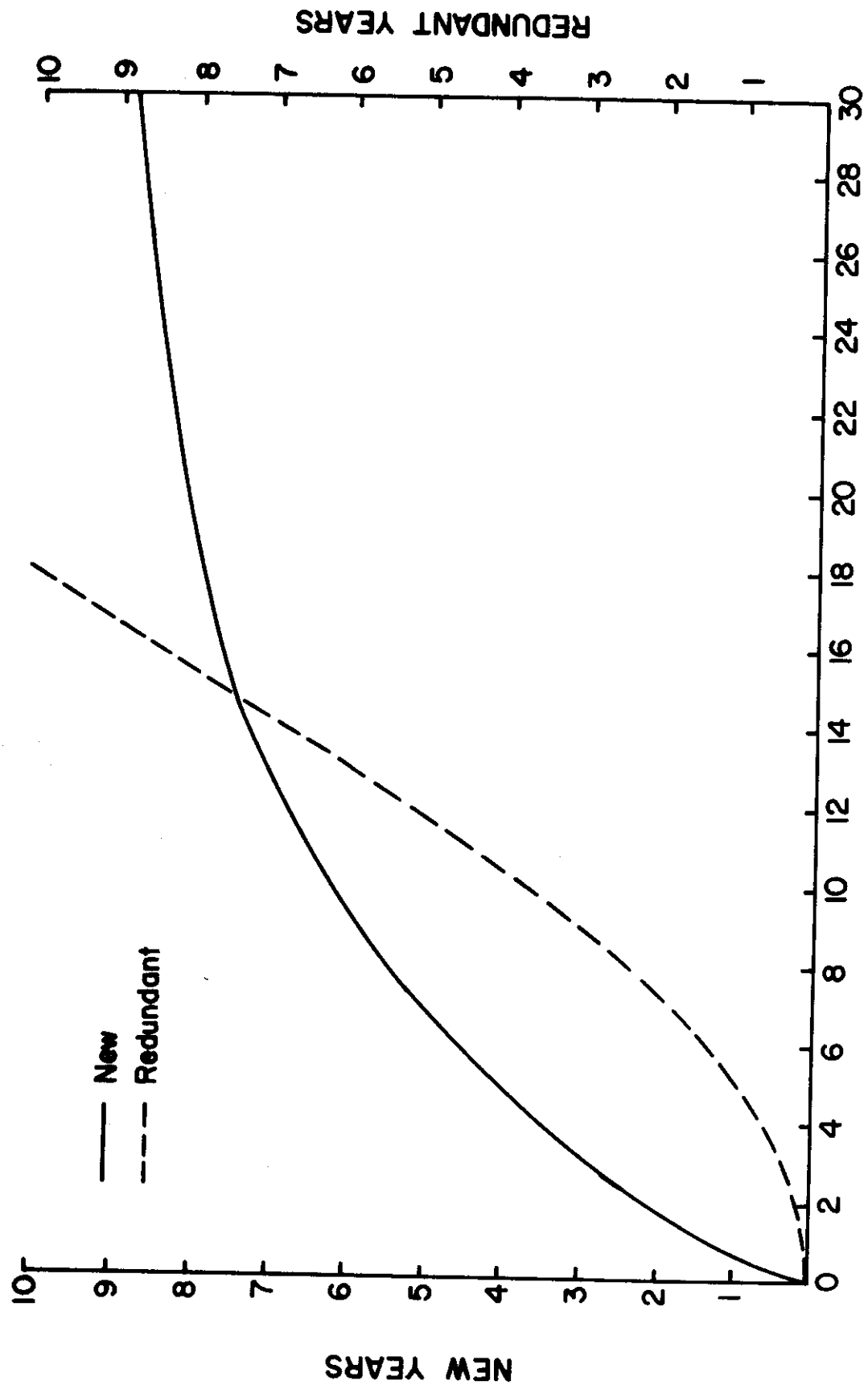

Fig. 1. Number of years sampled vs. years of new type spring and summer precipitation patterns.

Table 8. Gravimetric soil water on the Osage Site for both ungrazed and grazed treatments.

1972 Sample Date	Core Depth (cm)	Ungrazed Treatment				Grazed Treatment			
		Percent	SE	Accumulative Percent	SE	Percent	SE	Accumulative Percent	SE
22 Apr	0-5	40.31	0.53	40.31	0.53	33.94	2.68	33.94	2.68
	5-10	36.26	2.18	38.28	0.82	28.86	1.72	31.40	2.20
	10-20	34.33	2.31	36.97	0.22	28.60	0.84	30.47	1.75
	20-50	30.37	0.76	35.32	0.36	28.87	0.99	30.07	1.56
15 May	0-5	38.81	3.21	38.81	3.21	36.31	6.61	36.31	6.61
	5-10	39.18	1.56	39.00	0.83	32.91	5.79	34.61	6.20
	10-20	45.00	4.81	41.00	2.15	34.60	5.16	34.61	5.86
	20-50	67.63[a]	30.52	47.66	9.25	34.37	1.43	34.55	4.75
6 Jun	0-5	22.36	0.22	22.36	0.22	9.13	0.61	9.13	0.61
	5-10	25.52	0.24	23.94	0.23	16.99	1.41	9.53	3.13
	10-20	26.43	1.73	24.77	0.42	19.24	1.39	10.96	3.44
	20-50	37.10	1.29	29.65	1.79	25.76	0.38	13.18	4.19
5 Jul	0-5	25.20	0.73	25.20	0.73	25.86	0.87	25.86	0.87
	5-10	25.18	0.22	25.19	0.26	22.89	1.39	24.38	0.26
	10-20	24.53	0.31	24.97	0.28	115.30[a]	91.89	54.68	30.46
	20-50	22.40	0.66	24.32	0.37	18.05	3.27	45.53	22.03
8 Aug	0-5	20.42	0.86	20.42	0.86	23.30	4.94	23.30	4.94
	5-10	18.45	0.85	19.44	0.00	17.23	0.63	20.27	2.15
	10-20	19.47	1.37	19.45	0.46	17.14	0.25	19.23	1.35
	20-50	26.70	5.58	21.26	1.05	19.00	0.98	19.17	1.26
2 Sept	0-5	31.94	0.64	31.94	0.64	27.61	3.33	27.61	3.33
	5-10	35.81	8.57	33.88	4.61	29.15	1.58	28.38	2.45
	10-20	27.06	0.21	31.61	3.00	19.02	2.32	25.26	0.86
	20-50	17.11	2.01	27.98	2.76	22.07	7.68	24.46	1.27

[a] An extremely high value in one quadrat out of four.

sampling season's precipitation occurred in the 2 September to 14 November interval should result in relatively high soil water percentages. Soil water is consistently higher on the ungrazed treatment than on the grazed treatment and is probably a reflection of generally higher biomass and greater cover; hence, less exposed soil surface for evaporation. The greater biomass on the ungrazed treatment is not necessarily detrimental in terms of transpirational loss, as a higher percentage is in the standing dead component and therefore, not transpiring.

Site Characterization

Additional soil cores were taken on 8 August and 14 November to document the relative amounts of ammonia, nitrate, and bicarbonate phosphorus. On both dates three cores were taken in each replicate at depths of 0 to 5, 5 to 10, 10 to 20, and 20 to 50 cm for this purpose. At this writing no results have been returned. On the November 14 sample date three cores per replicate were taken and composited from depths of 0 to 5 cm, the A horizon and the B horizon for determination of soil texture and pH. In addition, three cores per replicate were taken at depths of 0 to 5, 5 to 10, 10 to 20, 20 to 30, 30 to 40, 40 to 50, 50 to 60 cm for analysis of exchangeable Ca, Mg, Na, and K; total nitrogen and phosphorus; cation exchange capacity; and soil water retention curves. These samples have been submitted, but no analyses have been returned.

On November 14, bulk density was sampled using a sand displacement method with five determinations per replicate (Table 9) to a depth of 5 cm. Values were consistently lower on the ungrazed treatment. On comparison with a similar study done during the 1970 season, the 1972 values were slightly lower, but showed the same general pattern and magnitude of difference between treatments.

Table 9. Bulk density (g/cc) using the scud displacement method on both ungrazed and grazed treatments, Osage Site, 14 November 1972. Five quadrats were sampled in each replicate, at the 0 to 5 cm level.

Treatment	Replicate 1 $\bar{X}$	Replicate 2 $\bar{X}$	Treatment $\bar{X}$
Ungrazed	0.932	0.872	0.902
Grazed	1.052	1.067	1.059

Primary Producer

The double sampling technique initiated in 1971 was continued during the 1972 season, but at a somewhat reduced level. The number of quadrats which were clipped and estimated, and the number estimated only are presented in Table 10. Quadrats which were clipped and estimated also had the litter removed, using a portable D-vac; were decrowned, using a small shovel; and were estimated for percent bare ground as a means of estimating cover.

Root samples were obtained from three quadrats per replicate on both treatments at depths of 0 to 5, 5 to 10, 10 to 20, and 20 to 50 cm. The number of 4.5 cm diameter cores taken per treatment is presented in Table 11.

Sorting of clipped plant material was always done in the laboratory. Beginning with the 22 April sample, the miscellaneous grasses in each quadrat were estimated for percent of cool season/warm season composition. This estimation was always done after the material had been sorted to categories. Additionally, seeds were sorted from the live category and their biomass determined separately for all important species and the miscellaneous categories. Table 12 presents a list of the important species on the Osage Site with their associated growth forms and species codes. Phenological observations were made on site at each sampling date and at various other times during the interval between sample dates on a tallgrass site near Norman, Oklahoma. An example of the phenological data sheet appears in Appendix I.

Upon completion of laboratory processing, ground samples of all producer components from each sample date were submitted for nutrient analysis on a replicate basis. Table 13 shows the number of samples submitted for these various analyses to date.

Table 10. Number of clipped and delittered quadrats and number of estimated quadrats per treatment on each sample date for the 1972 season at the Osage Site.

1972 Sample Date	Ungrazed		Grazed	
	Clipped and Delittered	Estimated	Clipped and Delittered	Estimated
22 Apr	10	50	10	50
15 May	10	50	10	50
6 Jun	6	14	10	50
5 Jul	6	26	10	42
8 Aug	6	45	10	48
2 Sept	6	22	10	30
14 Nov	6	14	10	18

Table 11. Number of 4.5 cm diameter cores taken in each treatment for root biomass estimation to a depth of 50 cm.

1972 Sample Date	Ungrazed	Grazed
15 May	18	18
5 Jul	21	24
8 Aug	24	24
14 Nov	18	18

Table 12. Osage species codes[a/] and growth forms[b/].

Growth Form[a/]	Genus Code	Species Code	Subspecies Code	Scientific Name
1	AN	GE		*Andropogon gerardi* Vitman
1	AN	SC	2	*Andropogon scoparius* Michx.
1	PA	VI	2	*Panicum virgatum* L.
1	SO	NU	2	*Sorghastrum nutans* (L.) Nash
1	SP	AS		*Sporobolus asper* (Michx.) Kunth
8	AM	CA	6	*Amorpha canescens* Pursh
0	MI	GR		Misc. grasses (includes sedges)
0	MI	FO		Misc. forbs
0	MI	SU		Misc. succulent
Phenology considerations only				
6	AC	MI	2	*Achillea millefolium* L.[d/]
1	BO	CU		*Bouteloua curtipendula* (Michx.) Torr.
2	BR	JA		*Bromus japonicus* Thunb.

[a/] These are the species codes and growth forms which will be used on all data forms at the Osage Site during 1972 season.

[b/] Species codes and growth forms follow the National List of Scientific Plant Names (1971).

[c/] Growth forms:

1 Perennial grass
2 Annual grass
6 Perennial forb
8 Shrub
0 Miscellaneous

[d/] *Achillea lanulosa* is listed as synonomous with *A. millefolium*.

Table 13. Number of aboveground herbaceous biomass samples submitted to NREL for laboratory analysis. Producer components included are litter, litter accumulation, crowns, live, old dead, recent dead, seed, and culm material.

Analysis Requested	Number of Samples Submitted as of 12 December 1972
Ash	193
Nitrogen	191
Phosphorus	189
Cell wall constituent	172
Lignin	170
Carbon	98
Total available carbohydrates	71
Total Number of Samples Submitted	1084

The maximum aboveground biomass on the ungrazed treatment during 1972 was 786 g/m^2 during the 8 August to 2 September interval. The grazed treatment maximum was obtained during the 5 July to 8 August interval where a total of 459 g/m^2 occurred. Peak live material was 254 g/m^2 on the ungrazed treatment and 311 g/m^2 on the grazed treatment. The amount of standing dead material was consistently higher on the ungrazed treatment (Table 14). Graphic representations of the live, old dead, and live + dead categories are shown in Fig. 2 through 7.

The biomass of the major species on both ungrazed and grazed treatments is shown in Tables 15 through 23 and graphically by species category in Fig. 8 through 49. Asterisks appearing in graphs indicate a lower confidence limit which has a negative value. No graphs are presented for either the recent dead category of any species or for any category of *Amorpha canescens* (AMCA6) or miscellaneous succulent (MISU) due to an insufficient number of data points.

Table 24 documents the relative amounts of cool season/warm season biomass contained in the miscellaneous grass component. Generally the amount of cool season grass is higher on the grazed treatment and is consistently higher when only the live category is considered. The ungrazed treatment values appear to more variable than the grazed.

Crown biomass was collected from all clipped quadrats on both treatments and is presented in Table 25. The ungrazed treatment reached a maximum value of 540 g/m^2 and the grazed a maximum of 301 g/m^2, both at the September sample date. Samples were highly variable on all sample dates and at no time were crowns samples adequately (SD 2 $\bar{X}$, $p < 0.8$). Litter biomass (Table 26) was sampled adequately on four of seven sample dates on the ungrazed and once on the grazed treatment. Biomass values for grazed litter reached 542 g/m^2 and a maximum of 339 g/m^2 on the ungrazed treatment.

Table 14. Total aboveground herbaceous biomass (g/m^2) by category and including 80% confidence limits, Osage Site, 1972.

1972 Julian Date	Live Mean	Upper	Lower	Old Dead Mean	Upper	Lower	Recent Dead Mean	Upper	Lower	Live + Dead Mean	Upper	Lower
						Ungrazed						
113	14.90	18.64	11.16	718.45	768.66	668.24	--	--	--	733.40	782.67	684.13
136	31.90	41.42	22.38	498.20	561.97	434.43	--	--	--	530.10	591.98	468.22
158	128.25	147.43	109.07	509.60	633.66	385.54	--	--	--	637.85	764.36	511.34
187	203.35	242.26	164.44	540.15	628.19	452.11	9.80	19.97	-.37	753.40	837.47	669.33
220	254.35	275.23	233.47	246.65	375.43	117.87	214.05	334.73	93.37	715.05	894.46	535.64
246	222.35	250.94	193.76	484.20	646.65	321.75	79.30	154.17	4.43	785.75	905.16	666.34
						Grazed						
113	34.30	45.32	23.28	194.54	254.32	133.78	--	--	--	228.35	285.34	171.36
136	72.80	86.51	59.09	167.20	229.53	104.87	--	--	--	239.95	309.50	170.40
158	115.90	133.31	98.49	63.70	75.36	52.04	--	--	--	179.60	202.66	156.54
187	159.05	183.83	134.27	53.05	79.55	26.55	9.05	13.35	4.75	221.10	265.77	176.43
220	311.25	335.97	286.53	99.10	150.03	48.17	48.40	83.52	13.28	458.70	519.53	397.87
246	269.90	341.85	197.95	64.05	101.80	26.30	75.80	108.04	43.56	409.75	495.26	324.24

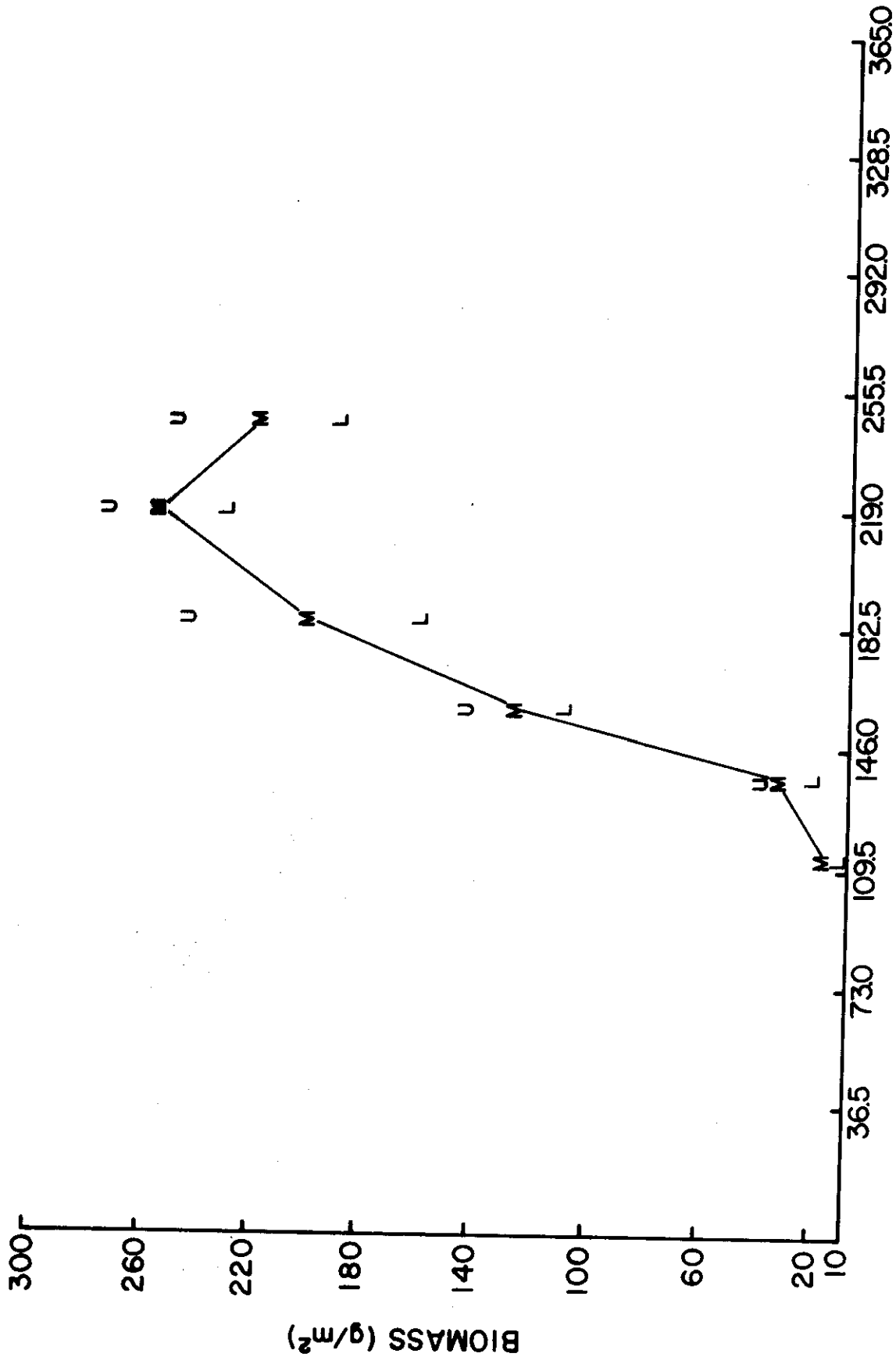

Fig. 2. Total aboveground live biomass (g/m^2) from the ungrazed treatment.

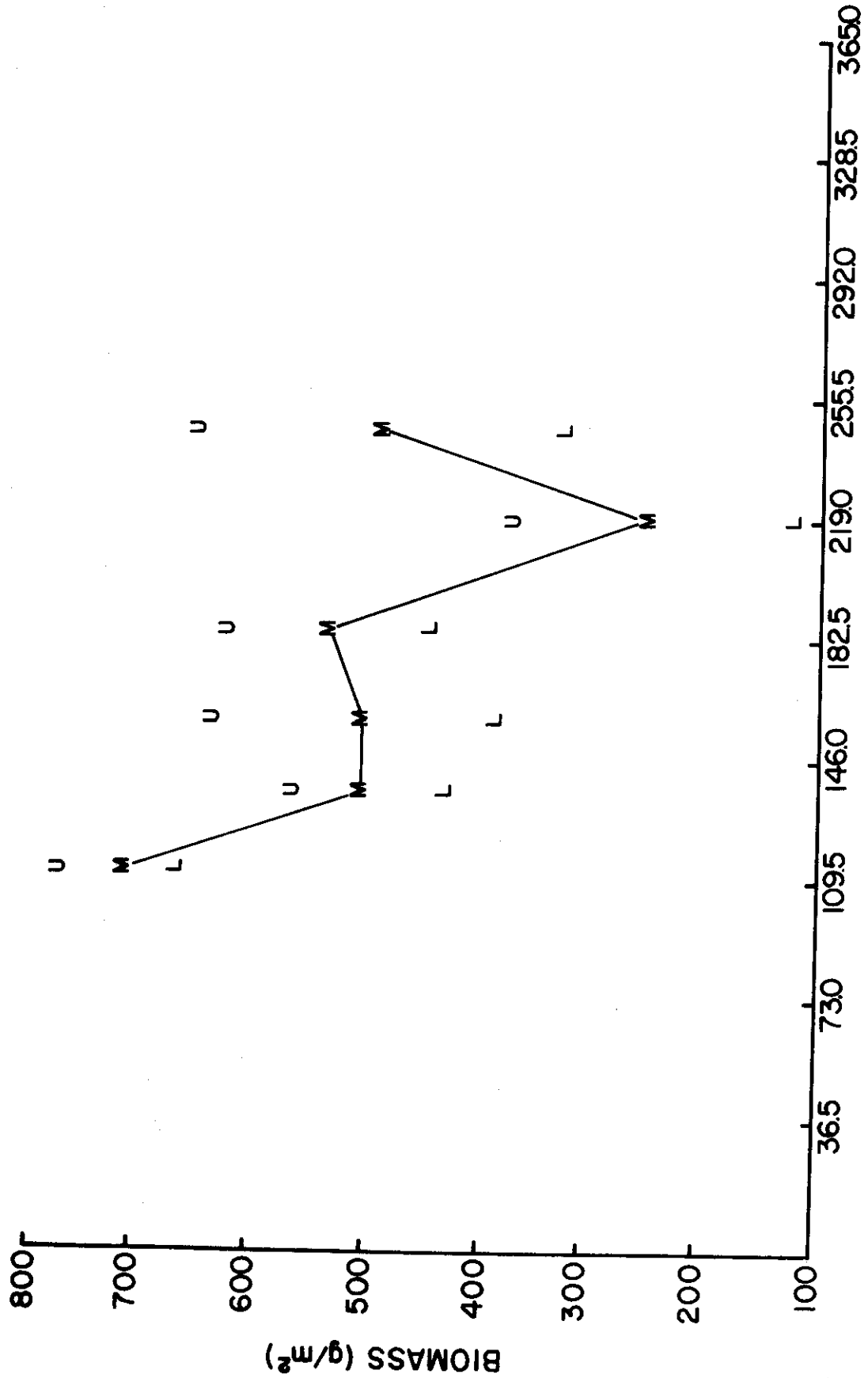

Fig. 3. Total aboveground old dead biomass (g/m^2) from the ungrazed treatment.

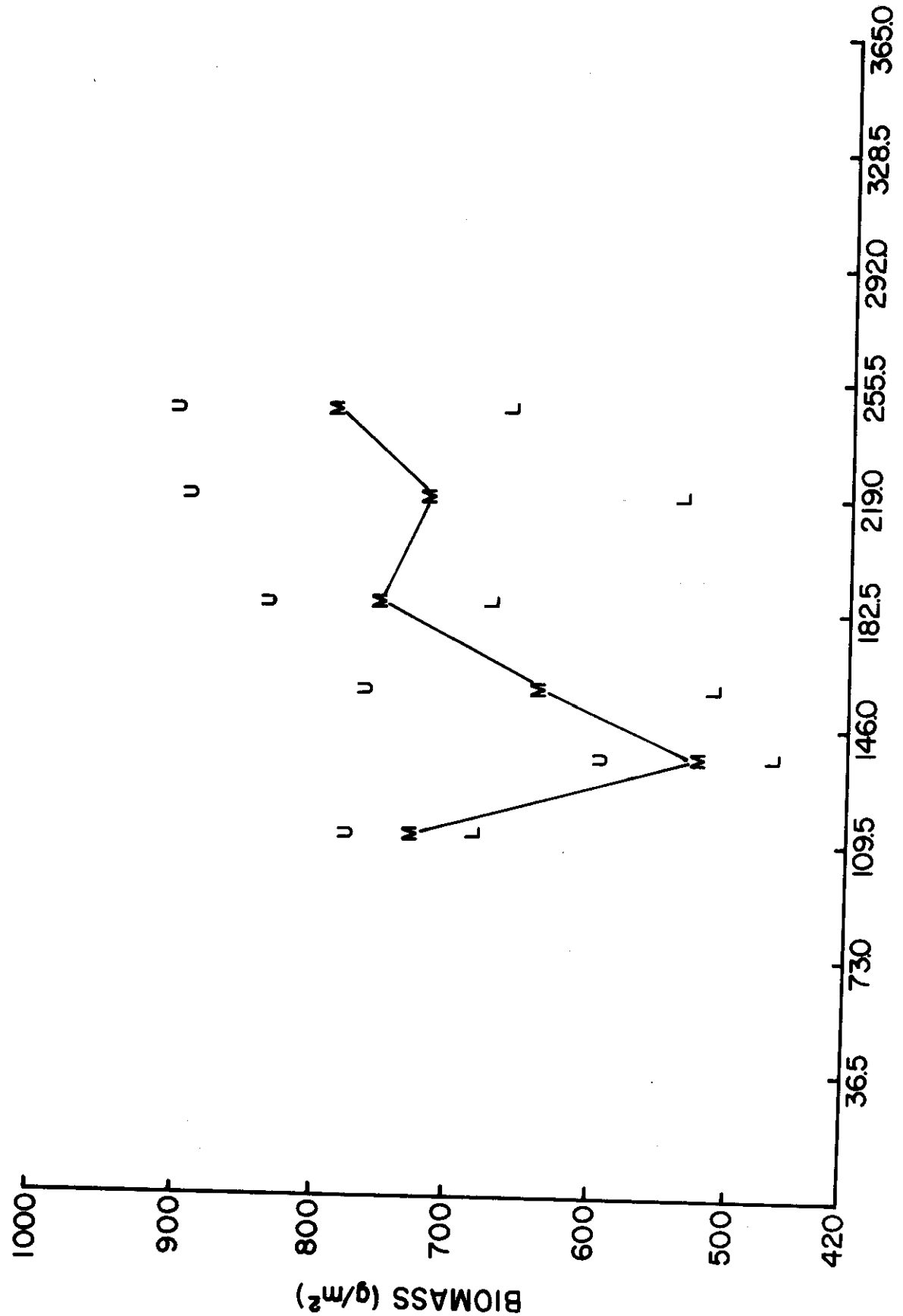

Fig. 4. Total aboveground live and dead biomass (g/m^2) from the ungrazed treatment.

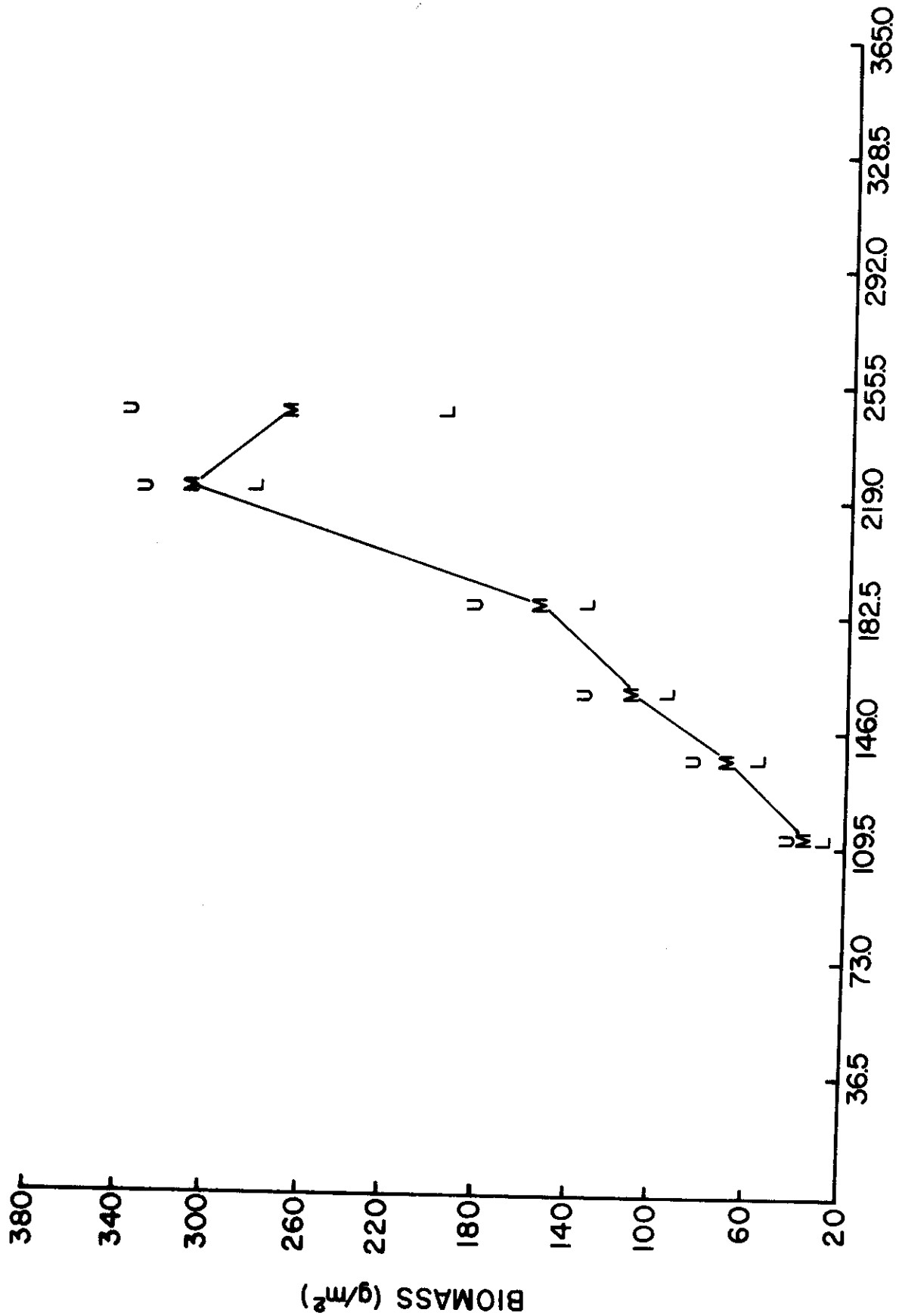

Fig. 5. Total aboveground live biomass (g/m^2) from the grazed treatment.

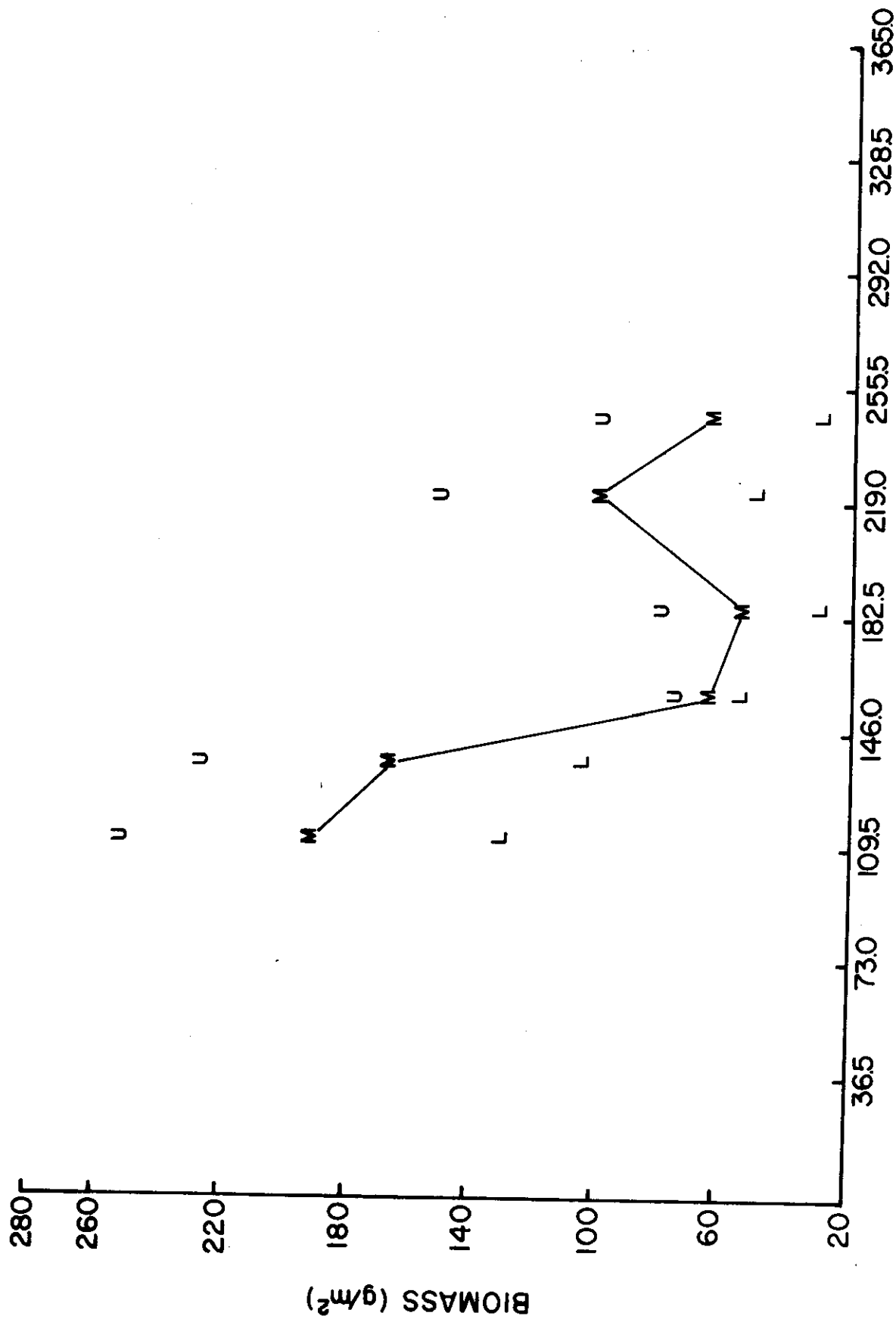

Fig. 6. Total aboveground old dead biomass (g/m^2) from the grazed treatment.

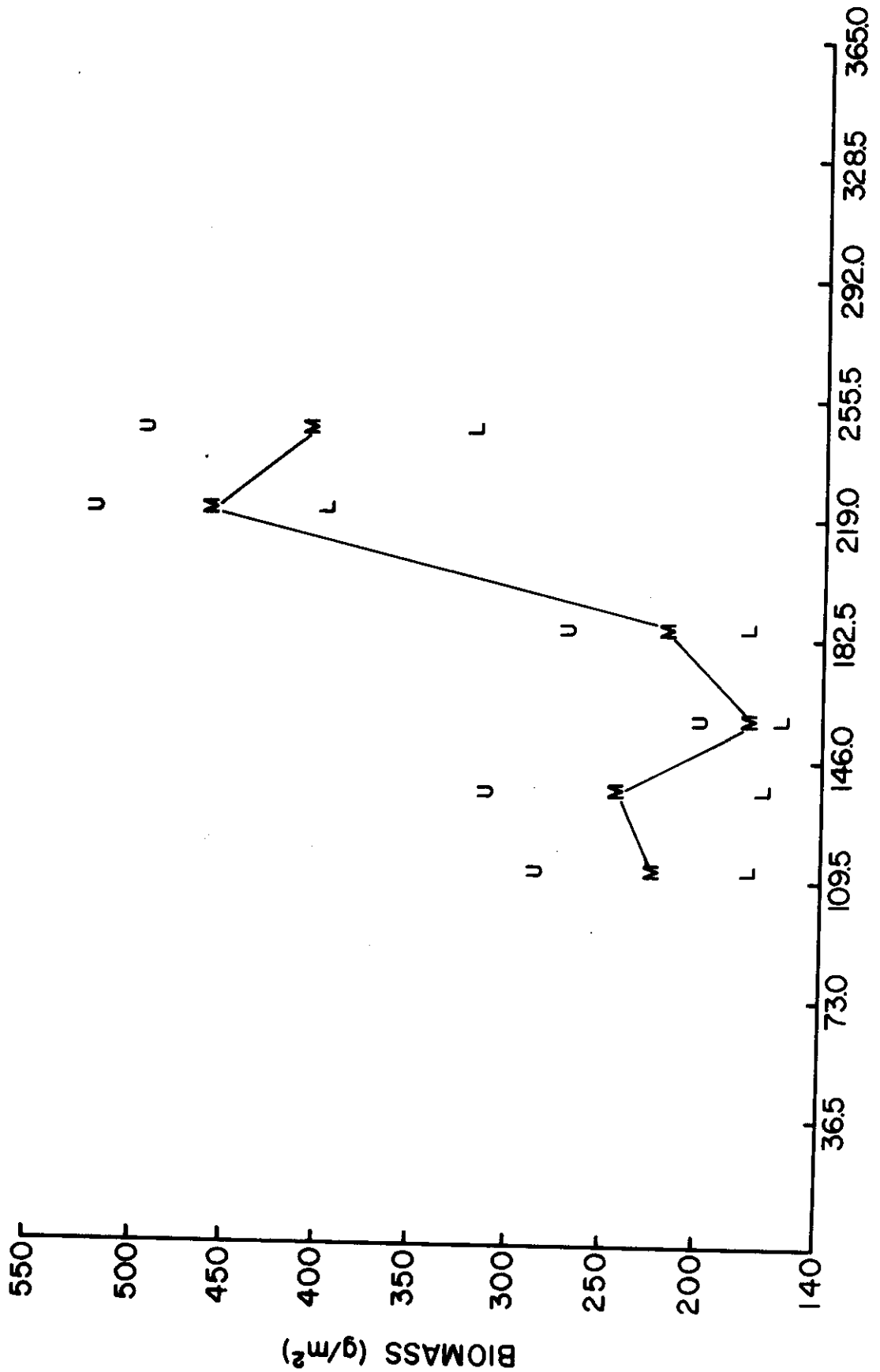

Fig. 7. Total aboveground live and dead biomass (g/m^2) from the grazed treatment.

Table 15. *Andropogon scoparius* (ANSC2) aboveground herbaceous biomass (g/m^2) by category and including 80% confidence limits, Osage Site, 1972.

1972 Julian Date	Live Mean	Upper	Lower	Old Dead Mean	Upper	Lower	Recent Dead Mean	Upper	Lower	Live + Dead Mean	Upper	Lower
						Ungrazed						
113	5.65	7.49	3.81	576.65	647.45	505.85	--	--	--	582.30	652.90	511.70
136	7.00	9.53	4.47	410.20	480.56	339.84	--	--	--	417.30	488.98	345.62
158	54.60	77.25	31.85	409.15	508.07	310.23	--	--	--	463.75	557.90	369.60
187	117.00	162.80	71.20	456.00	558.77	353.23	1.35	3.60	-.90	574.35	679.89	468.81
220	150.70	211.34	90.06	214.55	348.98	80.12	183.40	291.67	75.13	548.70	777.42	319.98
246	132.65	162.70	102.60	447.60	616.62	278.58	60.85	130.48	-8.78	641.05	763.94	518.16
						Grazed						
113	1.70	4.17	-.77	61.55	108.35	14.75	--	--	--	63.30	109.73	16.87
136	6.90	11.18	2.62	83.85	132.92	34.78	--	--	--	90.75	143.15	38.35
158	21.30	32.70	9.90	29.05	47.41	10.69	--	--	--	50.30	76.64	23.96
187	52.05	74.49	29.61	31.20	57.84	4.56	2.00	3.42	0.58	85.25	131.72	38.78
220	81.35	102.80	60.50	49.35	73.37	25.33	22.15	42.69	1.61	152.85	191.84	113.86
246	37.30	56.16	18.44	27.65	51.26	4.04	11.30	21.53	1.07	76.25	114.35	38.15

Table 16. *Andropogon gerardi* (ANGE) aboveground herbaceous biomass (g/m^2) by category and including 80% confidence limits, Osage Site, 1972.

1972 Julian Date	Live Mean	Upper	Lower	Old Dead Mean	Upper	Lower	Recent Dead Mean	Upper	Lower	Live + Dead Mean	Upper	Lower
						Ungrazed						
113	--	--	--	5.85	11.47	0.23	--	--	--	5.85	11.47	0.23
136	2.55	4.68	0.42	1.05	3.27	-1.17	--	--	--	3.60	6.98	0.22
158	20.45	27.36	13.54	3.20	9.20	-2.80	--	--	--	23.65	32.43	14.87
187	8.10	22.86	-6.66	0.80	2.86	-1.26	--	--	--	8.90	26.64	-7.84
220	9.90	20.43	-0.63	0.90	3.51	-1.71	--	--	--	10.75	22.88	-1.38
246	23.30	46.49	0.11	6.05	44.14	-32.04	2.70	6.07	-.67	32.05	66.92	-2.82
						Grazed						
113	--	--	--	--	--	--	--	--	--	--	--	--
136	8.55	12.35	4.75	3.45	11.52	-4.62	--	--	--	12.00	20.51	3.49
158	11.40	31.72	-8.92	2.25	6.87	-2.37	--	--	--	13.65	34.52	-7.22
187	7.65	16.60	-1.30	0.05	0.16	-0.06	0.25	0.85	-.35	7.95	16.91	-1.01
220	12.65	34.22	-8.92	--	--	--	--	--	--	12.65	34.22	-8.92
246	20.70	35.31	6.09	1.75	3.24	0.26	7.55	15.10	-0.0	30.05	52.41	7.69

Table 17. *Sorghastrum nutans* (SONU2) aboveground herbaceous biomass (g/m^2) by category and including 80% confidence limits, Osage Site, 1972.

1972 Julian Date	Live Mean	Upper	Lower	Old Dead Mean	Upper	Lower	Recent Dead Mean	Upper	Lower	Live + Dead Mean	Upper	Lower
						Ungrazed						
113	0.20	0.57	-.17	55.05	90.90	19.20	--	--	--	55.25	91.34	19.16
136	0.60	1.40	-.20	17.90	31.36	4.46	--	--	--	18.50	32.43	4.57
158	8.70	16.97	0.43	21.15	55.21	-12.91	--	--	--	29.90	70.65	-10.85
187	26.25	59.54	-7.04	14.35	36.36	-7.66	--	--	--	40.60	88.74	-7.54
220	10.65	27.40	-6.10	1.70	6.72	-3.32	1.30	4.18	-1.58	13.55	31.04	-3.94
246	21.35	56.65	-13.95	4.55	11.27	-2.17	4.45	10.86	-1.96	30.35	64.14	-3.44
						Grazed						
113	2.40	6.69	-1.89	16.45	26.90	6.00	--	--	--	18.85	32.84	4.86
136	0.10	0.25	-.05	0.40	1.25	-.45	--	--	--	0.50	1.59	-.59
158	1.95	4.39	-.49	0.60	1.68	-.48	--	--	--	2.55	5.37	-.27
187	1.05	2.39	-.29	--	--	--	--	--	--	1.05	2.39	-.29
220	18.90	30.18	7.62	2.75	6.90	-1.40	2.15	4.22	0.08	23.80	38.51	9.09
246	32.85	65.22	0.48	7.45	16.24	-1.34	9.40	21.71	-2.91	49.65	94.46	4.84

Table 18. *Sporobolus asper* (SPAS) aboveground herbaceous biomass (g/m^2) by category and including 80% limits, Osage Site, 1972.

1972 Julian Date	Live Mean	Upper	Lower	Old Dead Mean	Upper	Lower	Recent Dead Mean	Upper	Lower	Live + Dead Mean	Upper	Lower
						Ungrazed						
113	0.15	0.45	-.15	18.45	23.40	13.50	--	--	--	18.60	23.40	13.80
136	2.20	4.17	0.23	3.80	6.19	1.41	--	--	--	6.00	9.71	2.29
158	11.50	21.34	1.66	11.75	19.12	4.38	--	--	--	23.20	36.26	10.14
187	5.65	11.96	-.66	3.70	9.12	-1.72	--	--	--	9.35	21.00	-2.30
220	35.80	70.01	1.59	3.90	8.02	-.22	8.70	39.88	-22.48	48.35	91.58	5.12
246	13.25	20.36	6.14	5.60	12.30	-1.10	0.90	3.55	-1.75	19.75	32.93	6.57
						Grazed						
113	5.15	7.43	2.87	13.05	20.49	5.61	--	--	--	18.25	26.70	9.80
136	10.25	16.54	3.96	9.95	19.07	0.83	--	--	--	20.20	32.77	7.63
158	17.95	26.91	8.99	1.90	4.20	-.40	--	--	--	19.85	28.58	11.12
187	26.90	41.77	12.03	0.95	1.40	0.50	--	--	--	27.90	42.90	12.90
220	84.95	133.68	36.22	5.40	14.04	-3.24	7.35	16.35	-1.65	97.75	159.31	36.19
246	47.15	78.18	16.12	3.50	6.56	0.44	17.10	34.31	-.11	67.70	117.31	18.09

Table 19. *Panicum virgatum* (PAVI2) aboveground herbaceous biomass (g/m^2) by category and including 80% confidence limits, Osage, 1972.

1972 Julian Date	Live Mean	Upper	Lower	Old Dead Mean	Upper	Lower	Recent Dead Mean	Upper	Lower	Live + Dead Mean	Upper	Lower
						Ungrazed						
113	--	--	--	23.60	40.69	6.51	--	--	--	23.65	40.75	6.55
136	3.35	7.48	-.78	12.75	27.27	-1.77	--	--	--	16.10	34.25	-2.05
158	3.15	8.29	-1.99	15.90	29.62	2.18	--	--	--	19.10	38.59	-.39
187	6.30	17.20	-4.60	11.55	22.64	0.46	--	--	--	17.85	40.75	-5.05
220	9.05	30.82	-12.72	8.25	23.17	-6.67	--	--	--	17.30	53.33	-18.73
246	8.25	17.87	-1.37	9.30	14.04	4.56	--	--	--	17.55	32.46	2.64
						Grazed						
113	4.00	12.23	-4.23	16.45	34.85	-1.95	--	--	--	20.45	39.04	1.86
136	7.30	14.83	-.22	29.80	57.37	2.23	--	--	--	37.10	70.87	3.33
158	15.90	26.64	5.16	11.80	20.18	3.42	--	--	--	27.70	41.24	14.16
187	24.45	40.76	8.14	10.20	17.97	2.43	--	--	--	34.60	56.13	13.07
220	67.95	108.60	27.30	20.40	39.15	1.65	1.90	5.37	-1.57	90.25	148.43	32.07
246	87.10	154.87	20.13	8.25	16.66	-.16	13.55	34.94	-7.84	108.85	192.23	25.47

Table 20. Miscellaneous grasses (MIGR) aboveground herbaceous biomass (g/m^2) by category and including 80% confidence limits, Osage, 1972.

1972 Julian Date	Live Mean	Upper	Lower	Old Dead Mean	Upper	Lower	Recent Dead Mean	Upper	Lower	Live + Dead Mean	Upper	Lower
						Ungrazed						
113	8.35	10.98	5.72	34.30	51.48	17.12	--	--	--	42.65	60.98	24.32
136	16.00	21.02	10.98	43.90	60.86	26.94	--	--	--	59.95	79.16	40.74
158	27.10	41.08	13.12	44.95	82.50	7.40	--	--	--	72.00	125.77	18.23
187	31.00	53.70	8.30	52.45	112.40	-7.50	8.45	19.27	-2.37	91.90	186.61	-2.81
220	27.50	47.48	7.52	14.25	27.97	0.53	20.50	44.03	-3.03	62.25	100.86	23.64
246	18.75	30.08	7.42	4.55	9.46	-.36	4.45	14.90	-6.00	27.75	49.93	5.57
						Grazed						
113	18.55	24.04	13.06	83.05	132.65	33.65	--	--	--	101.65	150.89	52.41
136	36.05	43.24	28.86	39.40	62.14	16.66	--	--	--	75.45	98.42	52.48
158	32.45	41.07	23.83	18.00	28.38	7.62	--	--	--	50.45	65.45	35.45
187	23.60	34.57	12.63	10.65	17.17	4.13	6.75	10.19	3.31	41.05	60.29	21.81
220	20.60	31.75	9.45	20.05	33.75	6.35	14.85	25.93	3.77	55.45	72.43	28.47
246	25.45	46.16	4.74	14.30	38.24	-9.64	16.70	21.70	11.70	56.45	90.76	22.14

Table 21. Miscellaneous forbs (MIFO) aboveground herbaceous biomass (g/m^2) by category and including 80% confidence limits, Osage, 1972.

1972 Julian Date	Live Mean	Upper	Lower	Old Dead Mean	Upper	Lower	Recent Dead Mean	Upper	Lower	Live + Dead Mean	Upper	Lower
						Ungrazed						
113	0.05	0.20	-.10	4.40	6.86	1.94	--	--	--	4.45	6.84	2.06
136	0.10	0.23	-.03	8.55	13.88	3.22	--	--	--	8.65	13.92	3.38
158	2.75	8.04	-2.54	3.50	9.03	-2.03	--	--	--	6.25	16.99	-4.49
187	9.15	22.31	-4.01	1.35	4.58	-1.88	--	--	--	10.45	26.40	-5.50
220	10.90	24.48	-2.68	3.15	7.69	-1.39	0.15	0.97	-.67	14.15	30.64	-2.34
246	4.80	17.17	-8.11	6.55	14.87	-1.77	5.90	20.90	-9.10	17.25	28.95	5.55
						Grazed						
113	0.65	1.01	0.29	1.95	3.22	0.68	--	--	--	2.60	3.97	1.23
136	2.05	3.90	0.20	0.30	0.62	-.02	--	--	--	2.35	4.18	0.52
158	13.75	23.35	4.15	0.10	0.36	-.16	--	--	--	13.90	23.42	4.38
187	23.35	34.04	12.66	--	--	--	--	--	--	23.35	34.04	12.66
220	23.00	47.71	-1.71	1.15	3.13	-.83	--	--	--	24.15	49.34	-1.04
246	19.35	29.37	9.33	1.15	1.83	0.47	0.20	0.73	-.33	20.75	31.00	10.50

Table 22. *Amorpha canescens* (AMCA6) aboveground herbaceous biomass (g/m^2) by category and including 80% confidence limits, Osage, 1972.

1972 Julian Date	Live Mean	Upper	Lower	Old Dead Mean	Upper	Lower	Recent Dead Mean	Upper	Lower	Live + Dead Mean	Upper	Lower
						Ungrazed						
113	0.55	1.82	-.72	--	--	--	--	--	--	0.55	1.82	-.72
136	--	--	--	--	--	--	--	--	--	--	--	--
158	--	--	--	--	--	--	--	--	--	--	--	--
187	--	--	--	--	--	--	--	--	--	--	--	--
220	--	--	--	--	--	--	--	--	--	--	--	--
246	--	--	--	--	--	--	--	--	--	--	--	--
319	--	--	--	--	--	--	--	--	--	--	--	--
						Grazed						
113	1.85	6.22	-2.52	1.45	4.90	-2.00	--	--	--	3.30	11.12	-4.52
136	1.70	5.65	-2.25	--	--	--	--	--	--	1.70	5.65	-2.25
158	1.20	4.07	-1.67	--	--	--	--	--	--	1.20	4.07	-1.67
187	--	--	--	--	--	--	--	--	--	--	--	--
220	--	--	--	--	--	--	--	--	--	--	--	--
246	--	--	--	--	--	--	--	--	--	--	--	--

Table 23. Miscellaneous succulent (MISU) aboveground herbaceous biomass (g/m^2) by category and including 80% confidence limits, Osage, 1972.

1972 Julian Date	Live Mean	Upper	Lower	Old Dead Mean	Upper	Lower	Recent Dead Mean	Upper	Lower	Live + Dead Mean	Upper	Lower
							Grazed					
220	1.85	5.81	-2.11	--	--	--	--	--	--	1.85	5.81	-2.11

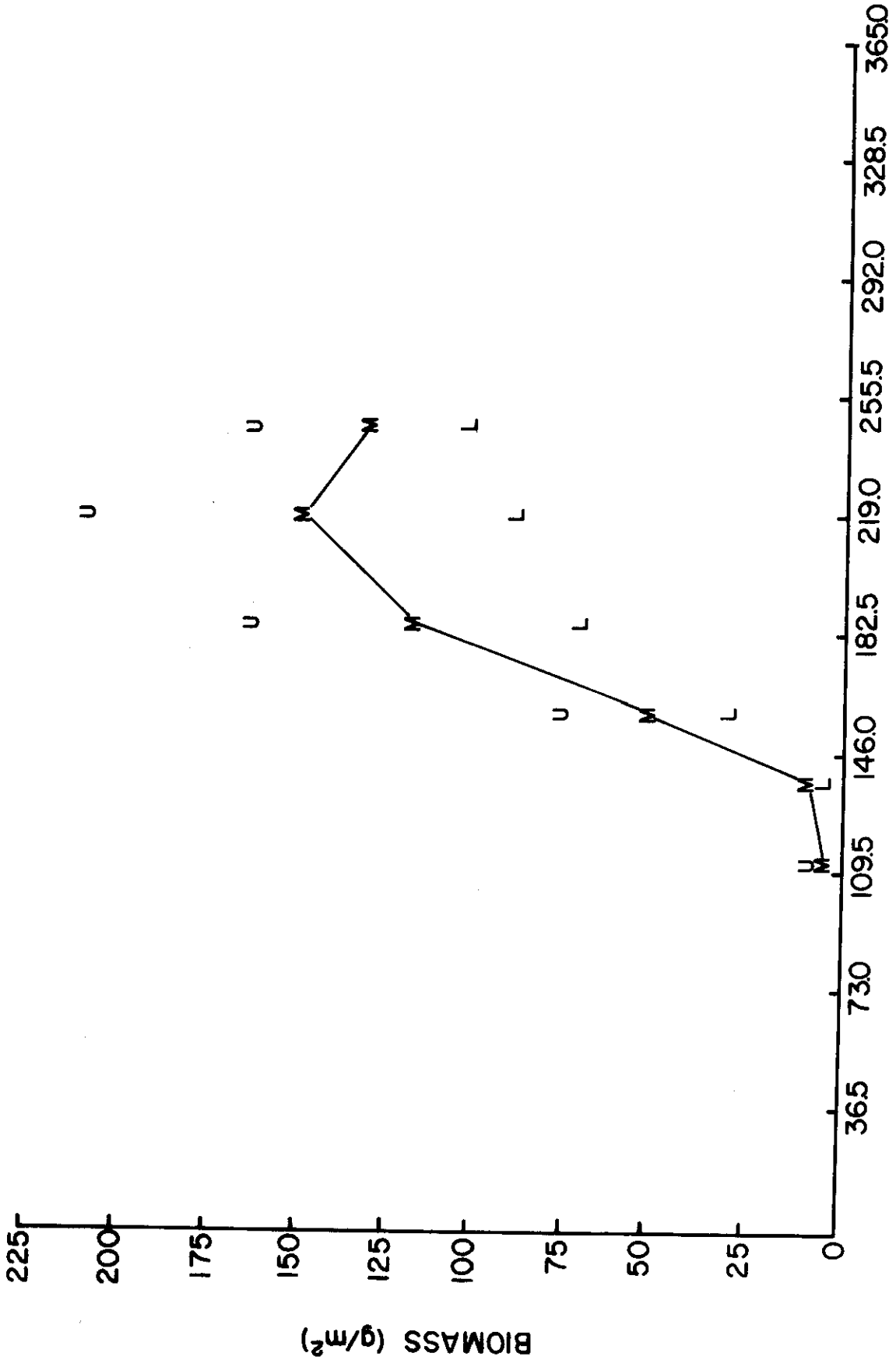

Fig. 8. *Andropogon scoparius* live biomass (g/m^2) from the ungrazed treatment.

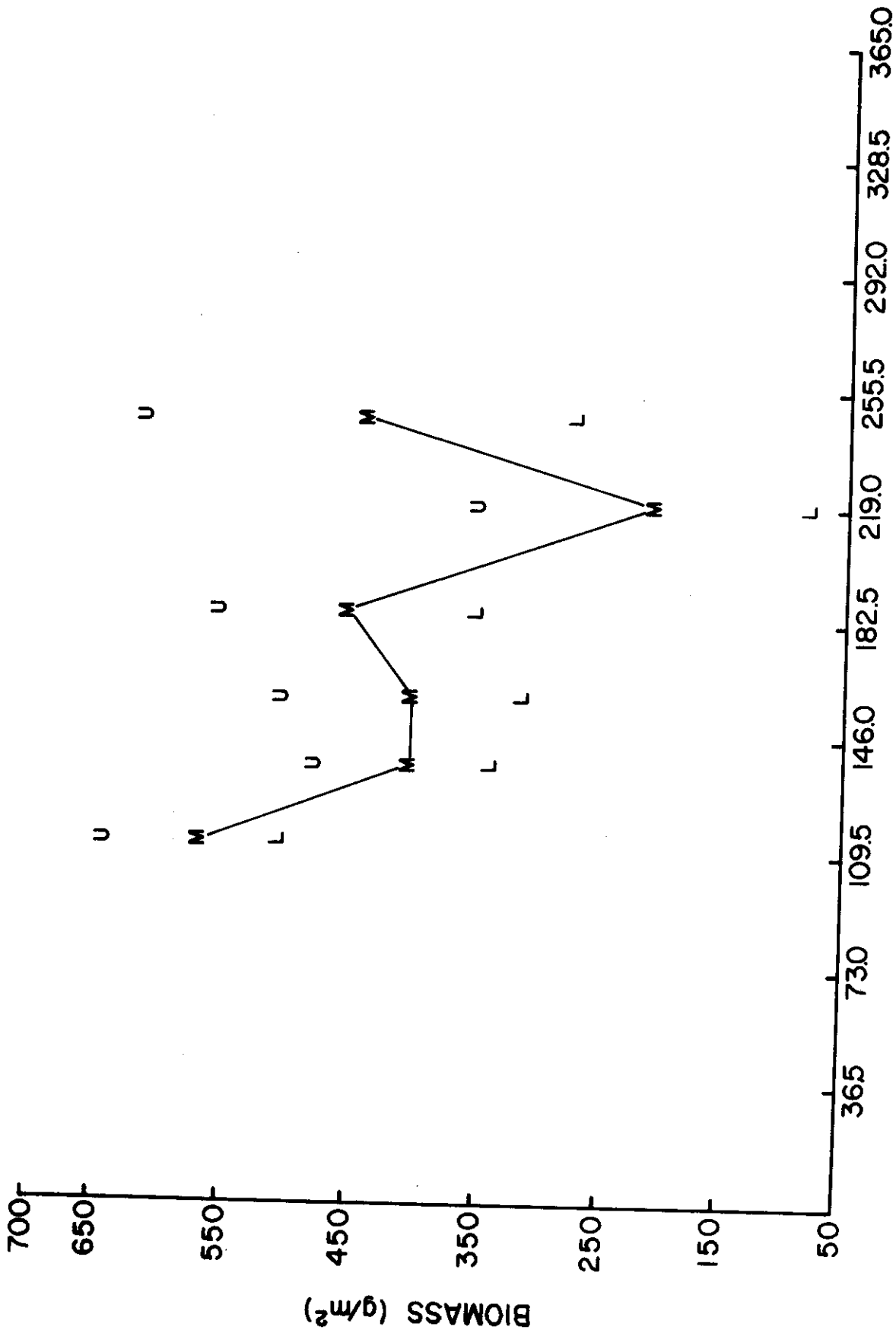

Fig. 9. *Andropogon scoparius* old dead biomass (g/m^2) from the ungrazed treatment.

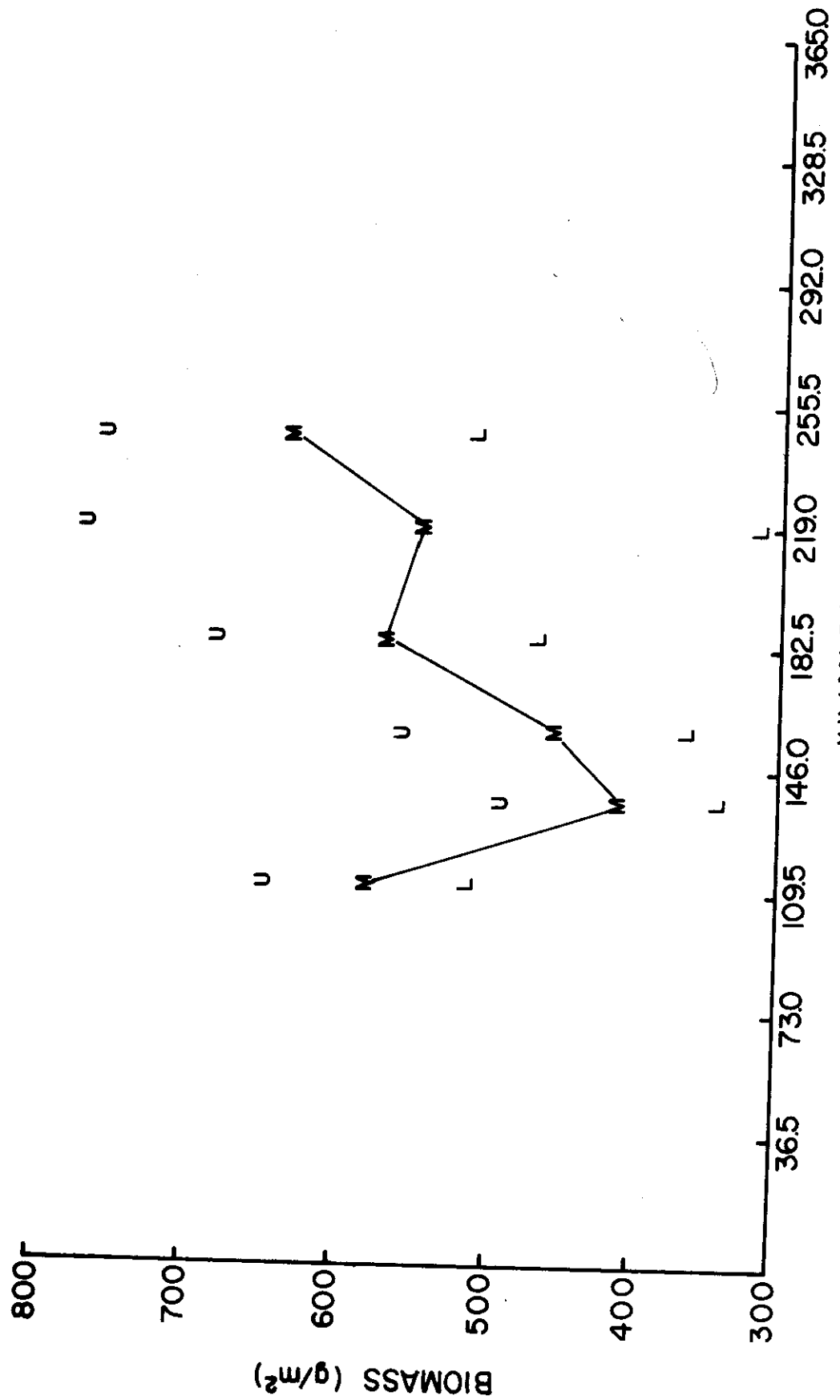

Fig. 10. *Andropogon scoparius* live and dead biomass (g/m^2) from the ungrazed treatment.

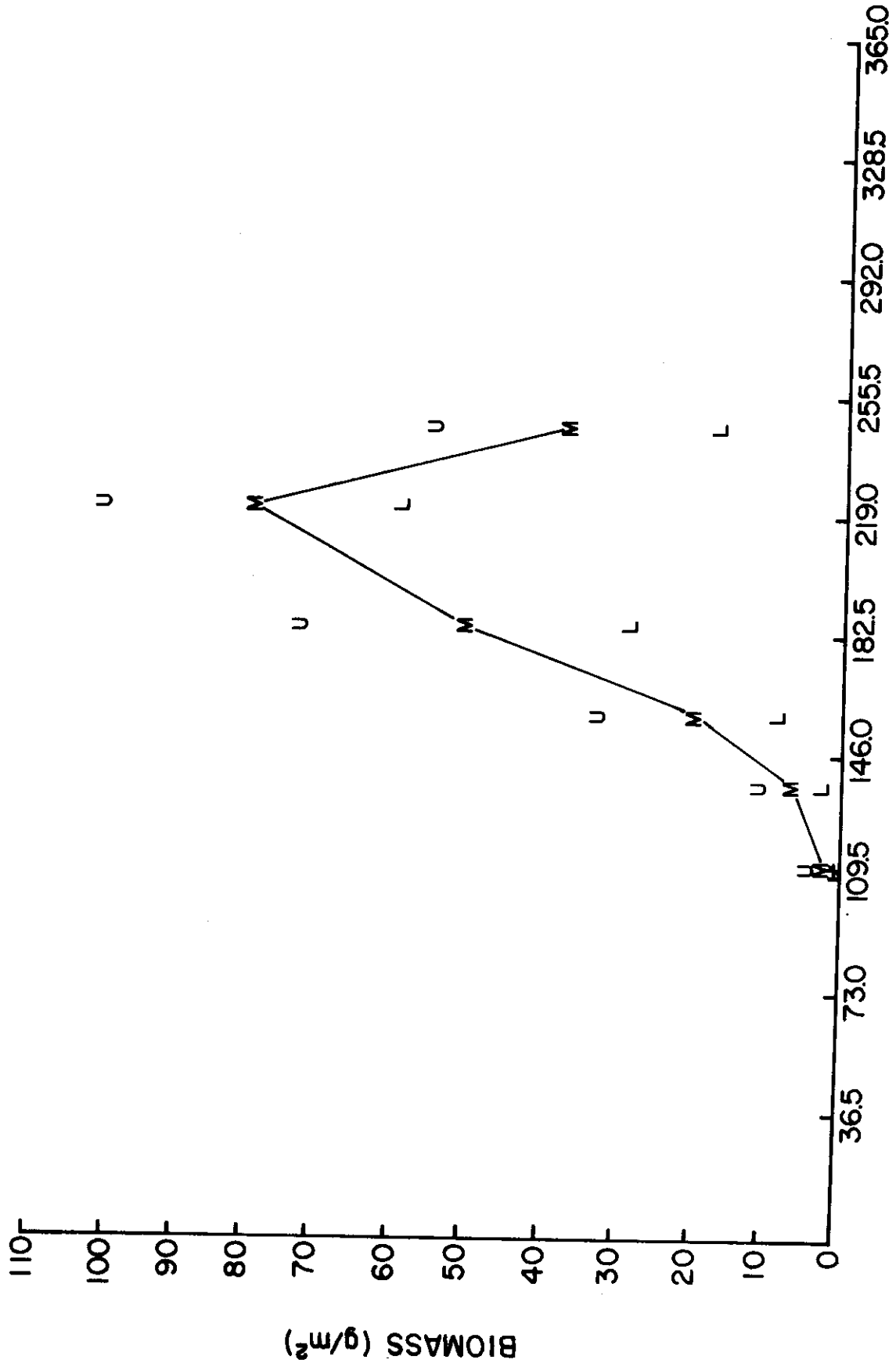

Fig. 11. *Andropogon scoparius* live biomass (g/m^2) from the grazed treatment.

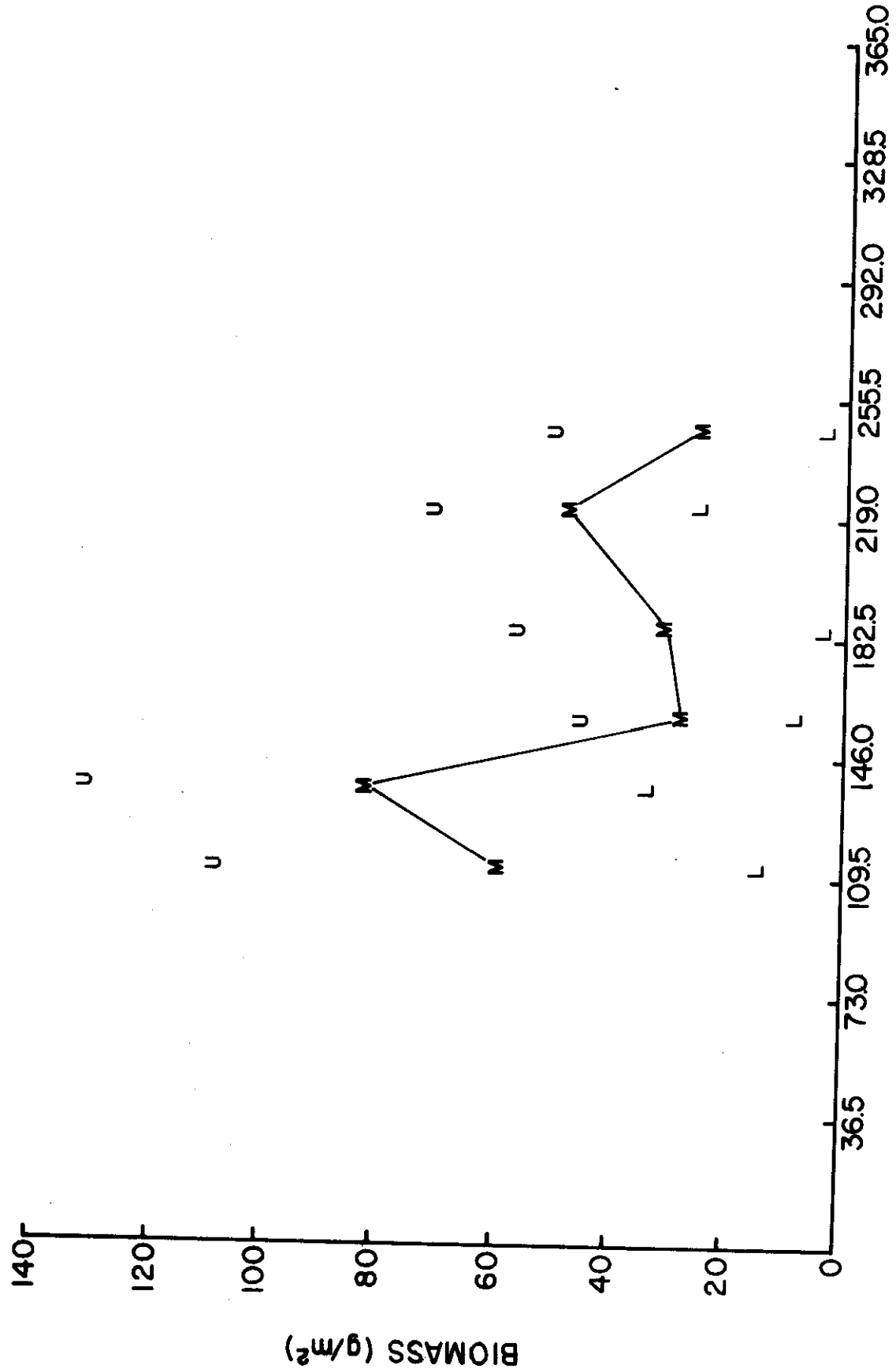

Fig. 12. *Andropogon scoparius* old dead biomass (g/m^2) from the grazed treatment.

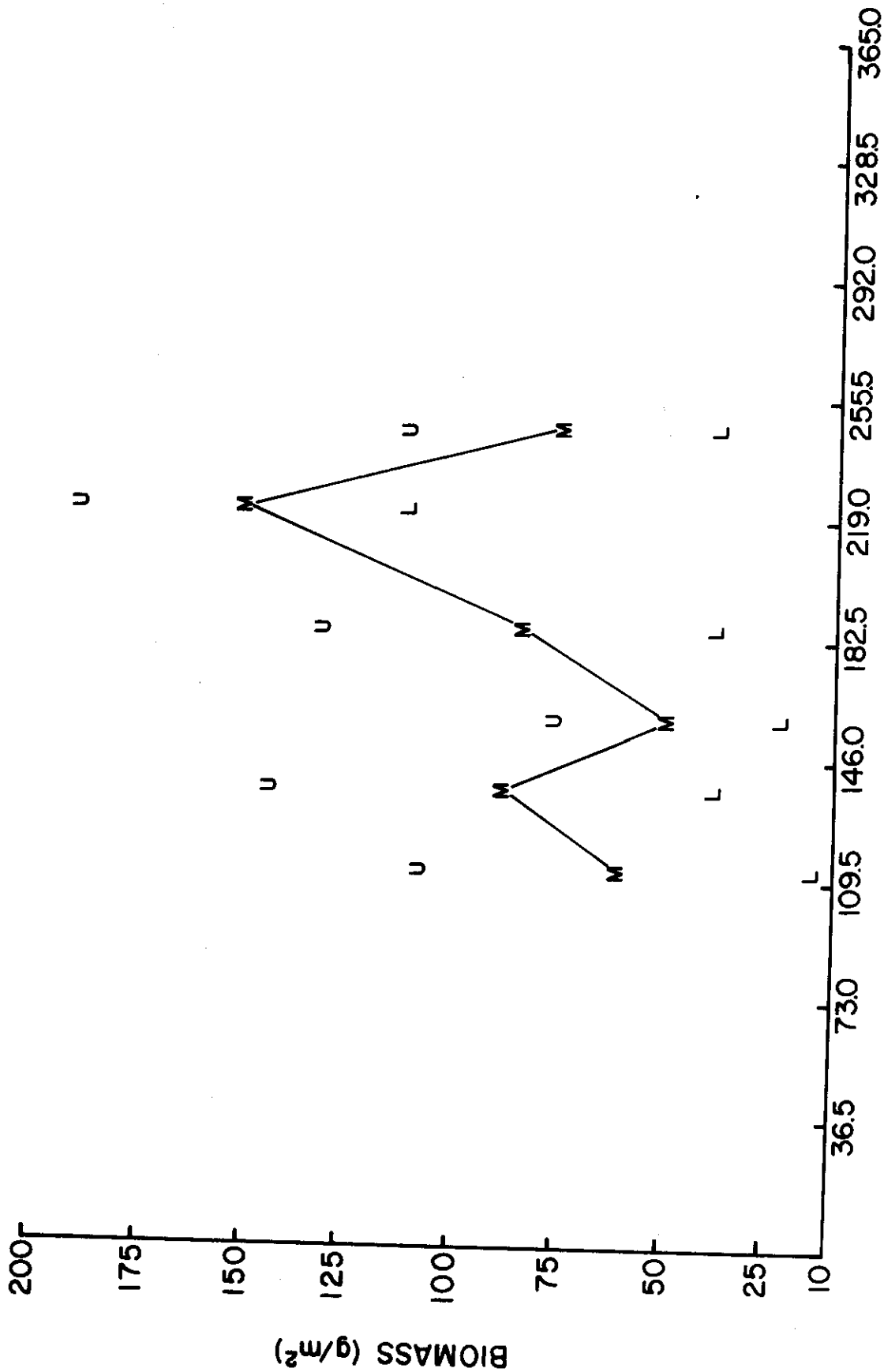

Fig. 13. *Andropogon scoparius* live and dead biomass (g/m^2) from the grazed treatment.

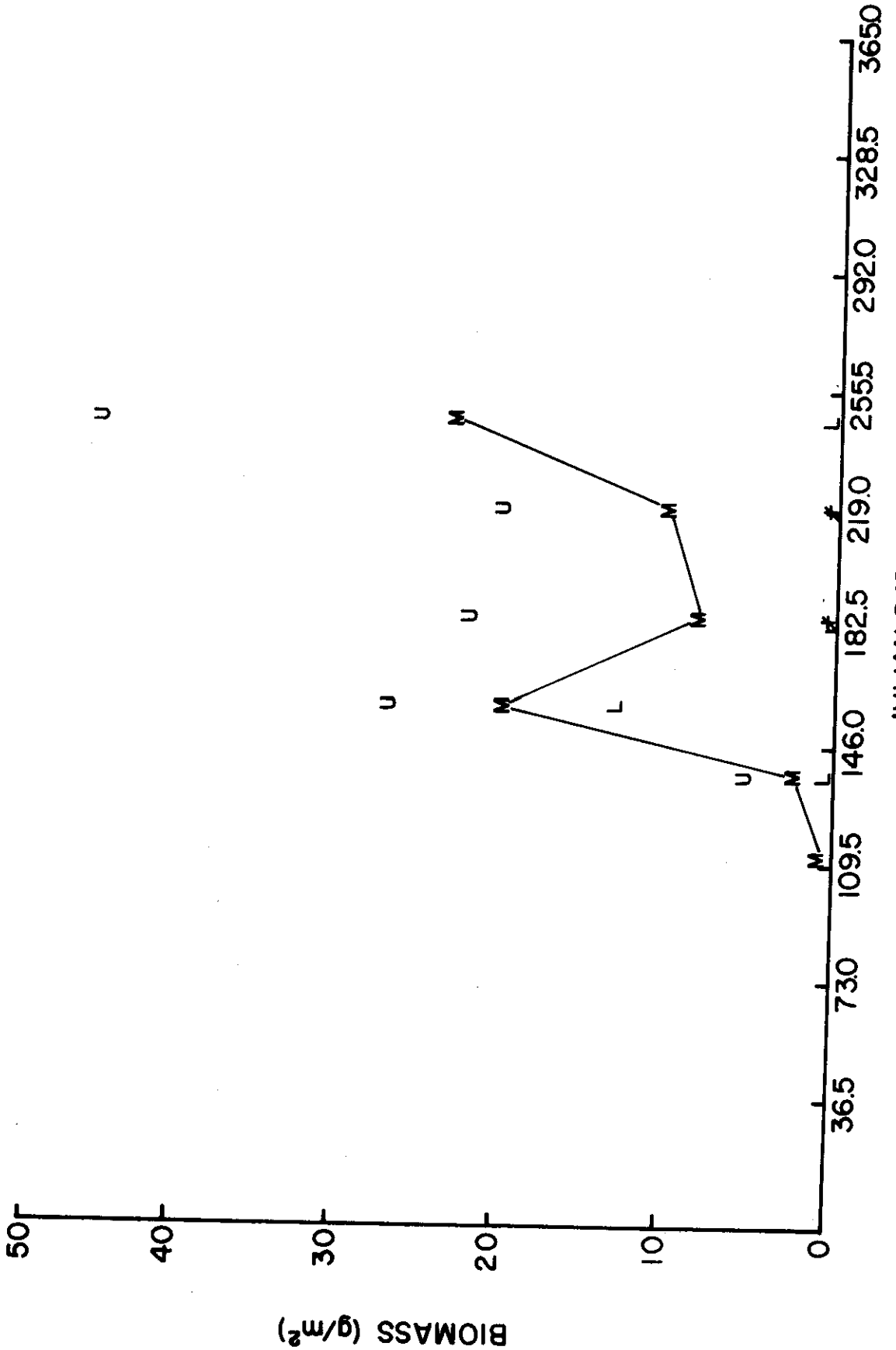

Fig. 14. *Andropogon gerardi* live biomass (g/m^2) from the ungrazed treatment.

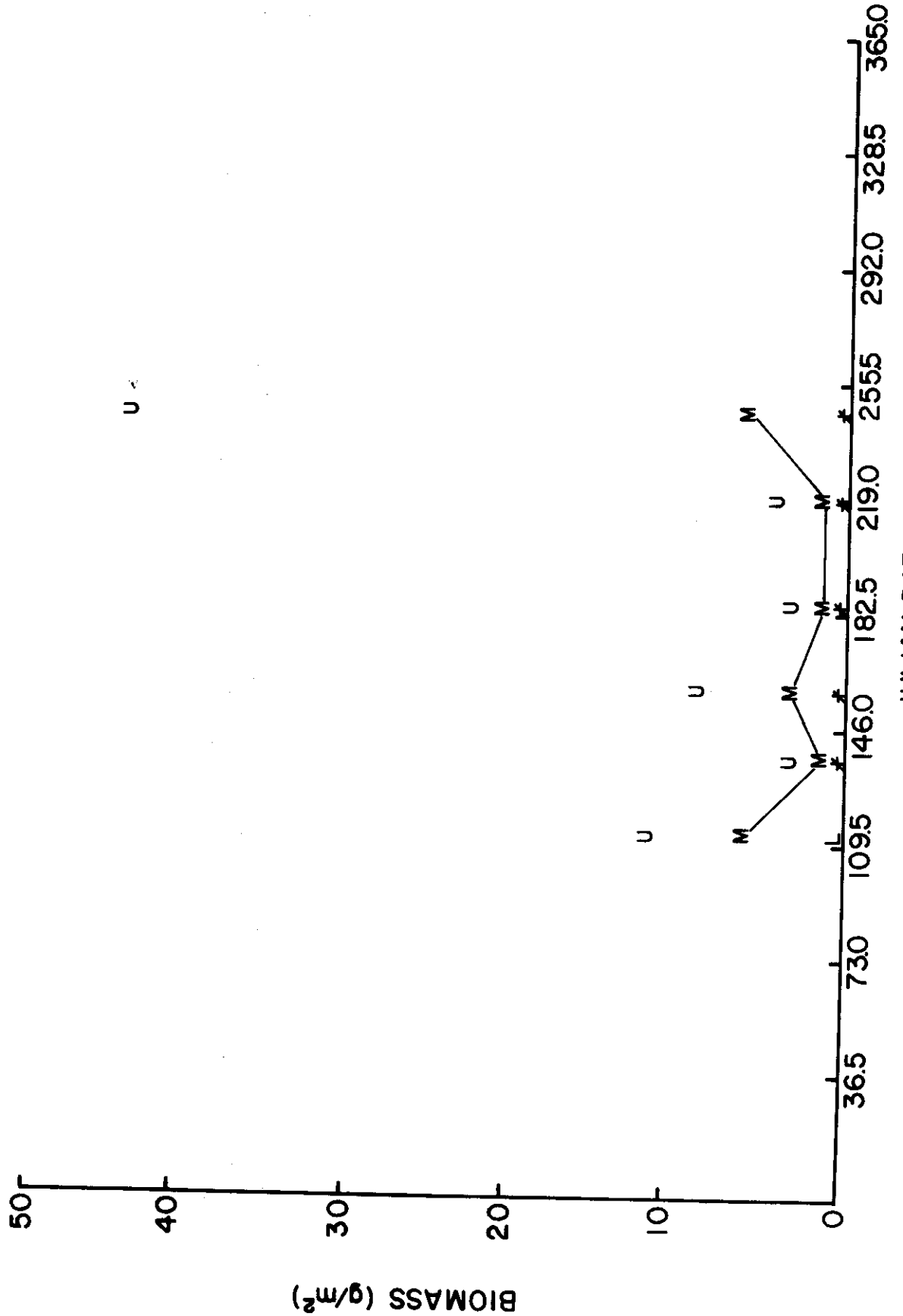

Fig. 15. *Andropogon gerardi* old dead biomass (g/m^2) from the ungrazed treatment.

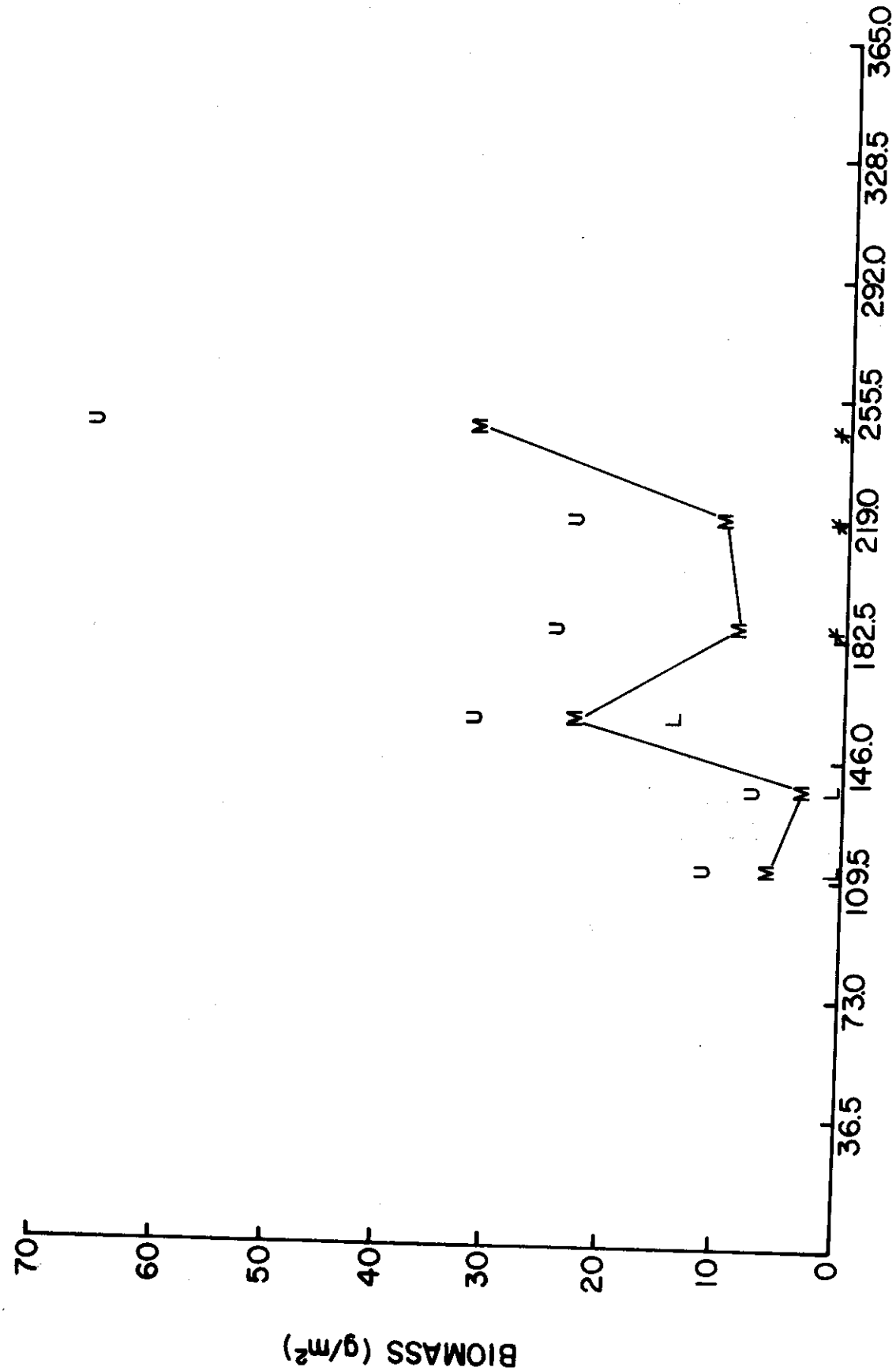

Fig. 16. *Andropogon gerardi* live and dead biomass (g/m^2) from the ungrazed treatment.

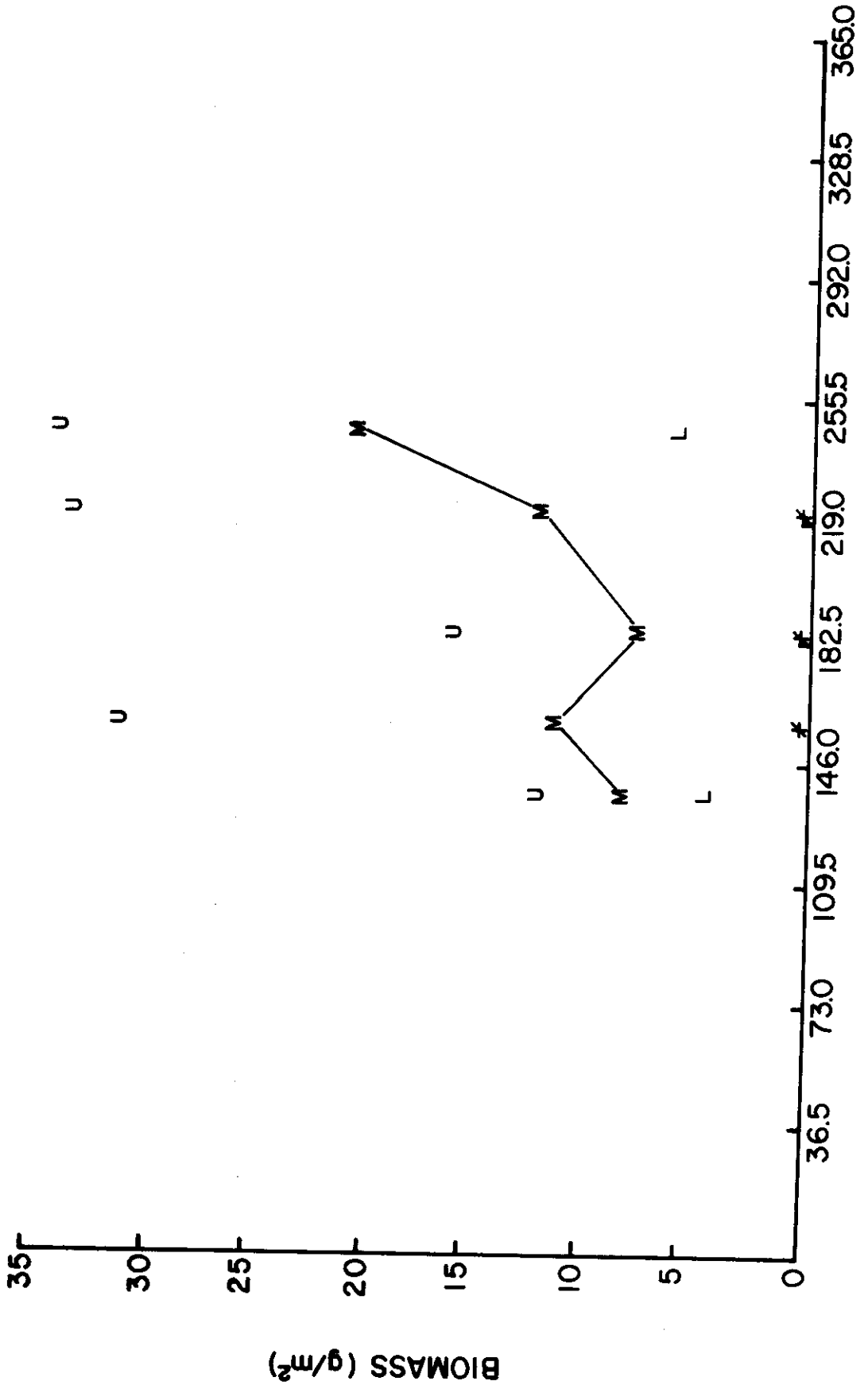

Fig. 17. *Andropogon gerardi* live biomass (g/m^2) from the grazed treatment.

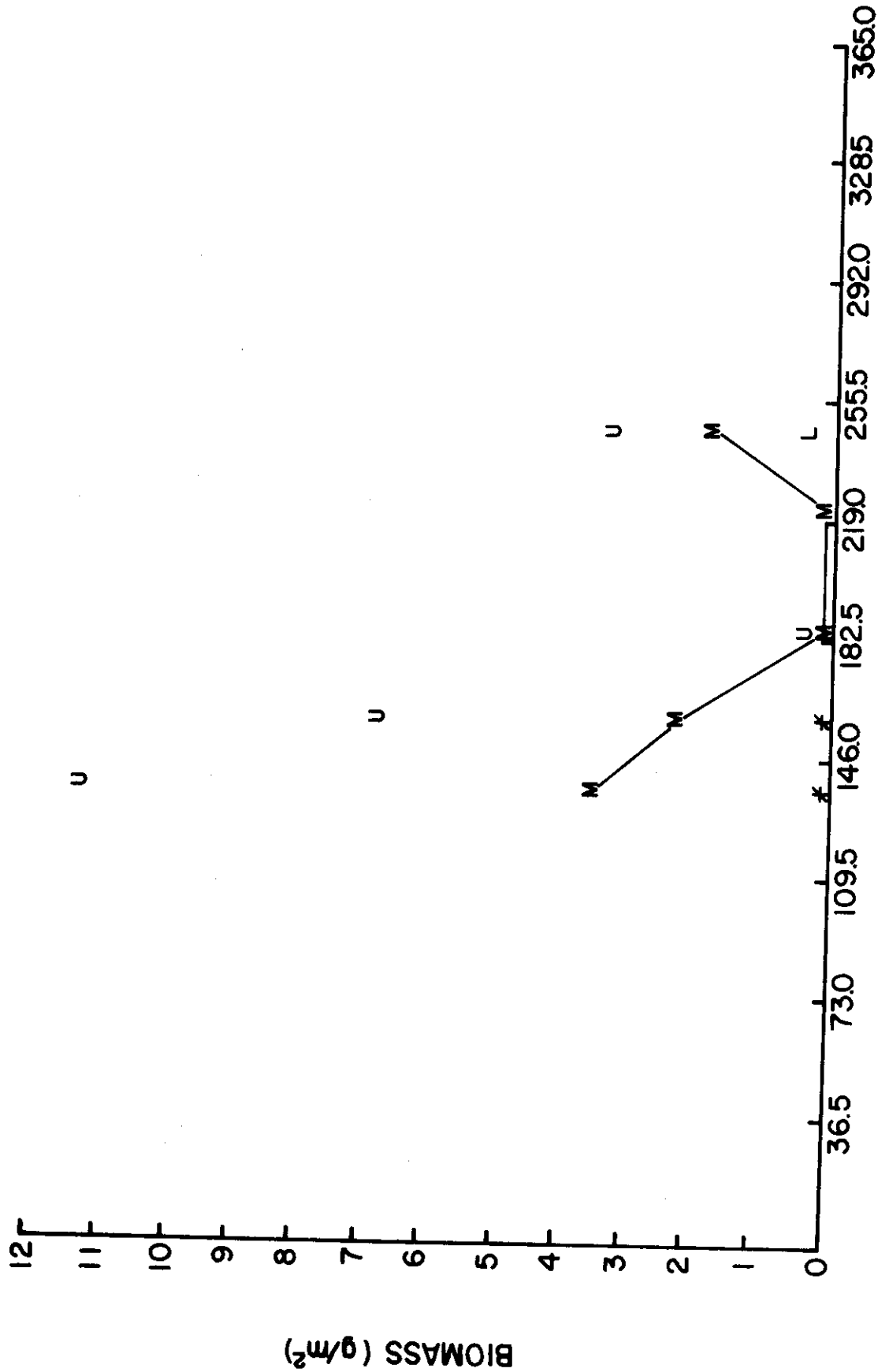

Fig. 18. *Andropogon gerardi* old dead biomass (g/m^2) from the grazed treatment.

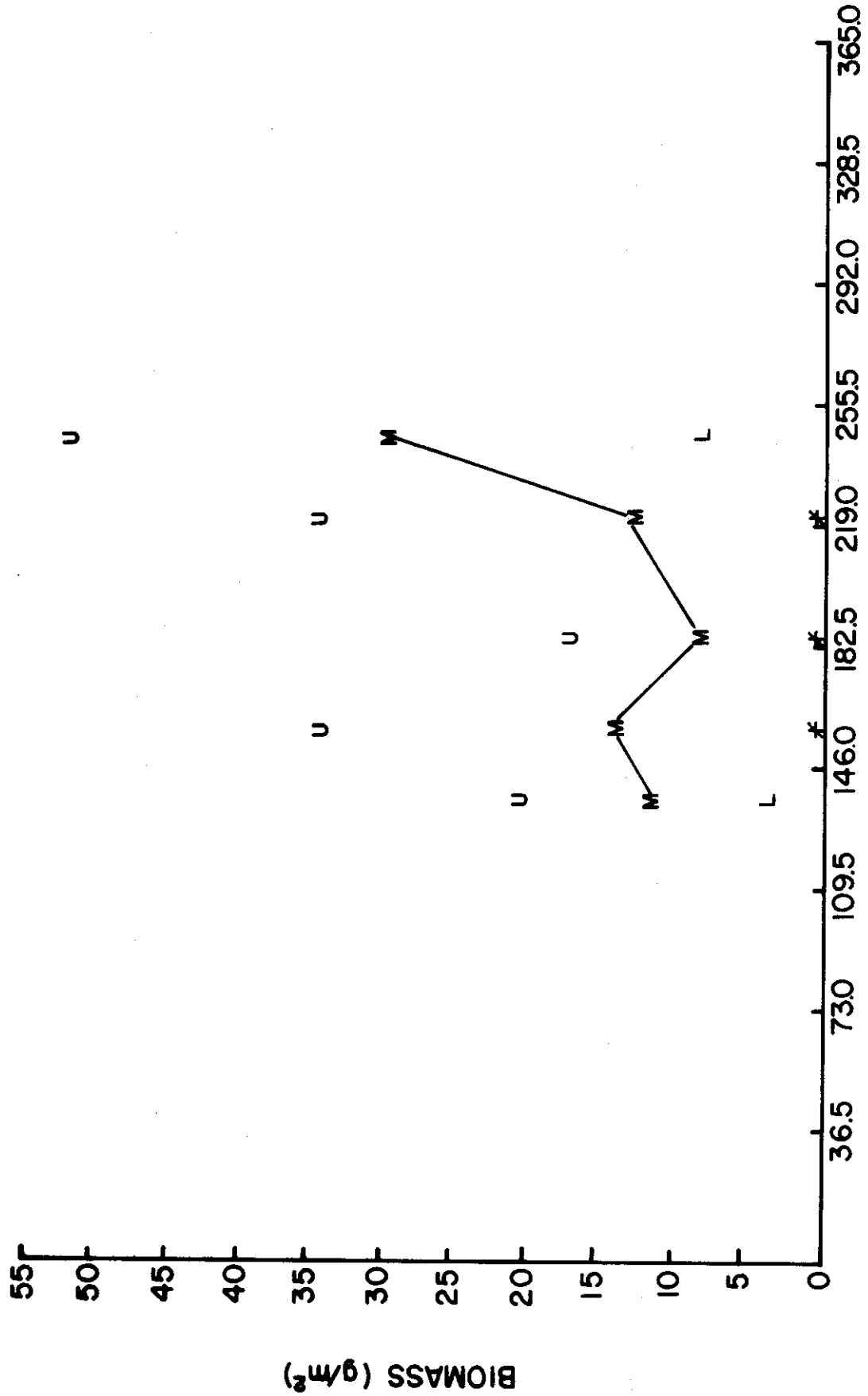

Fig. 19. *Andropogon gerardi* live and dead biomass (g/m^2) from the grazed treatment.

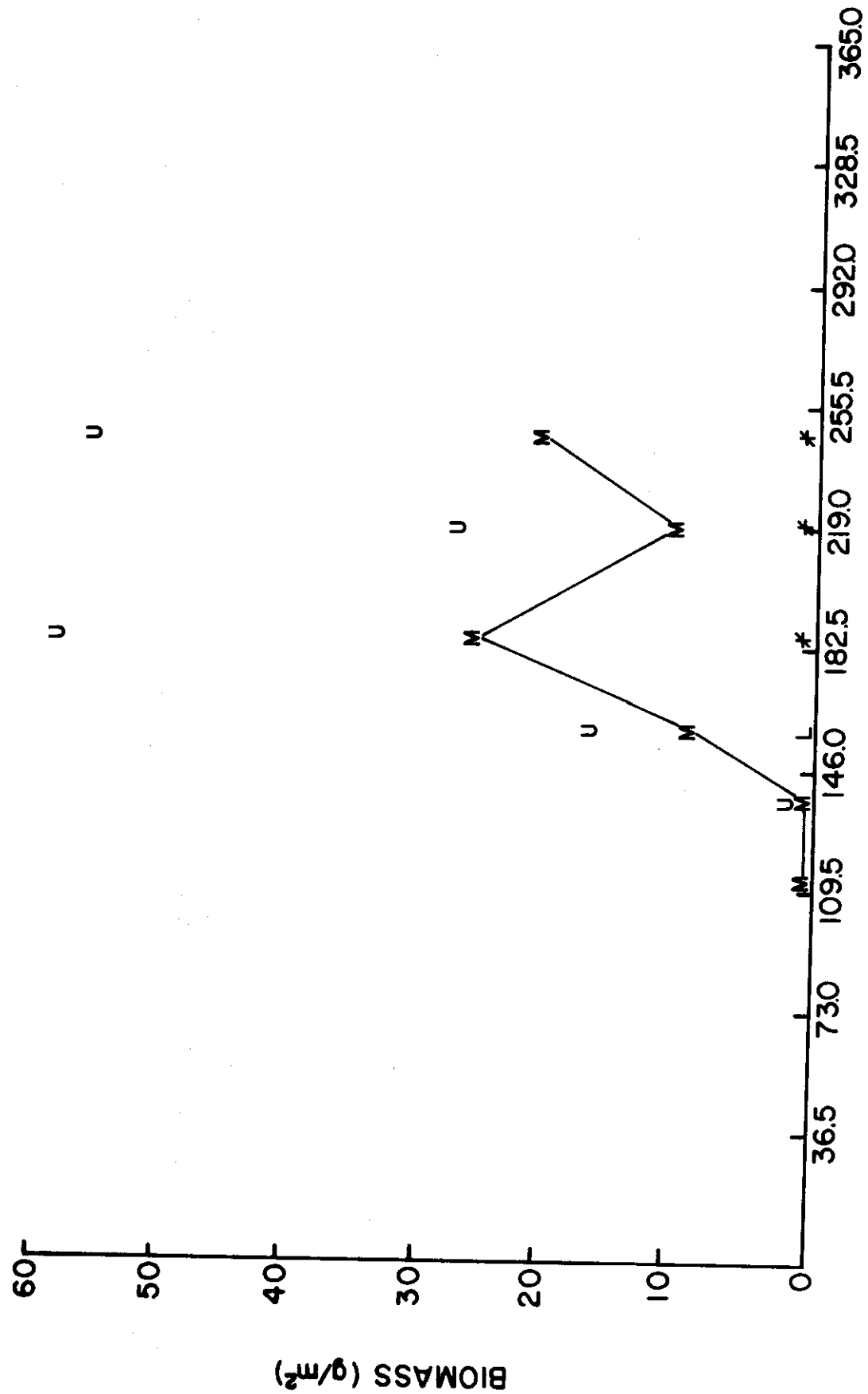

Fig. 20. *Sorghastrum nutans* live biomass (g/m^2) from the ungrazed treatment.

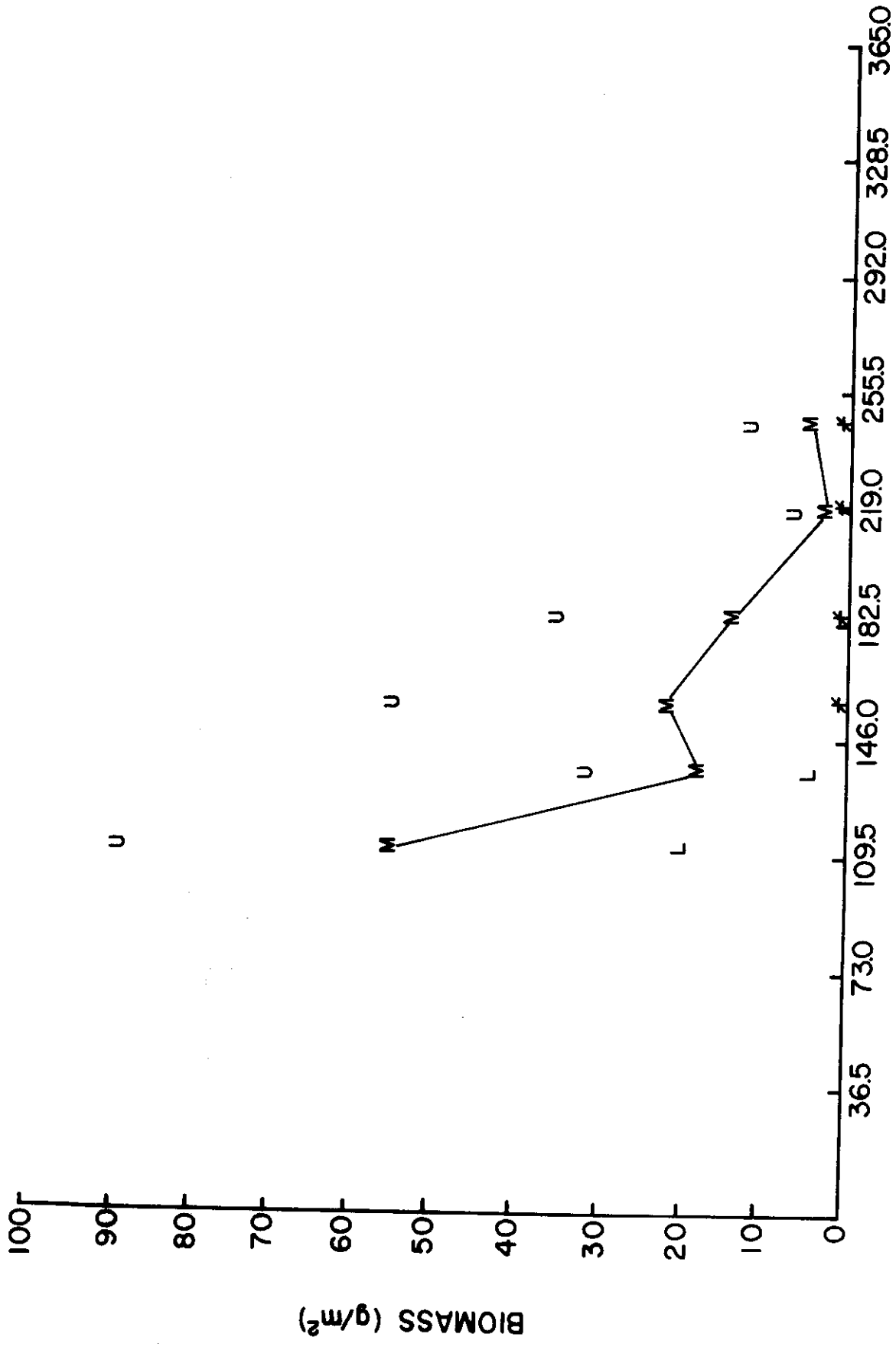

Fig. 21. *Sorghastrum nutans* old dead biomass (g/m^2) from the ungrazed treatment.

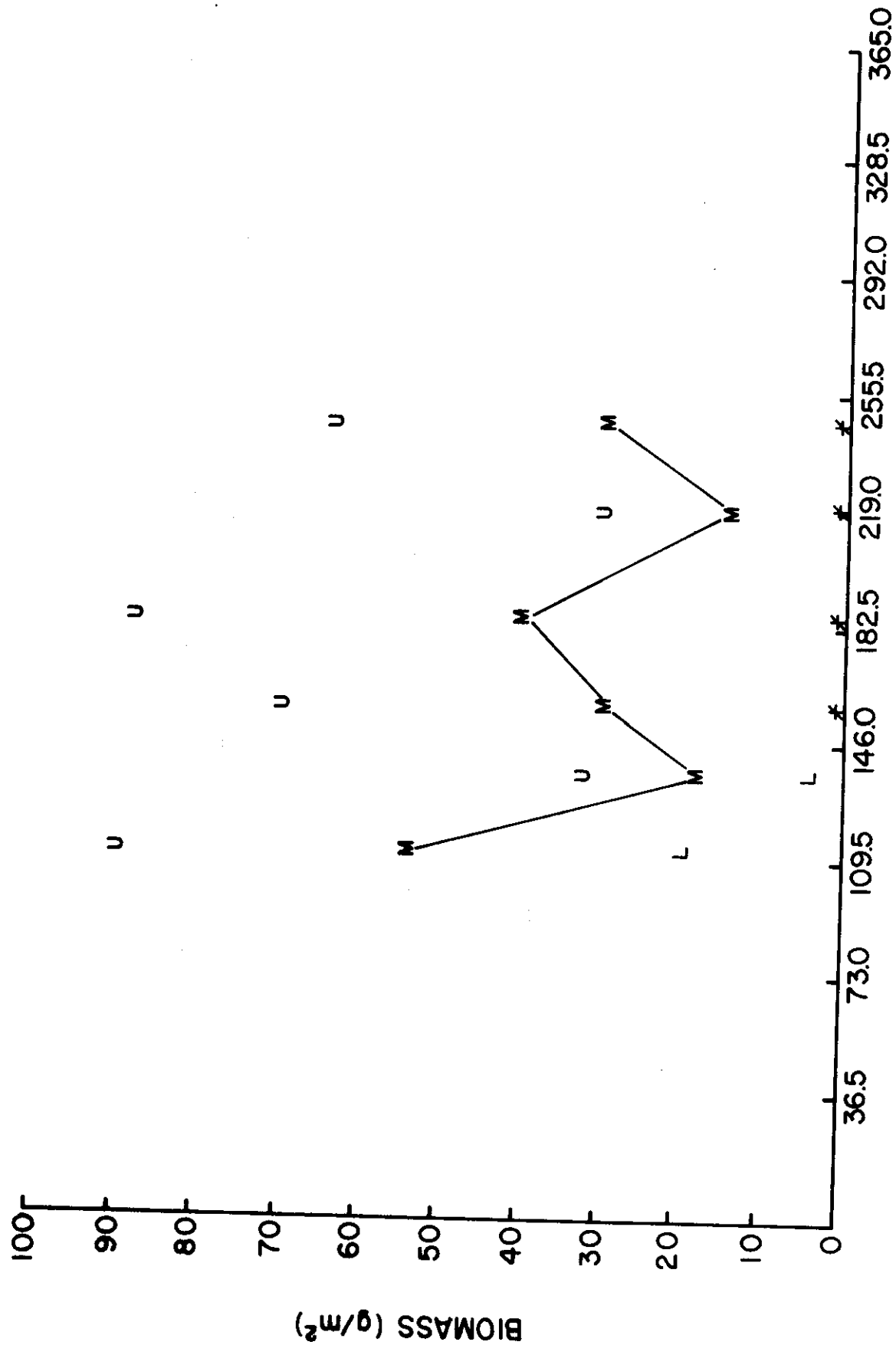

Fig. 22. *Sorghastrum nutans* live and dead biomass (g/m^2) from the ungrazed treatment.

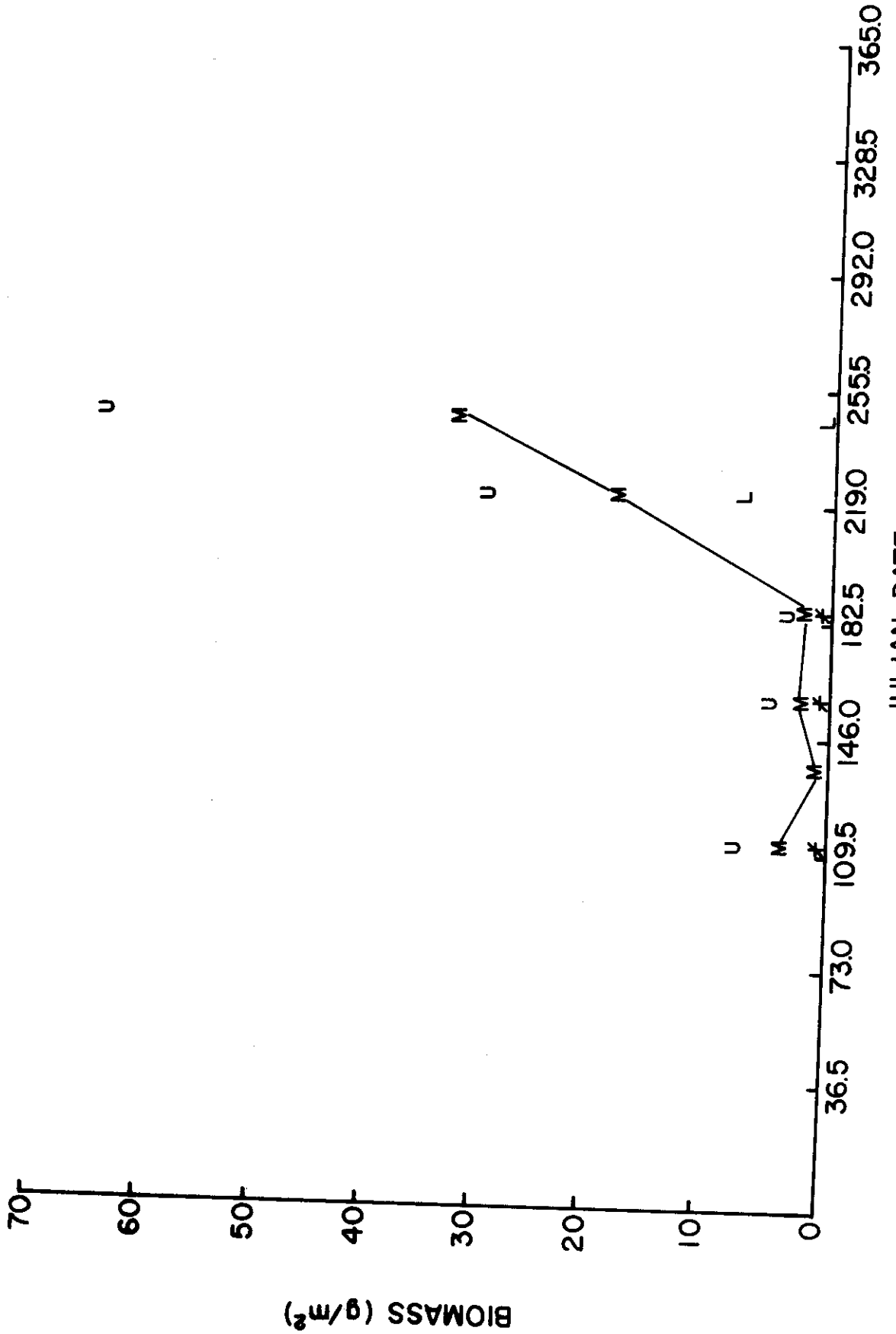

Fig. 23. *Sorghastrum nutans* live biomass (g/m^2) from the grazed treatment.

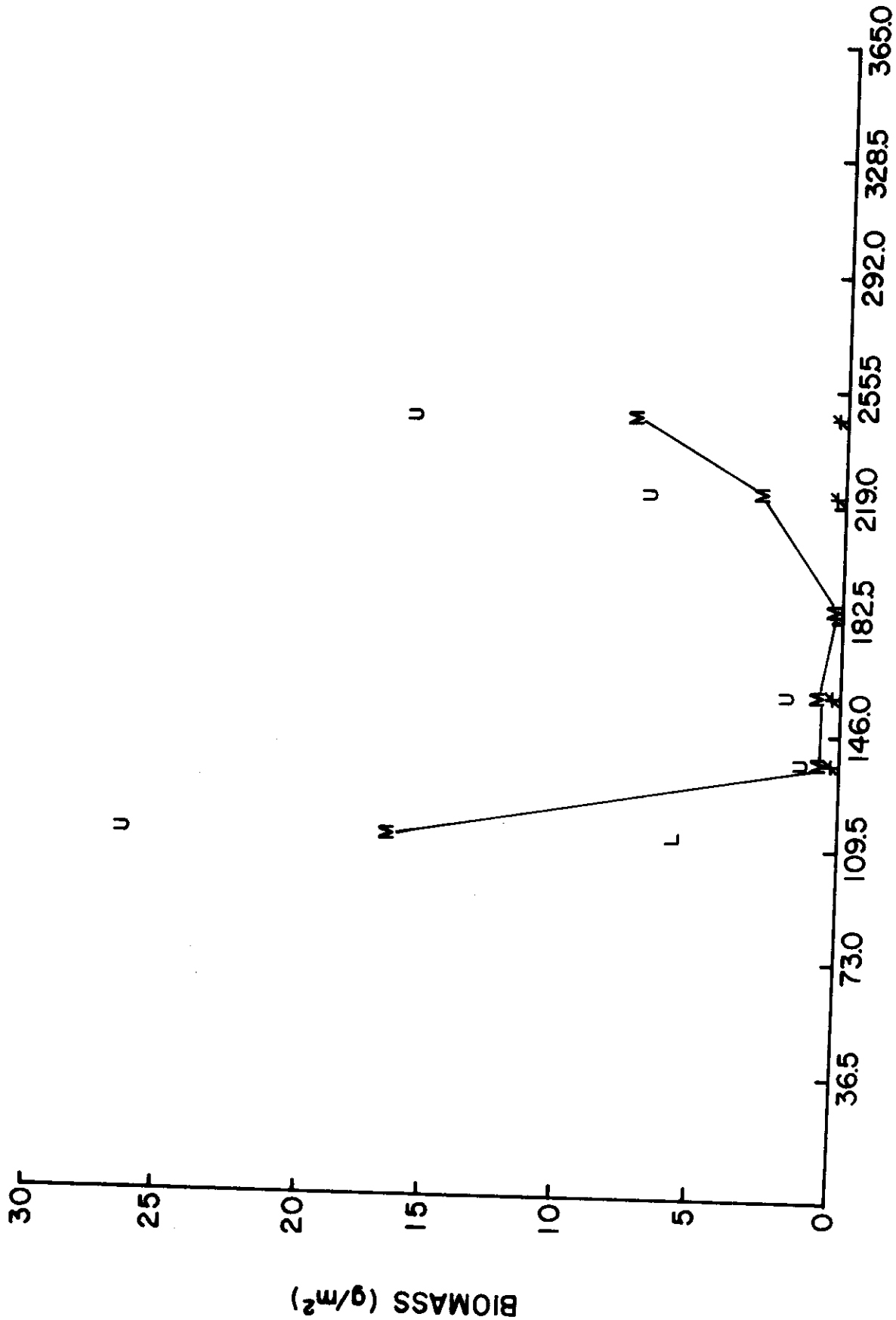

Fig. 24. *Sorghastrum nutans* old dead biomass (g/m^2) from the grazed treatment.

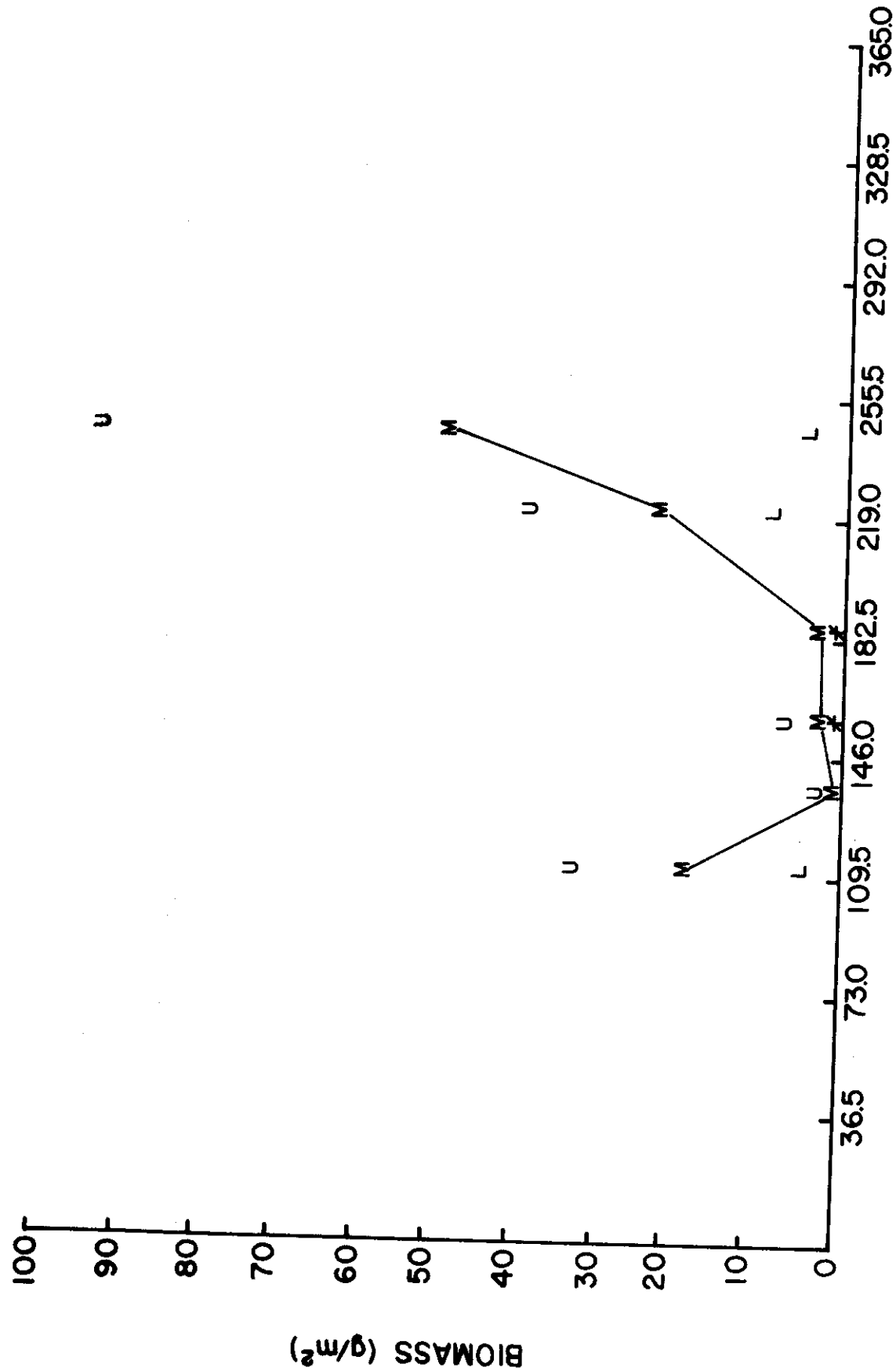

Fig. 25. *Sorghastrum nutans* live and dead biomass (g/m^2) from the grazed treatment.

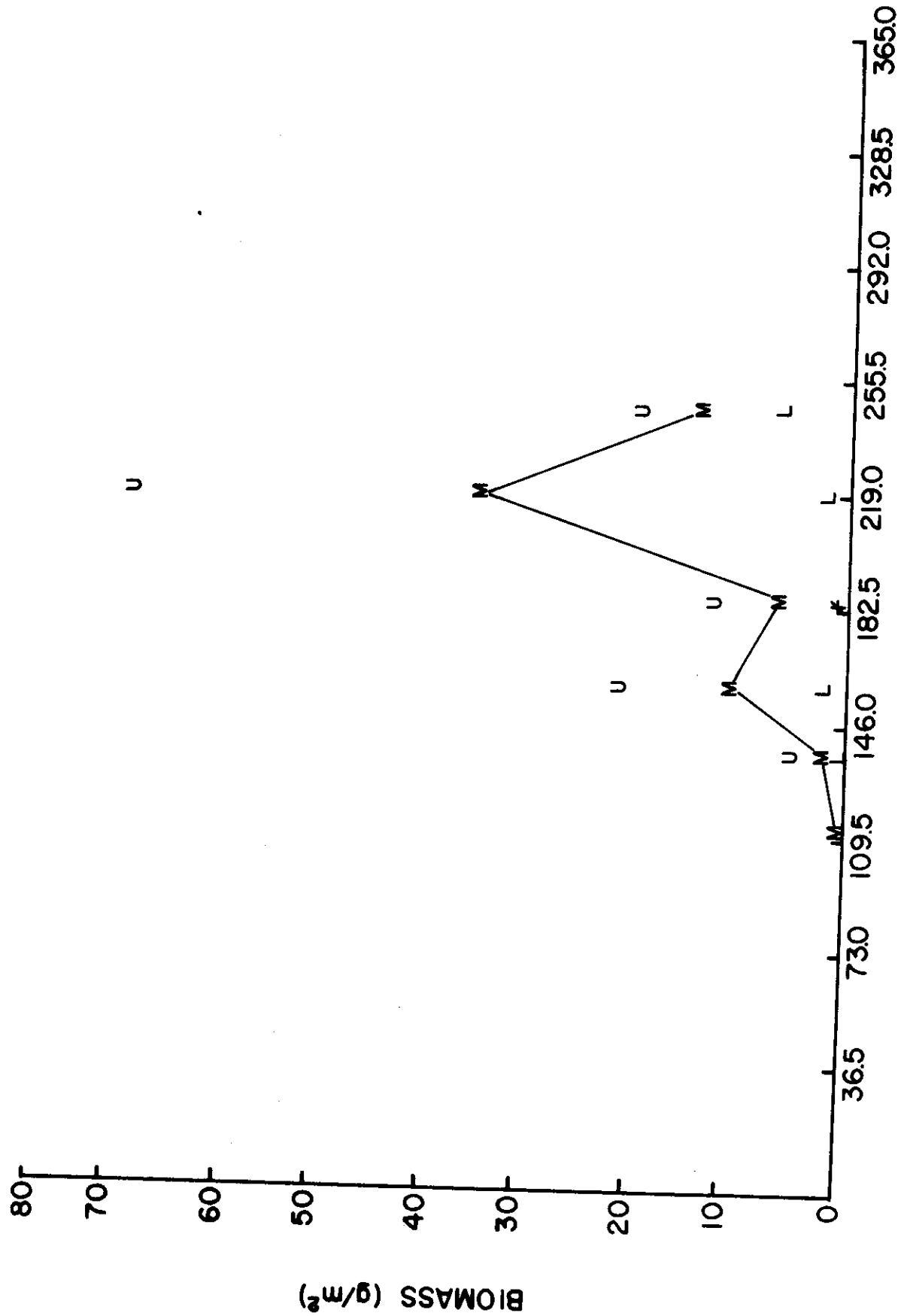

Fig. 26. *Sporobolus asper* live biomass (g/m^2) from the ungrazed treatment.

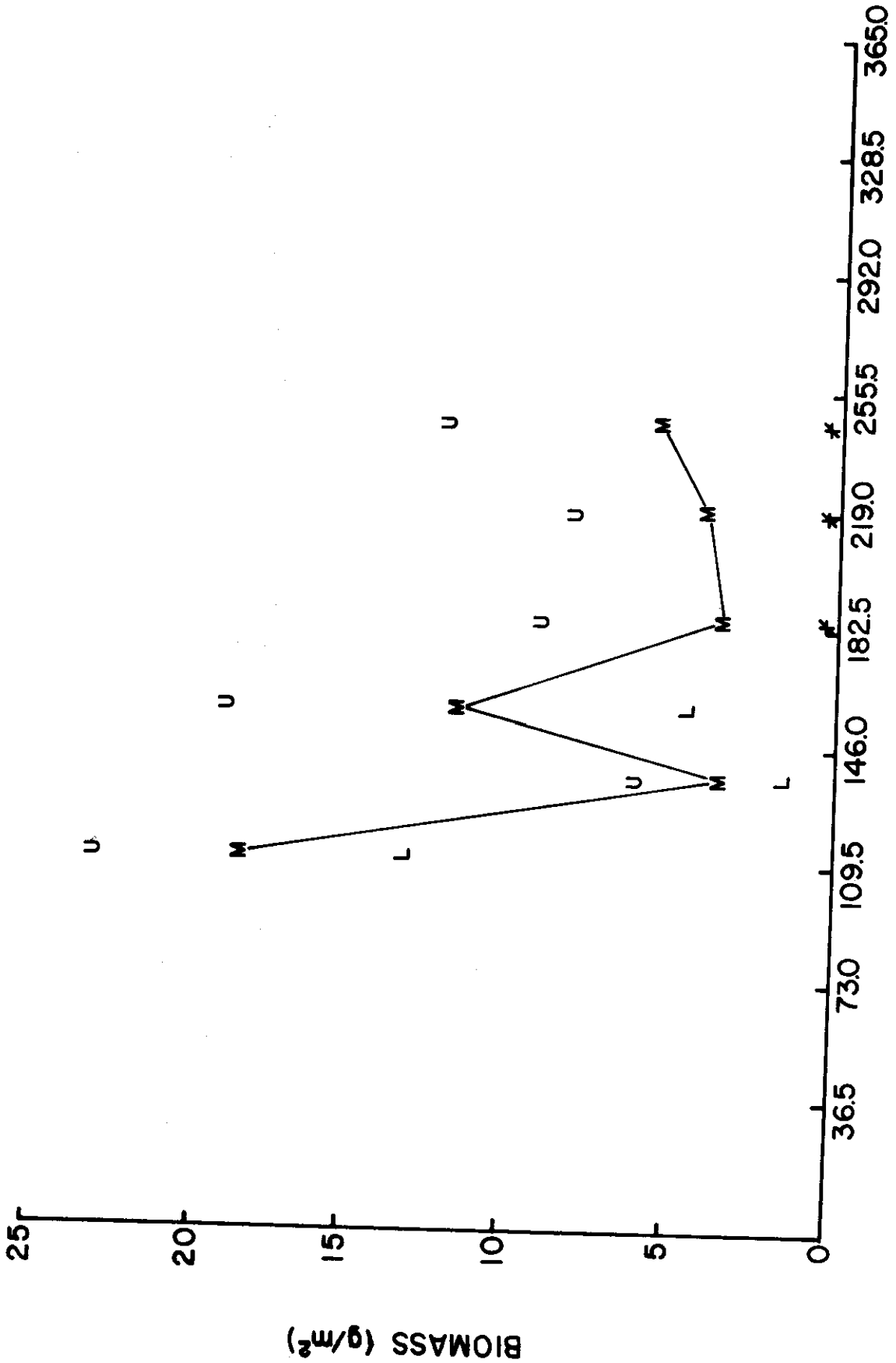

Fig. 27. *Sprobobolus asper* old dead biomass (g/m^2) from the ungrazed treatment.

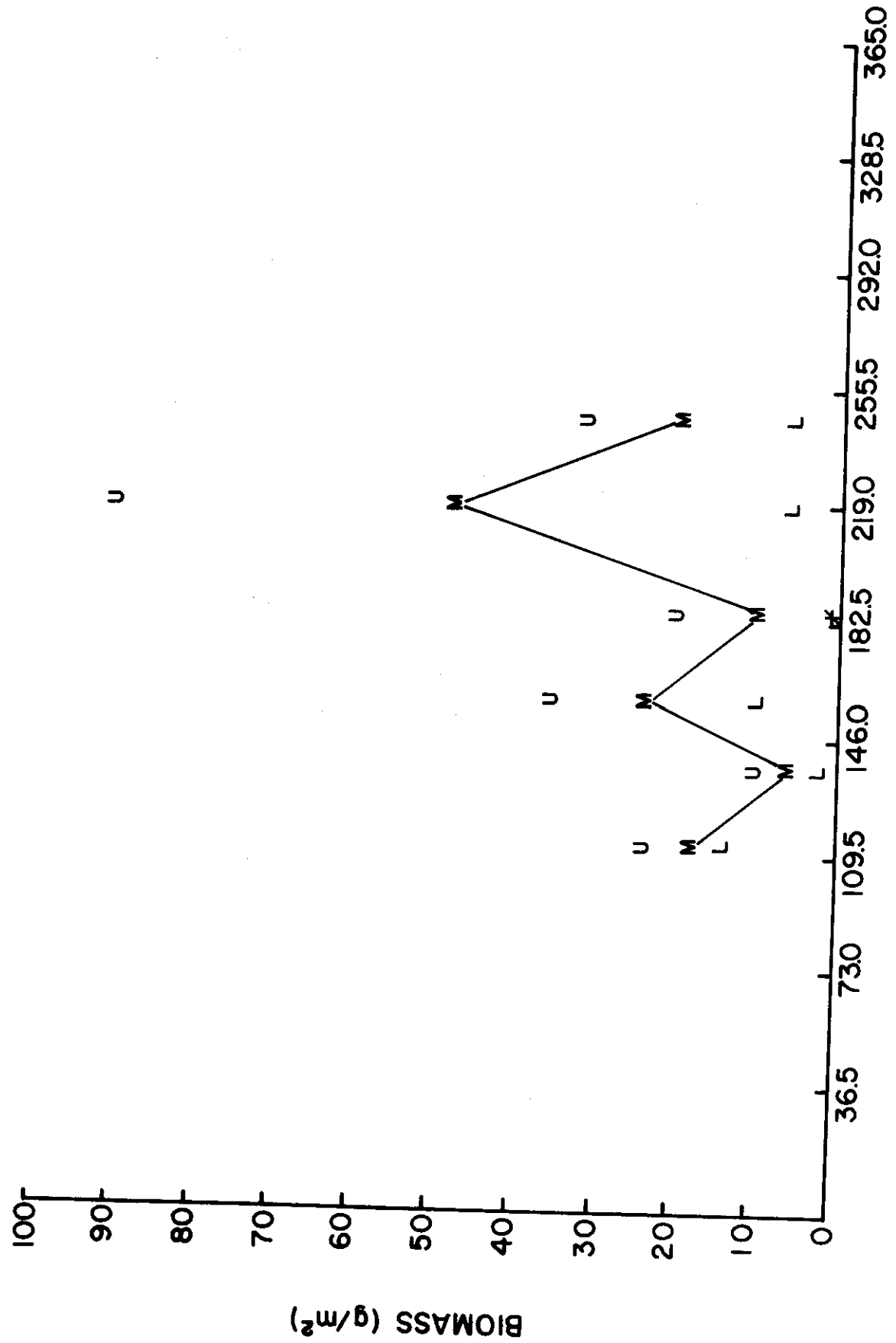

Fig. 28. *Sporobolus asper* live and dead biomass (g/m^2) from the ungrazed treatment.

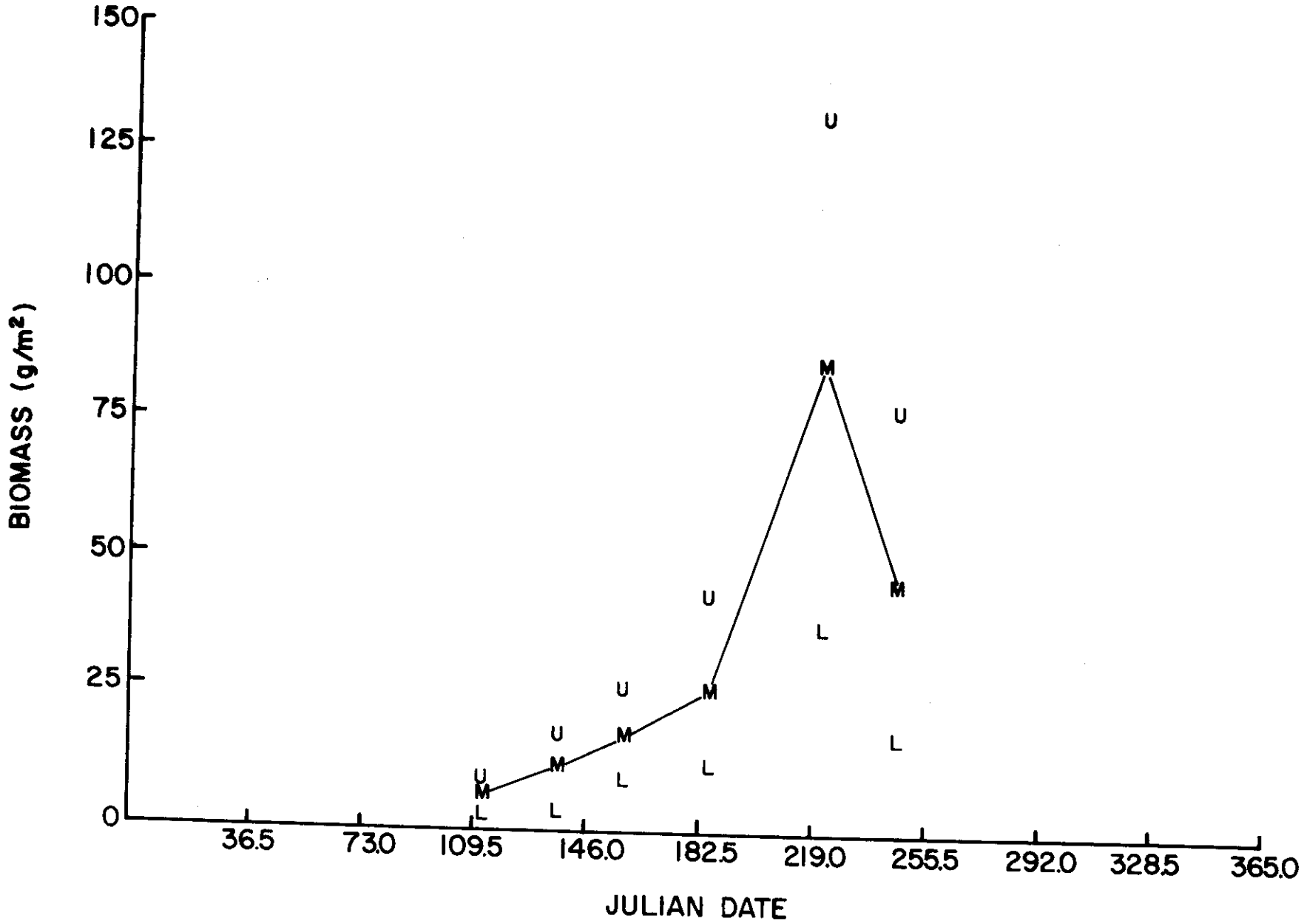

Fig. 29. *Sporobolus aeper* live biomass (g/m^2) from the grazed treatment.

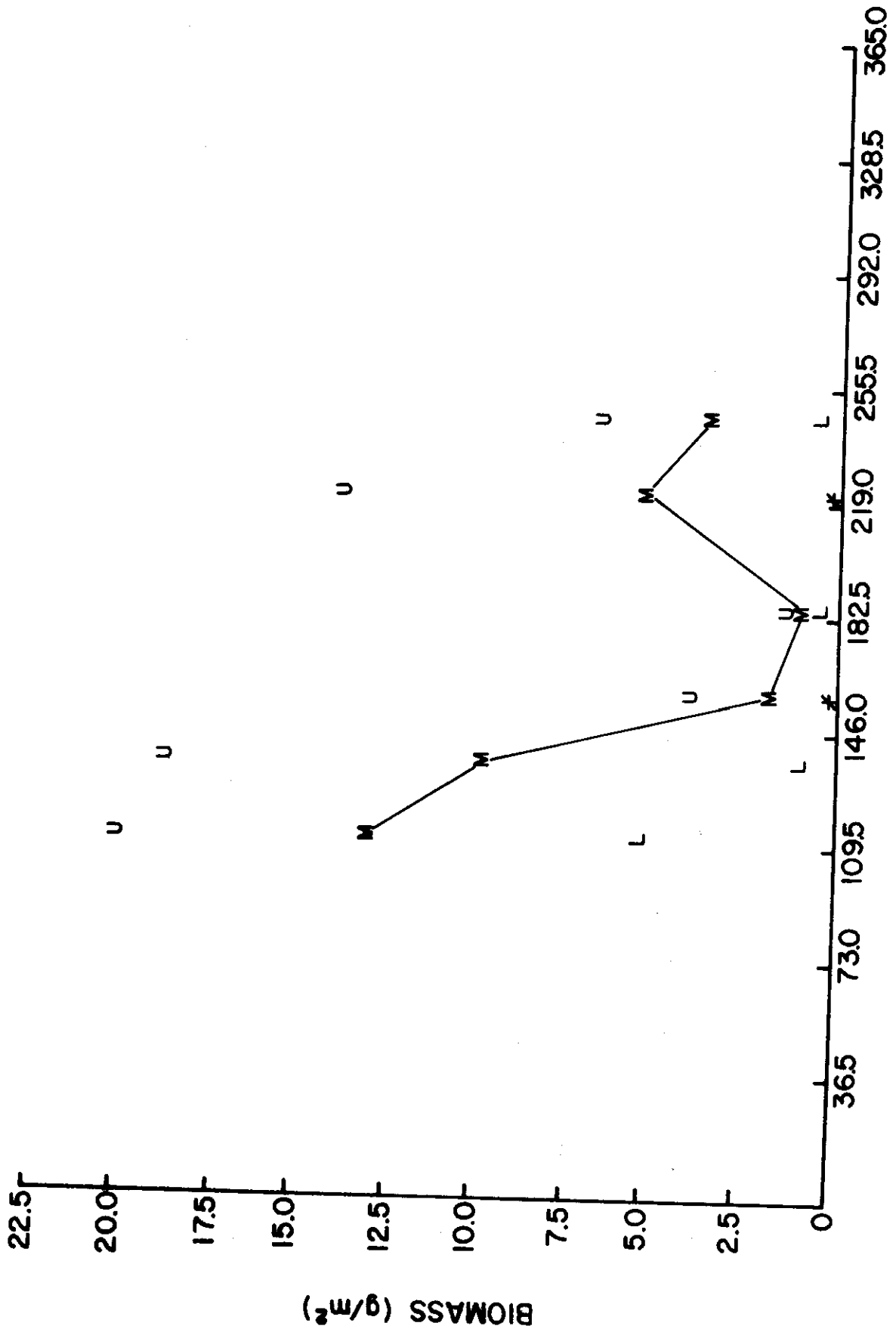

Fig. 30. *Sporobolus asper* old dead biomass (g/m^2) from the grazed treatment.

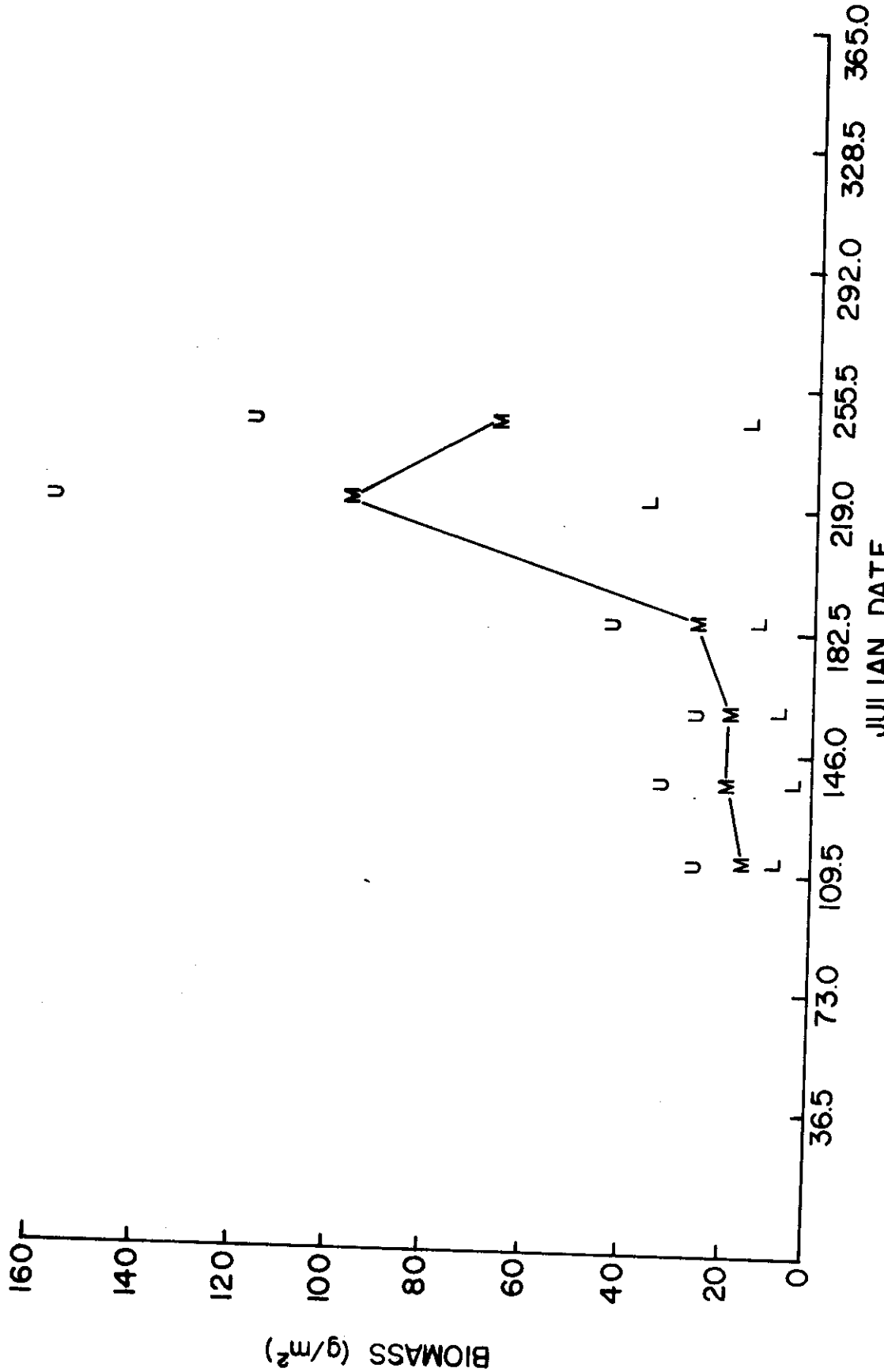

Fig. 31. *Sporobolus asper* live and dead biomass (g/m^2) from the grazed treatment.

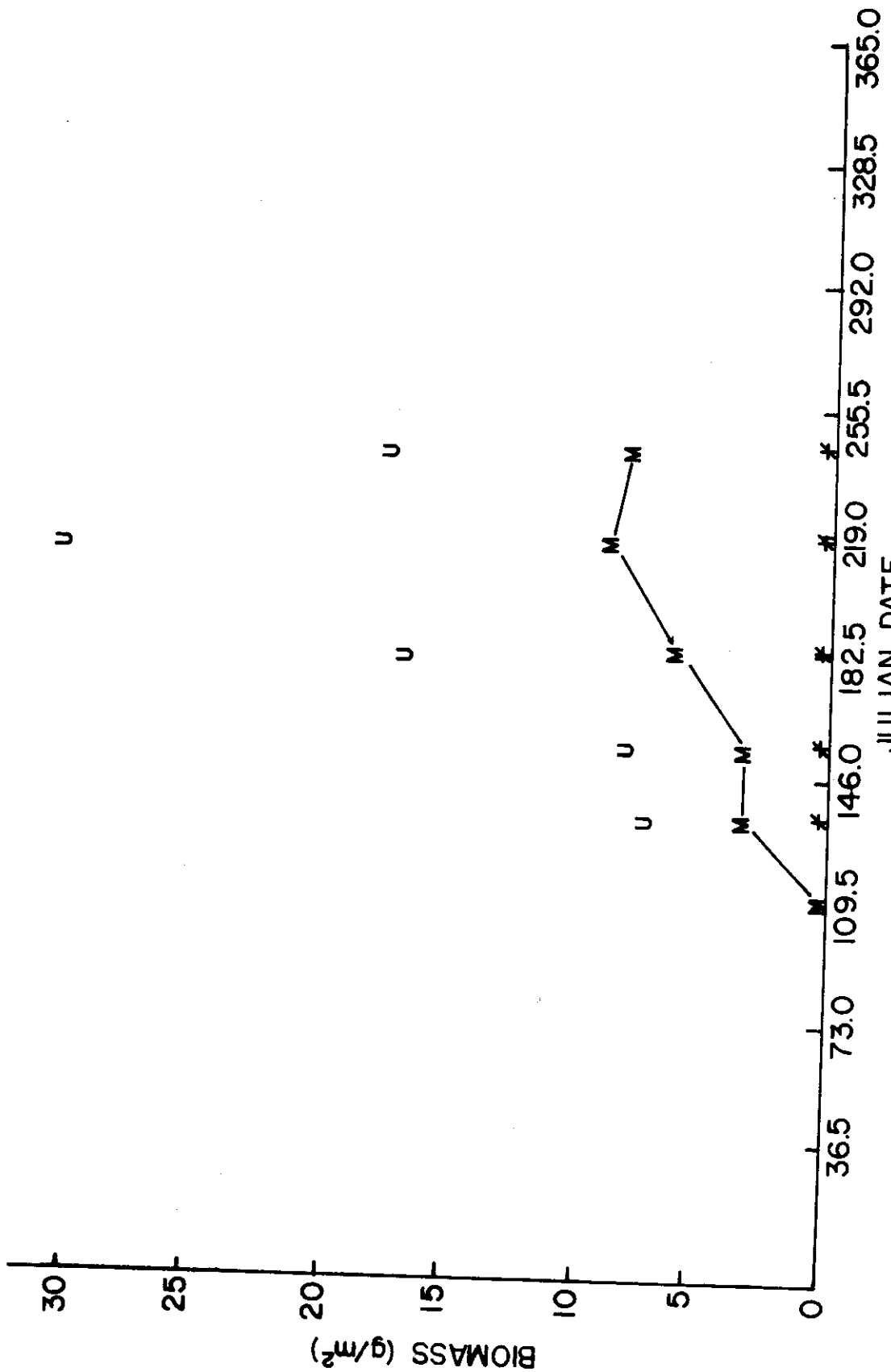

Fig. 32. *Panicum virgatum* live biomass (g/m^2) from the ungrazed treatment.

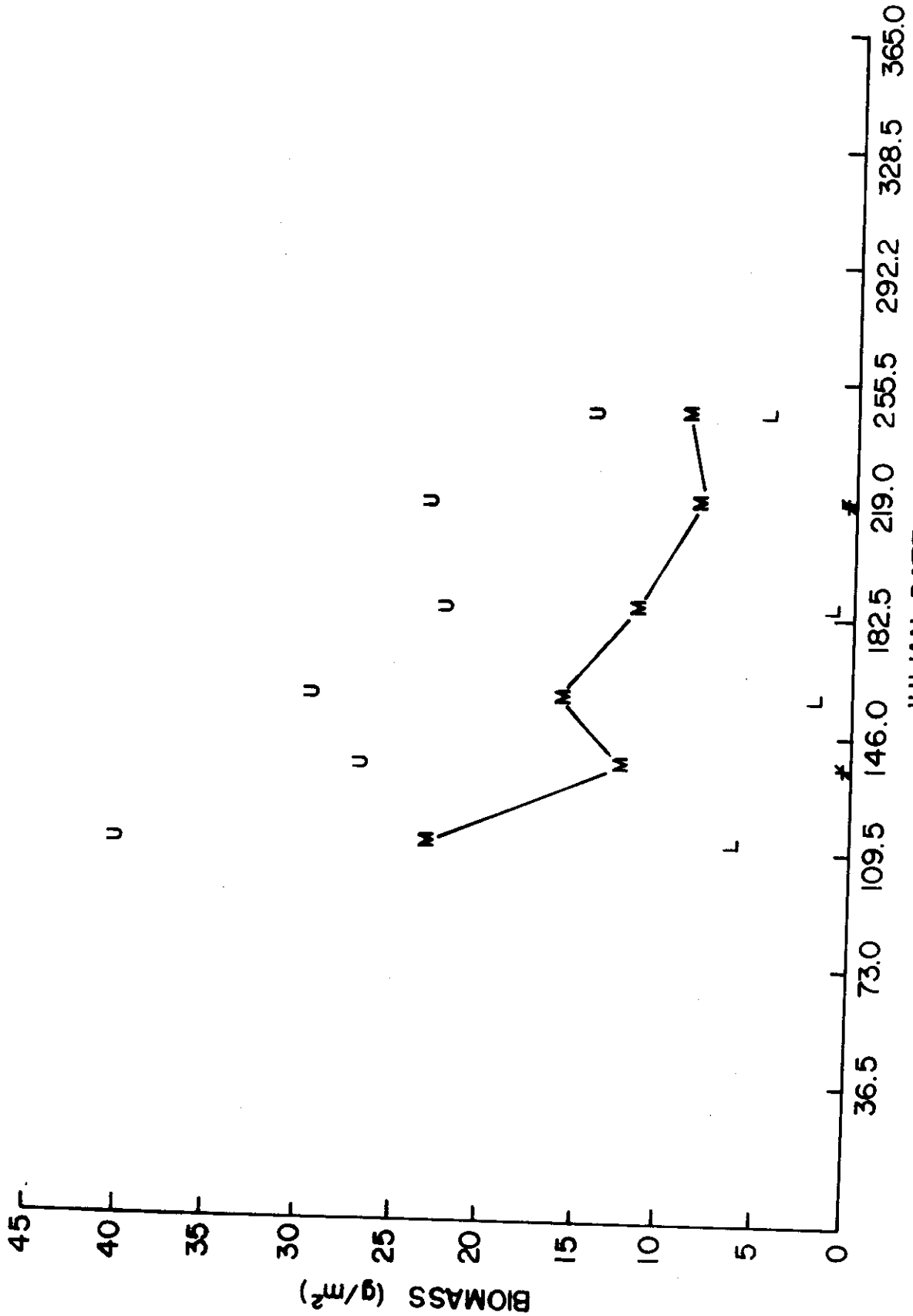

Fig. 33. *Panicum virgatum* old dead biomass (g/m^2) from the ungrazed treatment.

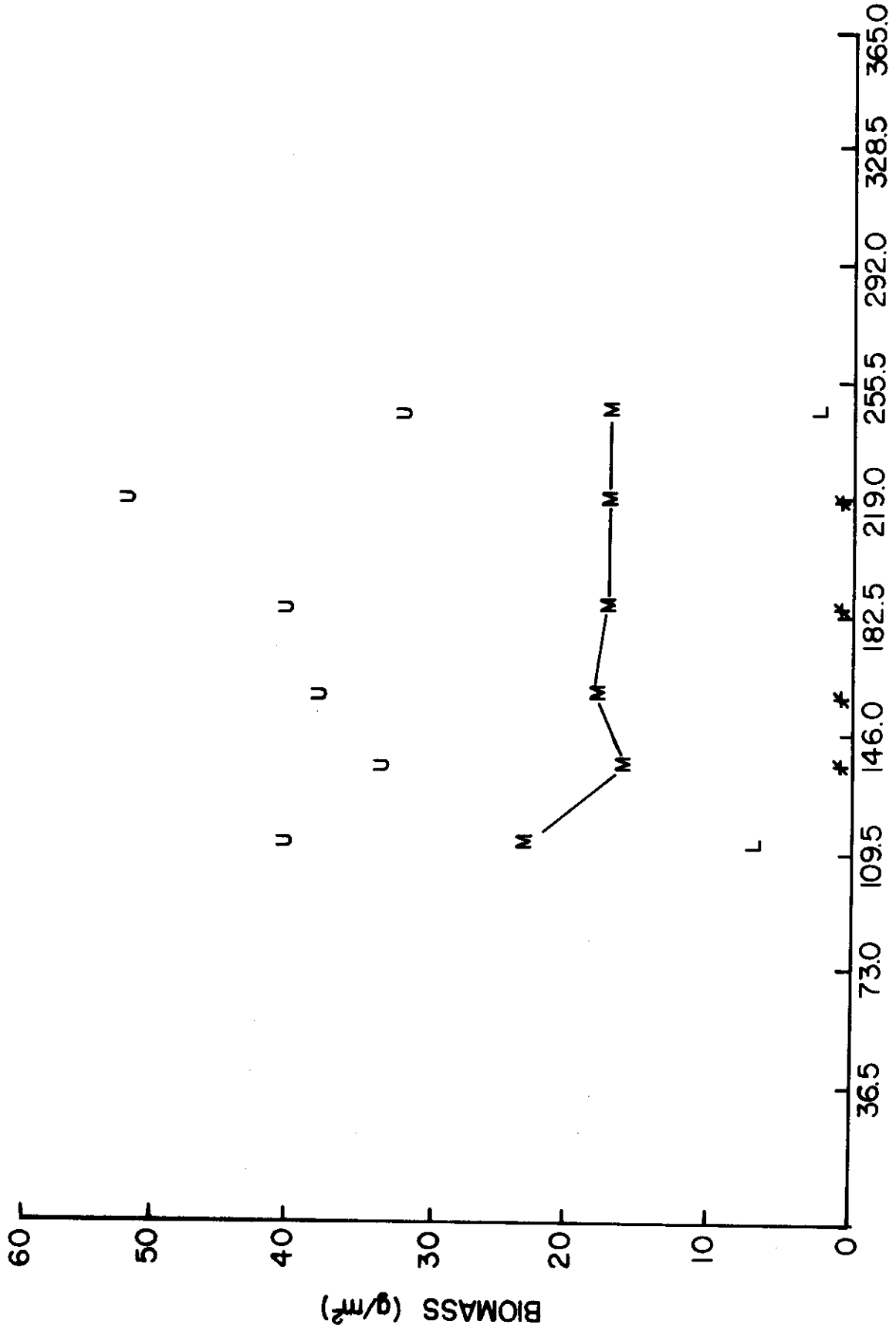

Fig. 34. *Panicum virgatum* live and dead biomass (g/m^2) from the ungrazed treatment.

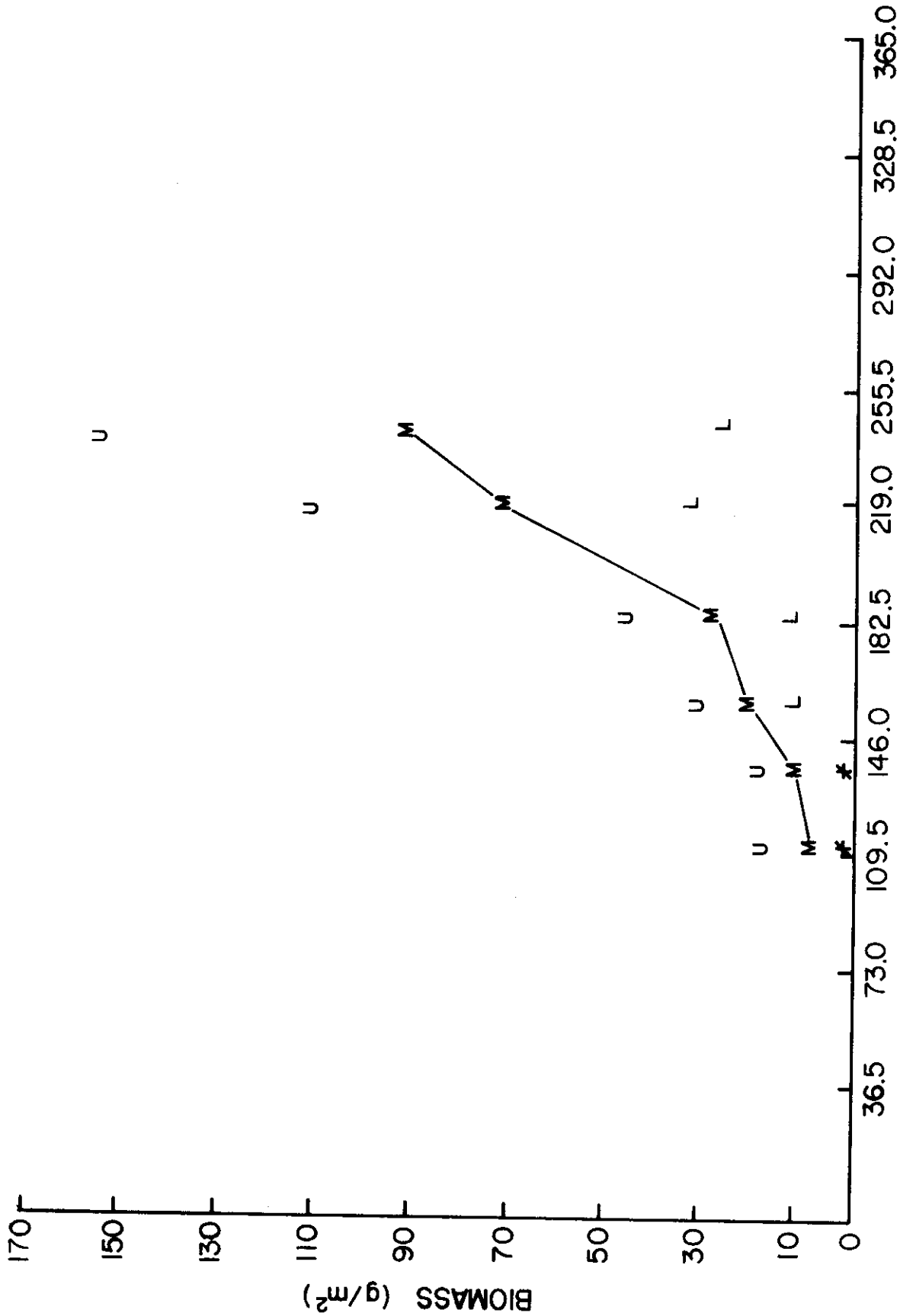

Fig. 35. *Panicum virgatum* live biomass (g/m^2) from the grazed treatment.

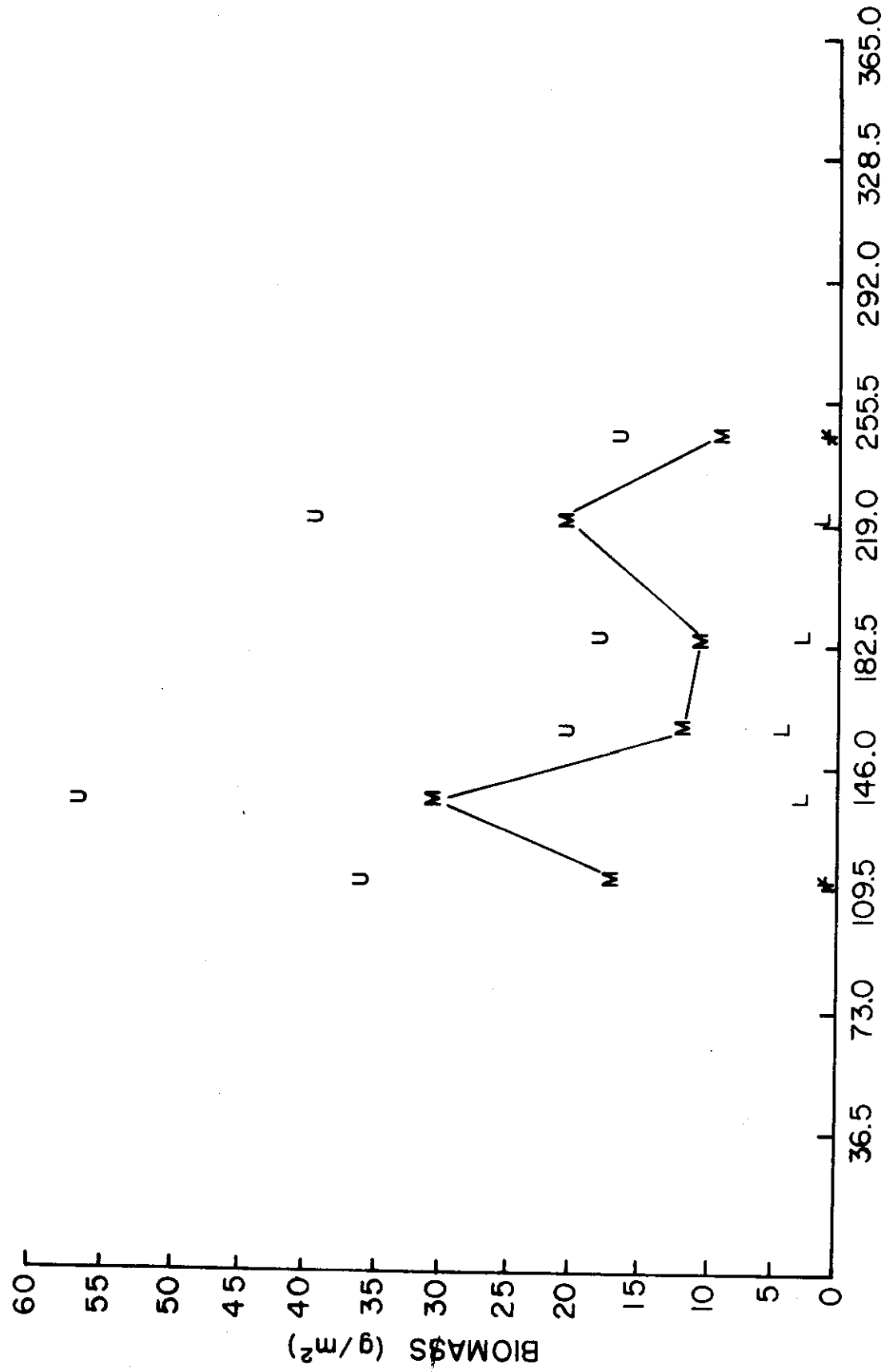

Fig. 36. *Panicum virgatum* old dead biomass (g/m^2) from the grazed treatment.

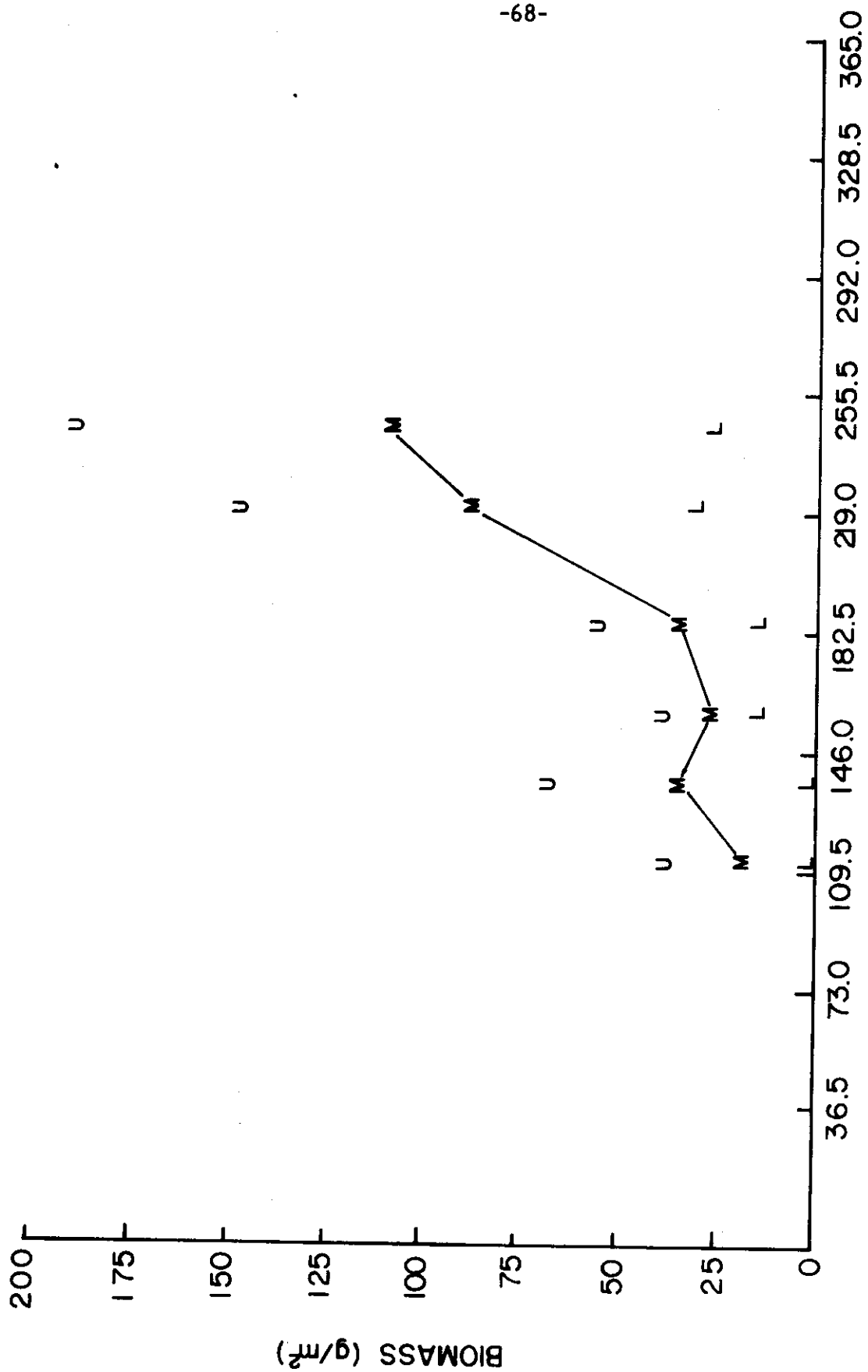

Fig. 37. *Panicum virgatum* live and dead biomass (g/m^2) from the grazed treatment.

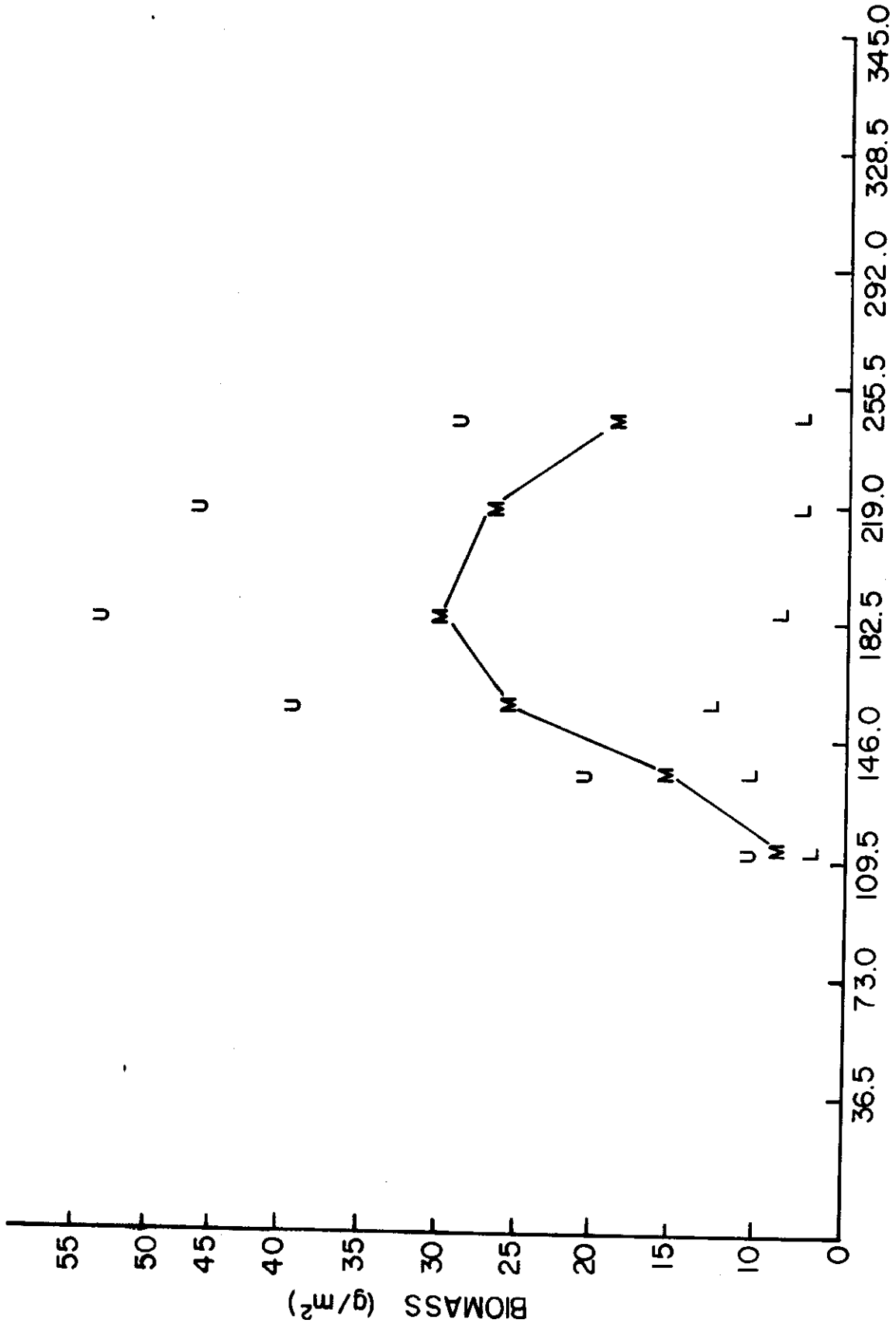

Fig. 38. Miscellaneous grass live biomass (g/m^2) from the ungrazed treatment.

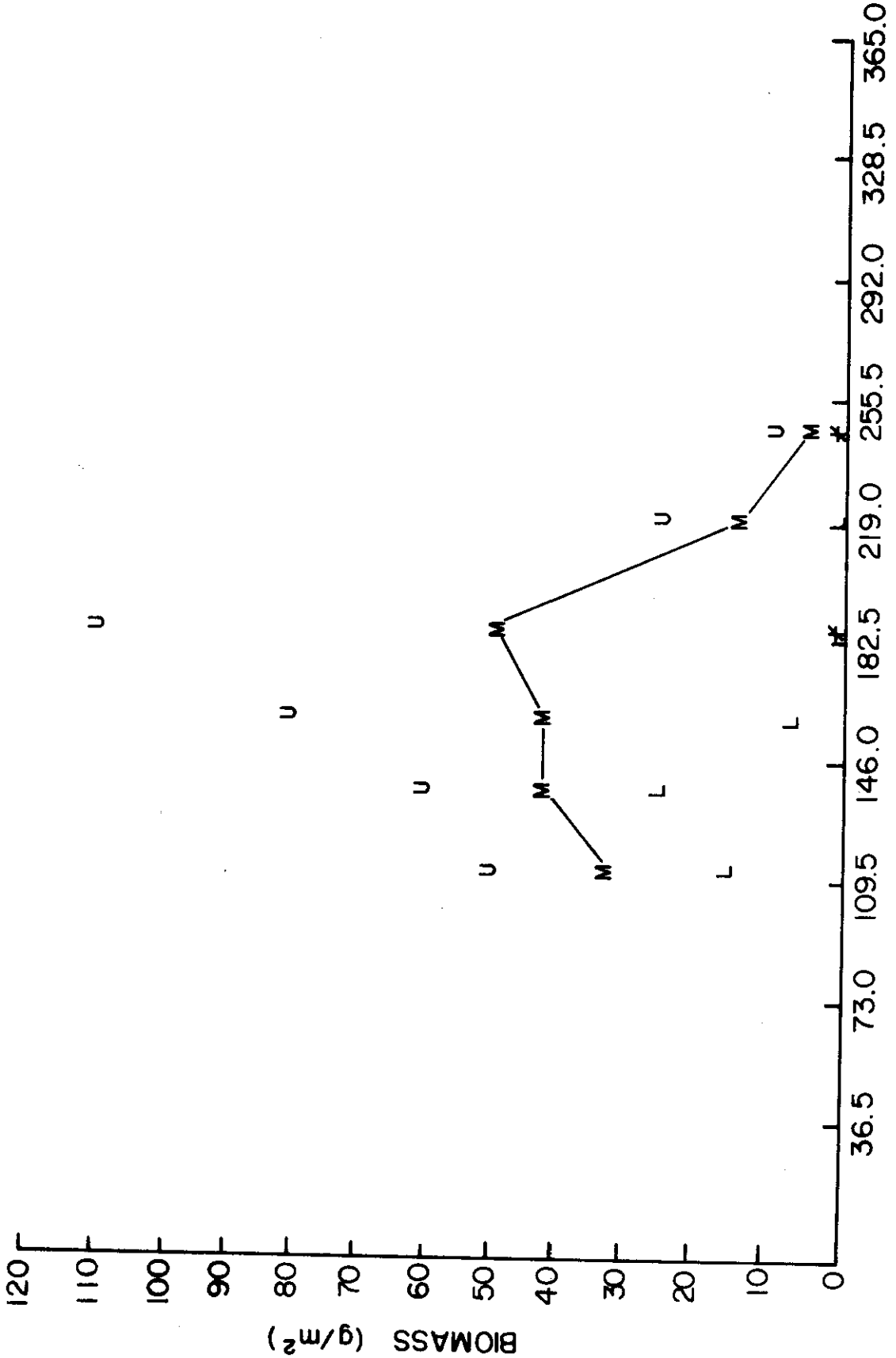

Fig. 39. Miscellaneous grass old dead biomass (g/m^2) from the ungrazed treatment.

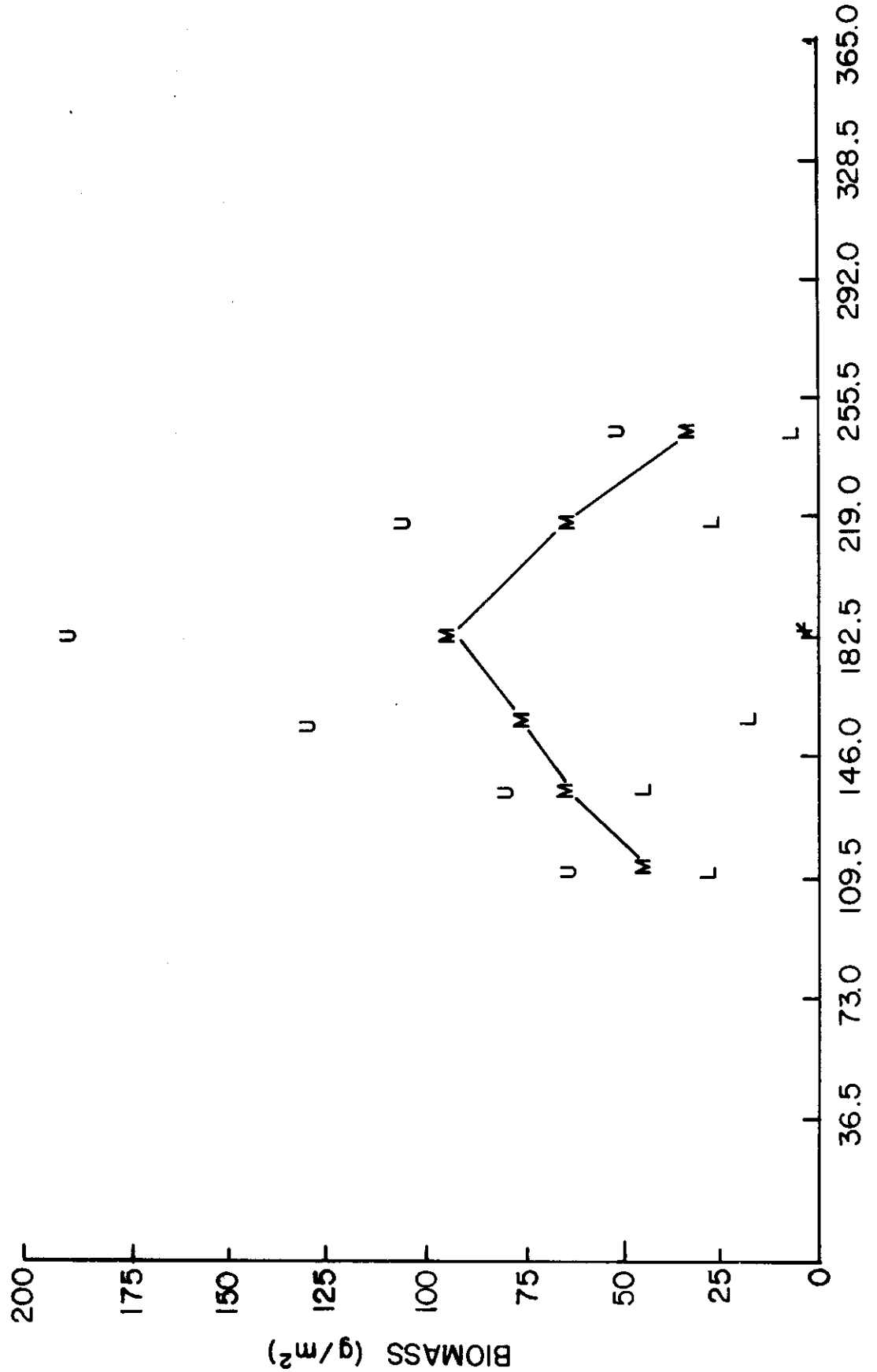

Fig. 40. Miscellaneous grass live and dead biomass (g/m^2) from the ungrazed treatment.

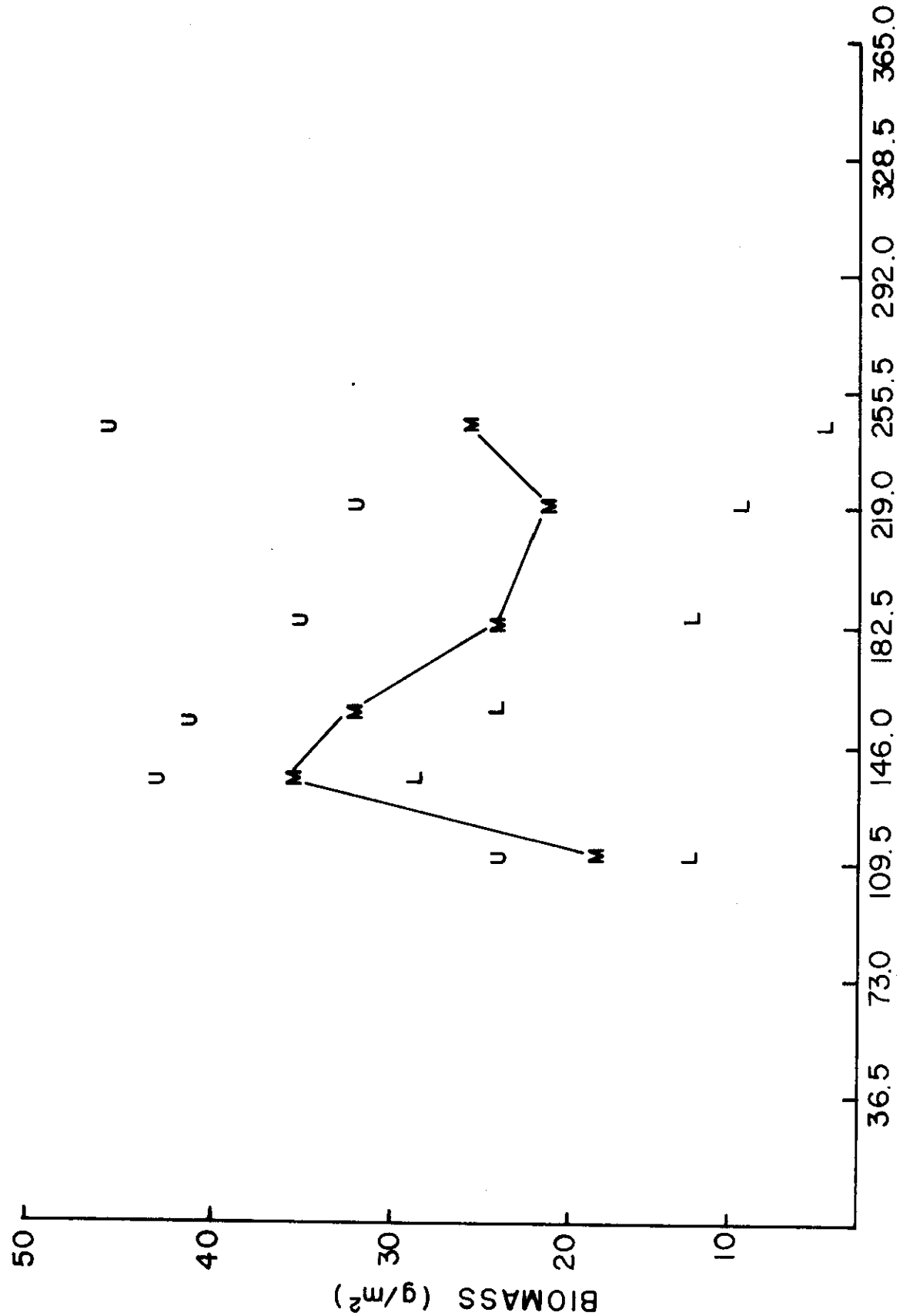

Fig. 41. Miscellaneous grass live biomass (g/m^2) from the grazed treatment.

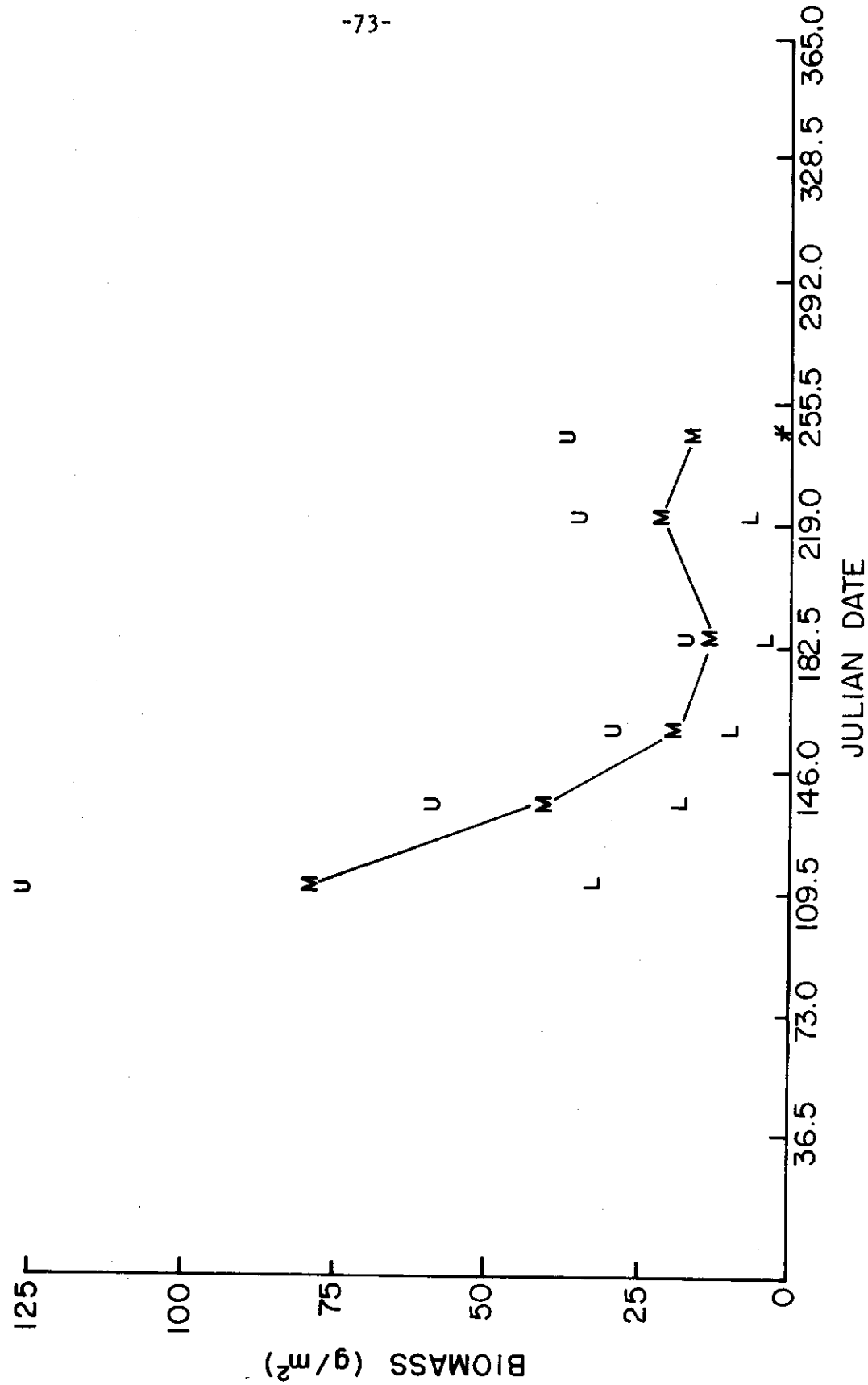

Fig. 42. Miscellaneous grass old dead biomass (g/m^2) from the grazed treatment.

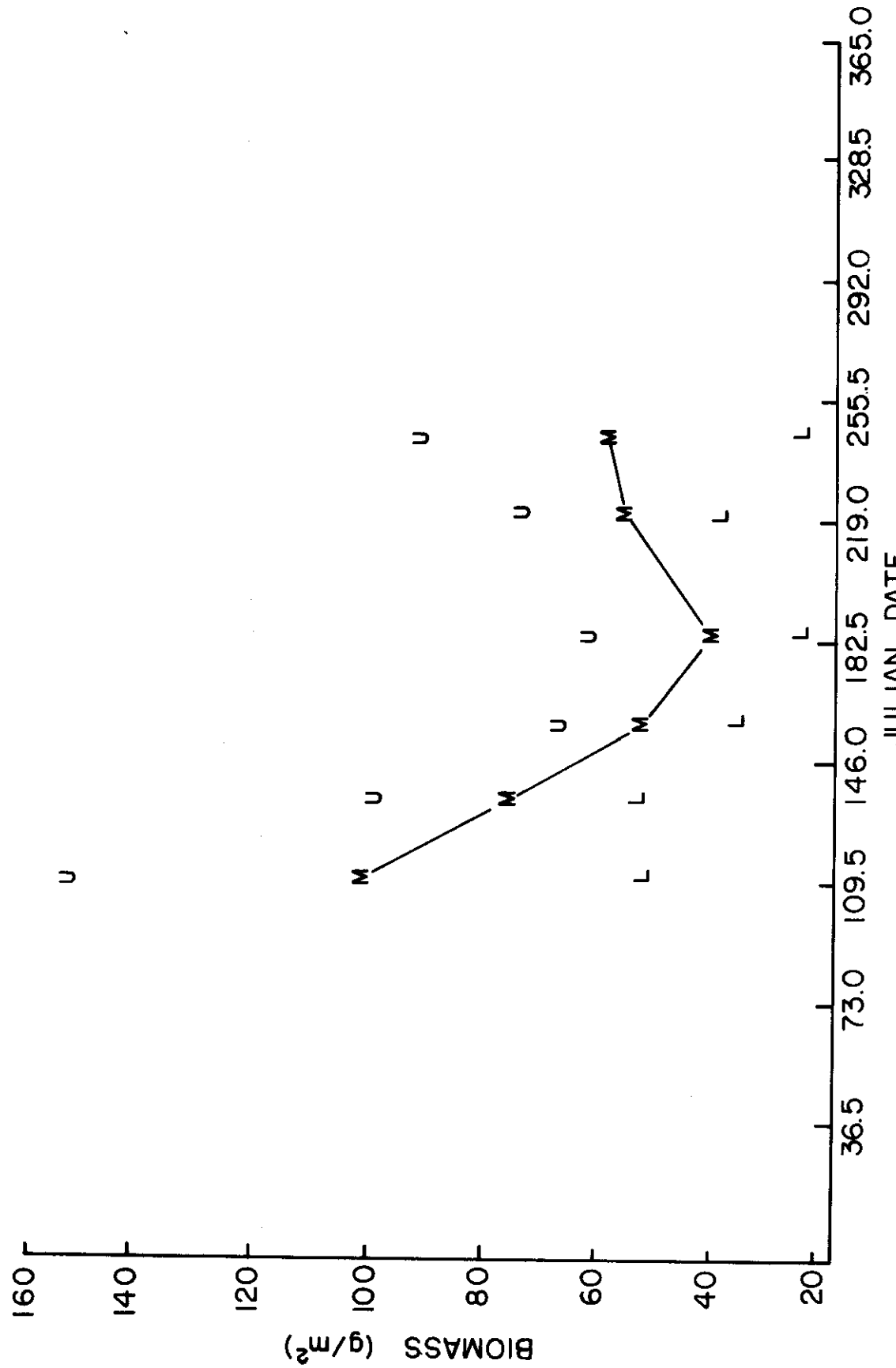

Fig. 43. Miscellaneous grass live and dead biomass (g/m^2) from the grazed treatment.

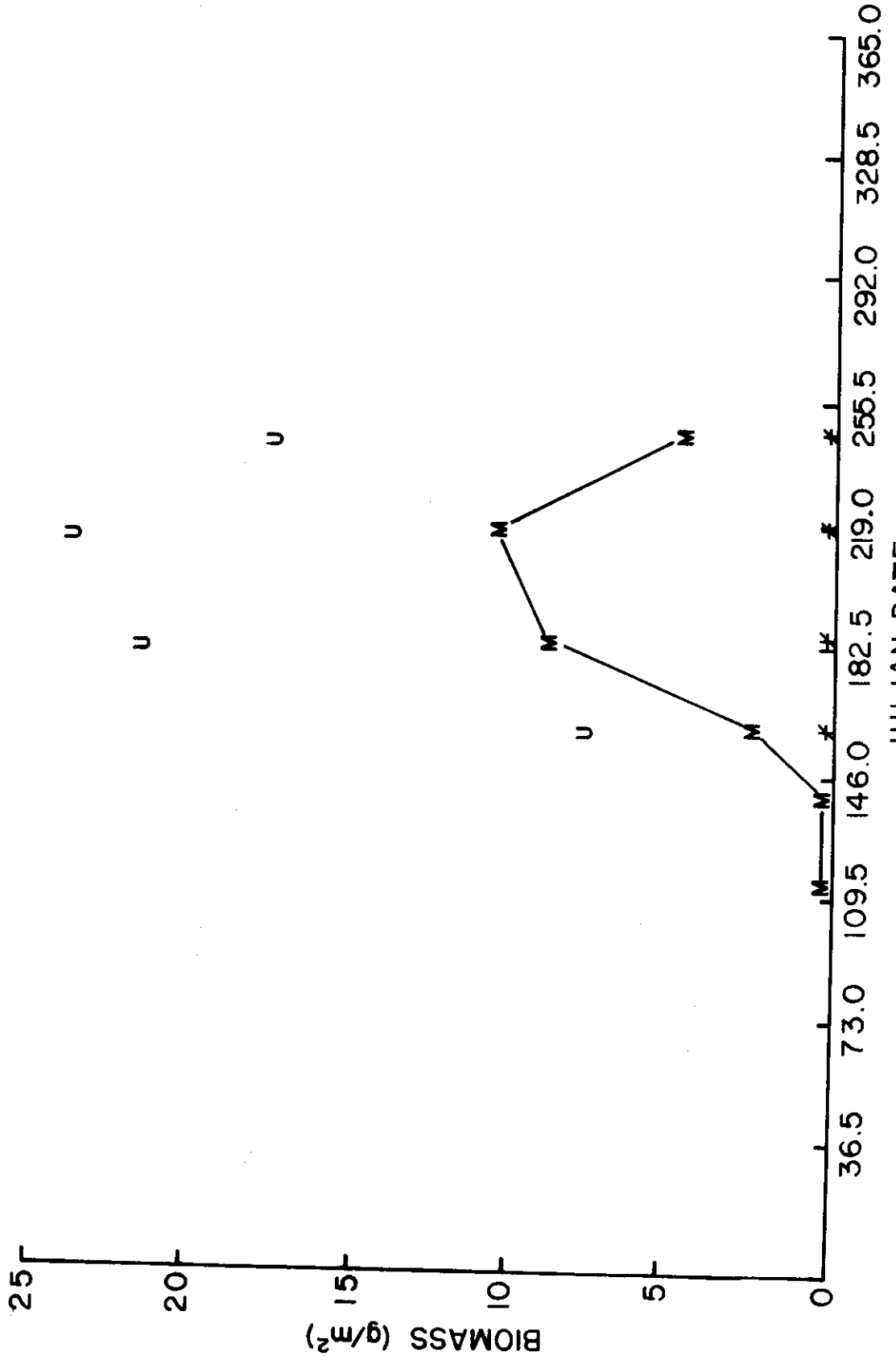

Fig. 44. Miscellaneous forb live biomass (g/m^2) from the ungrazed treatment.

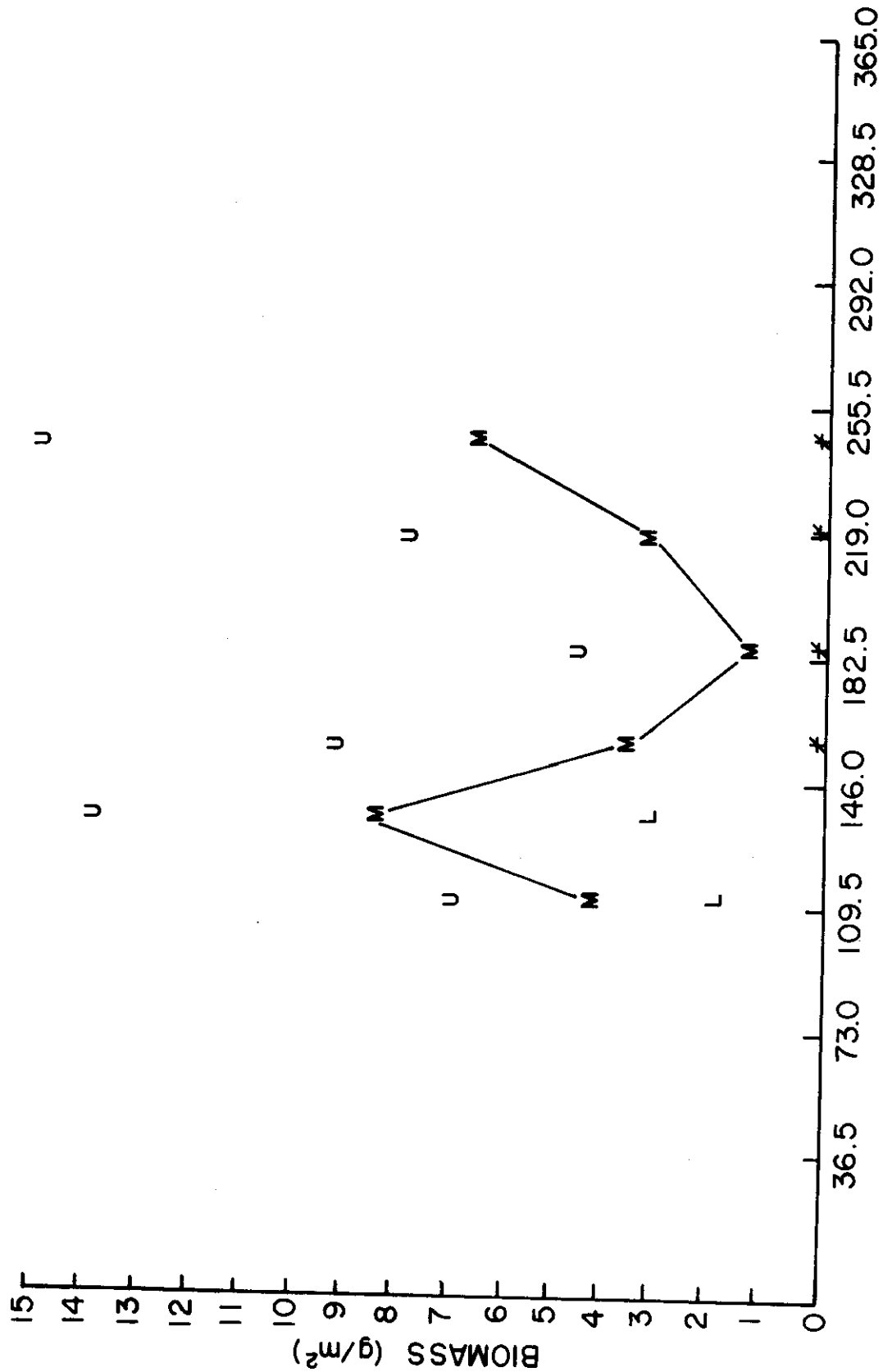

Fig. 45. Miscellaneous forb old dead biomass (g/m^2) from the ungrazed treatment.

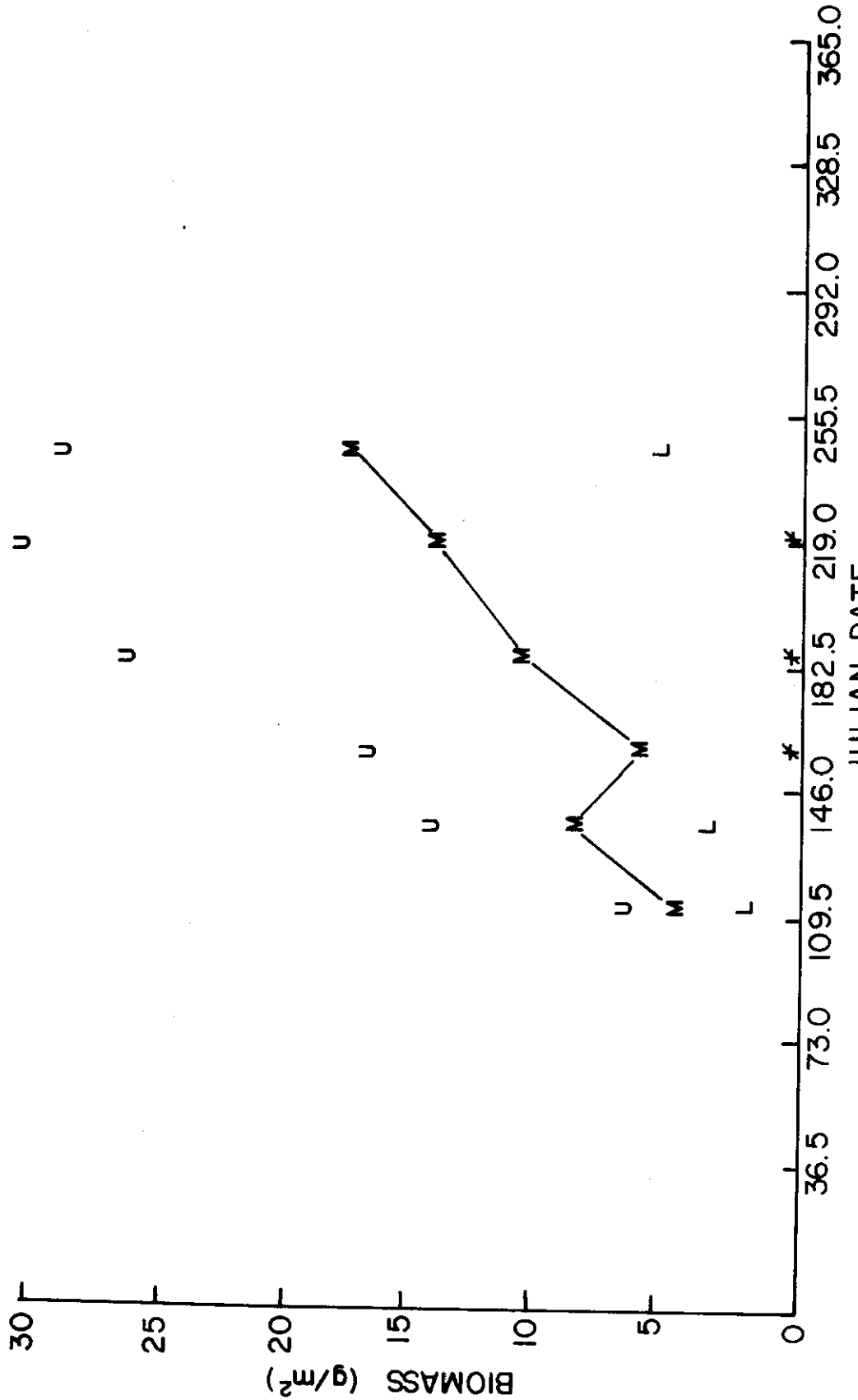

Fig. 46. Miscellaneous forb live and dead biomass (g/m^2) from the ungrazed treatment.

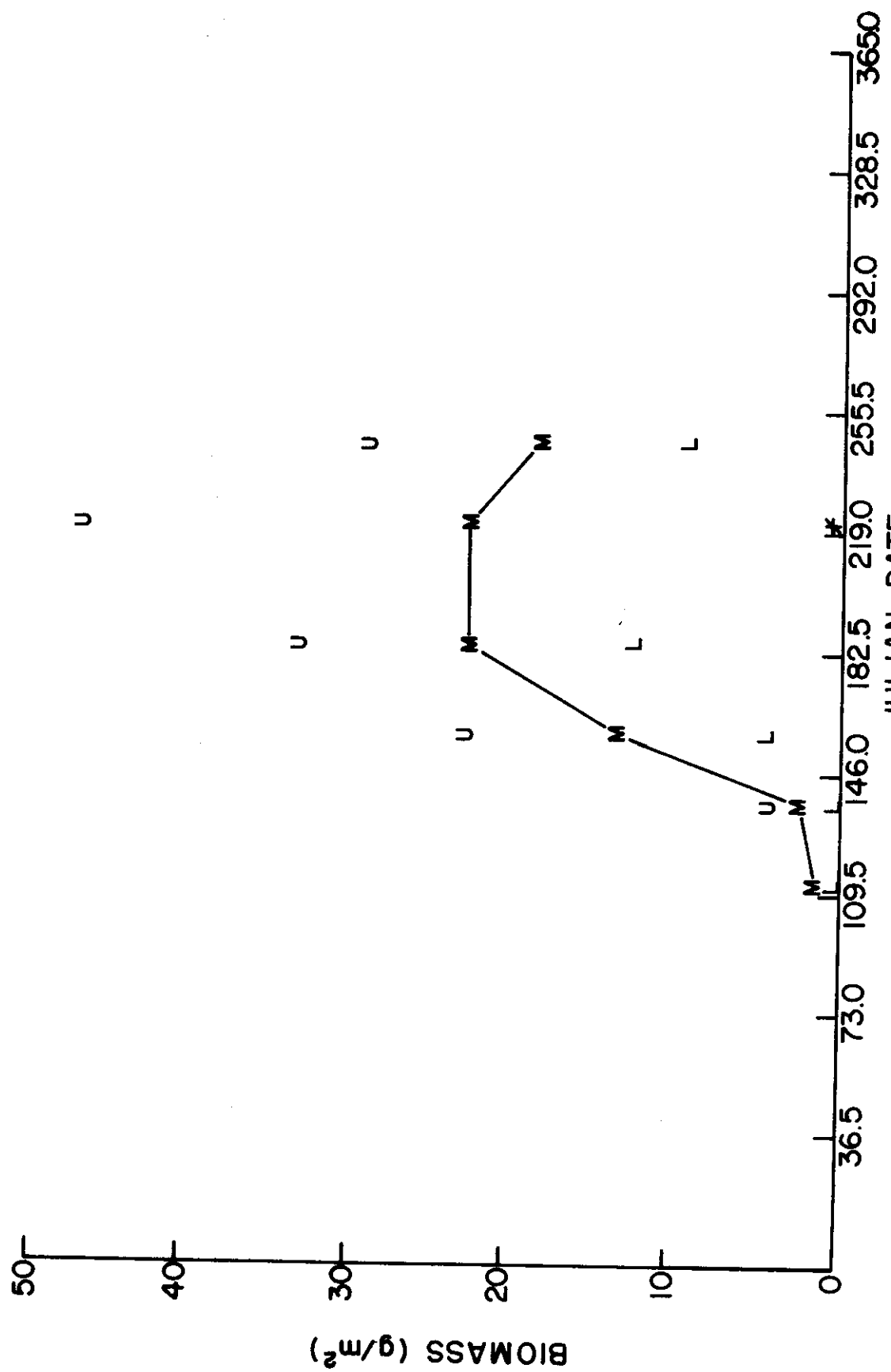

Fig. 47. Miscellaneous forb live biomass (g/m^2) from the grazed treatment.

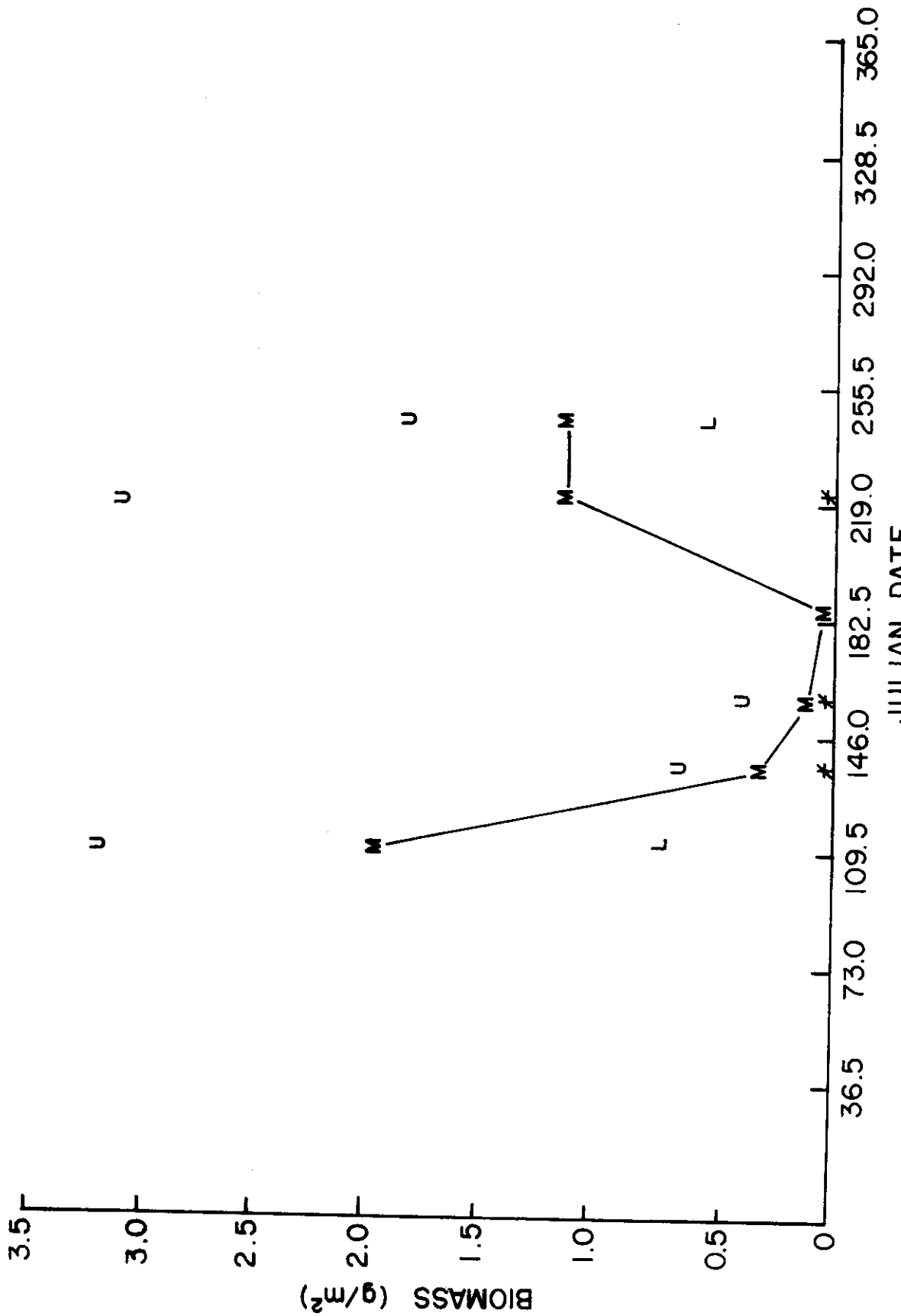

Fig. 48. Miscellaneous forb old dead biomass (g/m^2) from the grazed treatment.

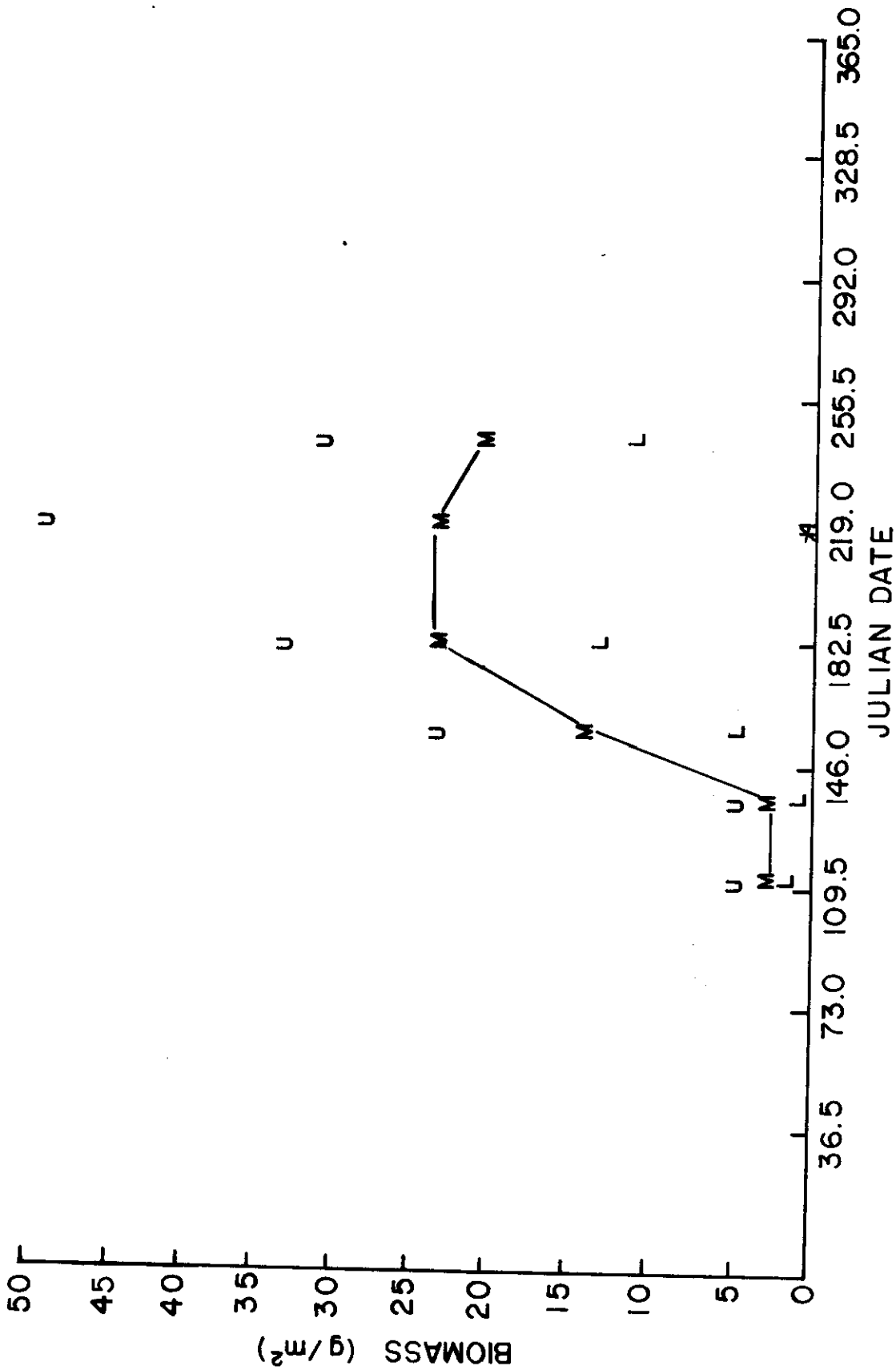

Fig. 49. Miscellaneous forb live and dead biomass (g/m^2) from the grazed treatment.

Table 24. Distribution of cool season/warm season biomass (g/m^2) within the MIGR (miscellaneous grass) component, Osage Site, 1972.

1972 Sample Date	Ungrazed Treatment						Grazed Treatment					
	Live		Old Dead		Recent Dead		Live		Old Dead		Recent Dead	
	Cool	Warm	Cool	Warm	Cool	Warm	Cool	Warm	Cool	Warm	Cool	Warm
22 April	1.51	6.71	10.51	19.90	--	--	12.47	2.80	34.61	39.65	--	--
15 May	2.84	14.41	14.23	29.67	--	--	21.33	15.46	18.15	10.41	--	--
6 June	32.46	4.11	24.77	5.86	--	--	34.75	4.61	14.57	3.93	--	--
5 July	15.49	16.25	28.73	23.75	5.95	2.75	16.30	11.06	7.51	3.51	4.67	2.02
8 Aug	20.67	7.28	7.62	5.48	14.73	5.79	23.12	5.38	16.05	3.99	11.82	3.03
2 Sept	14.58	4.18	2.46	0.77	3.39	1.08	18.08	7.36	6.06	7.69	13.34	3.37

Table 25. Crown biomass (g/m^2) from ungrazed and grazed treatments, Osage Site, 1972. Material was collected from 0.5 m^2 quadrats.

1972 Sample Date	Ungrazed			Grazed		
	No. Quadrats	Mean Biomass	SD	No. Quadrats	Mean Biomass	SD
22 Apr	10	71.98	51.94	10	34.18	23.40
15 May	10	195.86	123.10	10	79.78	52.26
6 Jun	6	228.40	76.10	10	115.22	50.06
5 Jul	6	479.54	240.02	10	282.48	130.30
8 Aug	6	332.14	52.08	10	159.42	74.20
2 Sept	6	540.42	443.18	10	300.90	160.12

Table 26. Litter biomass (g/m^2) collected from 0.5 m^2 quadrats on the Osage Site, 1972, using a portable D-vac for removal.

1972 Sample Date	Ungrazed Treatment			Grazed Treatment		
	No. Quadrats	Biomass (g/m^2)	SD	No. Quadrats	Biomass (g/m^2)	SD
22 Apr	10	158.30	53.36	10	262.65	108.74
15 May	10	194.62	47.40	10	261.35	106.53
6 Jun	6	250.29	135.69	10	542.10	268.31
5 Jul	6	260.76	32.23	10	484.56	134.75
8 Aug	6	339.19	45.50	10	458.67	140.20
2 Sept	6	273.92	143.63	10	474.20	97.42
14 Nov	6	313.11	69.53	10	469.95	207.49

The grazed treatment showed higher litter biomass on every sample date than did the ungrazed treatment.

The detachment and fall of standing dead material into the litter compartment was sampled using 0.0225 m^2 wire screens, 18 per replicate. This sampling arrangement was set up on 22 April and the 1971 screens were removed. The 1971 sampling had been done only on one replicate in the ungrazed treatment. Accumulation maximum occurred during the 15 May to 6 June interval on the ungrazed treatment and attained a value of 73 g/m^2/month. The grazed treatment maximum was 70 g/m^2/month during the 22 April to 15 May interval. It appears that the largest percentage of the total transfer for a particular year occurs during the growing season.

Table 28 documents seed biomass on both treatments. In nearly every case biomass on the grazed treatment exceeded that on the ungrazed treatment. The rather large seed biomass values on 6 June coincide with the flowering of *Bromus japonicus*, an annual invader. During September 1972 it was thought that some estimate of the ratio of seed to flowering culm biomass might be of value to an overall compartment synthesis effort. These data are presented in Table 29 for both the September sample and a second sampling in November. If no appreciable change in culm weight is assumed, an estimate of the seed shattering loss can be made.

Root biomass was estimated from 4.5 cm diameter soil cores in three quadrats per replicate. Table 30 shows that peak root biomass in the ungrazed treatment occurred in July, while the grazed treatment peaked in August. The ungrazed maximum was 3629 g/m^2 and the grazed was 4102 g/m^2. Sample variability is extremely large on both treatments.

On 6 June 1972 frequency data were taken using 25, 0.5 m^2 quadrats per replicate in each treatment. The percentage frequency for each species present is given in Table 31. A total of 36 species were found on the ungrazed treatment and 37 on the grazed. The 15 most frequent species in each treatment

Table 27. Litter accumulation on screens and accumulation rate for the 1972 season. Material was collected on 18, 0.0225 m^2 screens per replicate in both grazed and ungrazed treatments.

1972 Sample Date	Accumulation Period (Months)	Treatment							
		Ungrazed				Grazed			
		$\bar{X}$ Accumulation (g/m^2)	SD	Accumulation Rate (g/m^2/month)	SD	$\bar{X}$ Accumulation (g/m^2)	SD	Accumulation Rate (g/m^2/month)	SD
22 Apr[a/]	5.52	64.95	13.00	11.69	2.33	--	--	--	--
15 May	0.76	40.71	14.77	53.73	19.49	53.18	24.03	70.20	31.72
6 Jun	0.72	52.36	15.48	72.77	21.52	16.51	5.04	22.94	7.00
5 Jul	0.95	39.21	11.62	41.17	12.20	12.88	5.11	13.53	5.37
8 Aug	1.12	27.89	8.61	24.82	7.67	17.09	16.04	15.21	14.27
2 Sept	0.82	27.09	12.45	33.05	15.19	21.25	9.04	25.92	11.03
14 Nov	2.43	19.94	4.73	8.18	1.94	17.99	5.31	7.38	2.17

[a/] 36 litter screens were sampled on this date to quantify the winter accumulation on one replicate of the ungrazed treatment.

Table 28. Seed biomass (g/m^2) on the Osage Site, 1972, based on a minimum of six, 0.5 m^2 quadrats per treatment.

Date	Species Code	Ungrazed Treatment	Grazed Treatment
22 Apr	--	--	--
15 May	MIGR	0.16	0.78
	MIFO	--	0.07
6 Jun	MIGR	1.44	16.49
5 Jul	MIGR	0.35	3.91
	MIFO	--	0.32
8 Aug	MIGR	0.21	7.09
	ANSC2	0.03	--
2 Sept	MIGR	0.25	9.83
	MIFO	0.51	1.06
	ANGE	0.26	0.08
	ANSC2	1.80	1.09
	SONU2	0.21	0.43
	PAVI2	0.30	1.36

Table 29. Seed:culm ratio[a/] for warm season grasses from the grazed treatment on the Osage Site and percentage estimate of loss due to seed shattering.

International Species Code	Species	Seed:Culm Ratio		Percent (%) Seed Shattering Loss[b/]
		24 Sept. 1972	14 Nov. 1972	
ANSC2	*Andropogon scoparius*	1: 6.1	1: 17.2	55
ANGE	*Andropogon gerardi*	1: 6.5	1: 52.7	88
PAVI2	*Panicum virgatum*	1:12.4	1:194.5	94
SONU2	*Sorghastrum nutans*	1: 6.7	1: 42.0	84
SPAS	*Sporobolus asper*	--	1: 13.9[c/]	--
MIGR	Miscellaneous grasses	--	1: 34.7	--

[a/] Flowering culms were clipped at the soil surface, seeds removed with or without glumes (according to the normal disarticulation pattern for the species), material remaining was termed culm.

[b/] Assumes no appreciable change in culm weights (loss or gain).

[c/] No visible seed formation on 24 September 1972.

Table 30. Belowground biomass (g/m^2) from ungrazed and grazed treatments for the 1972 season.

Sample Date	Depth Increment									
	0-5	SD	5-10	SD	10-20	SD	20-50	SD	Total (0-50)	SD
Ungrazed										
15 May	395	114	103	30	150	85	186	48	834	128
5 July	580	325	192	175	116	52	251	132	1139	204
8 August	289	133	140	51	134	49	174	83	737	72
14 November	261	150	187	80	157	67	159	27	769	48
Grazed										
15 May	293	207	158	65	113	129	199	67	763	76
5 July	343	182	152	45	89	38	129	53	713	112
8 August	941	739	141	59	125	22	207	178	1414	393
14 November	410	291	110	70	161	50	234	111	915	131

Table 31. Frequency data were taken on 6 June 1972 on the Osage Site. Twenty-five 0.5 m^2 quadrats were taken in each replicate of both treatments. The percentage frequency for each species is given in the following table by replicate and treatment.

Code	Species Name	Treatment					
		Ungrazed			Grazed		
		Rep 1	Rep 2	Trt	Rep 1	Rep 2	Trt
ANSC2	*Andropogon scoparius*	100	100	100	100	56	78
ANGE	*Andropogon gerardi*	60	48	54	24	12	18
SONU2	*Sorghastrum nutans*	40	24	32	8	16	12
PAVI2	*Panicum virgatum*	40	32	36	72	56	64
SPAS	*Sporobolus asper*	20	36	28	84	92	88
PASC5	*Panicum scribnerianum*	64	84	74	72	72	72
POPR	*Poa pratensis*	48	20	34	24	12	18
BRJA	*Bormus japonicus*	20	28	24	100	100	100
BOCU	*Bouteloua curtipendula*	8	24	16	4	4	4
HOPU	*Hordeum pusillum*	0	20	10	36	60	48
ANSA	*Andropogon saccharoides*	0	0	0	28	20	24
ELVI3	*Elymus virginicus*	16	0	8	0	0	0
KOCR	*Koeleria macroantha*	8	8	8	0	0	0
CAREX	*Carex* spp.	24	24	24	16	20	18
LECO	*Leptoloma cognatum*	4	0	2	0	0	0
FEOC2	*Festuca octoflora*	0	4	2	4	0	2
AROL	*Aristida oligantha*	0	0	0	0	12	6
BUDA	*Buchloe dactyloides*	0	0	0	0	4	2
PSTE3	*Psoralea tenuiflora*	8	58	33	28	48	38
ASVI2	*Asclepias viridis*	12	4	8	12	32	22
AMPS	*Ambrosia psilostachya*	4	4	4	64	64	64
RUHI2	*Rudbeckia hirta*	4	0	2	12	12	12
AMCA6	*Amorpha canescens*	4	8	6	4	0	2
VEBA	*Vernonia baldwinii*	4	0	2	12	16	14
SOMI2	*Solidago missouriensis*	4	0	2	0	0	0
SICA9	*Sisyrinchium campestre*	4	8	4	0	0	0
ACMI2	*Achillea millefolium*	0	8	4	4	20	12
SAAZ	*Salvia azurea*	0	8	4	0	0	0
PHPUB	*Physalis pumila*	16	16	16	0	8	4
ASER3	*Aster ericoides*	0	8	4	0	0	0
EUCO10	*Euphorbia corollata*	0	12	6	8	36	22
NEGE	*Nemastylis geminiflora*	0	16	8	0	0	0
RUHU	*Ruellia humilis*	0	4	2	16	8	12
ARLU	*Artemisia ludoviciana*	0	4	2	0	0	0
STLE6	*Strophostyles leiosperma*	0	12	6	0	12	6

Table 31. (Continued).

Code	Species Name	Treatment					
		Ungrazed			Grazed		
		Rep 1	Rep 2	Trt	Rep 1	Rep 2	Trt
OXALI	*Oxalis* spp.	16	4	10	28	36	32
CIUN	*Cirsium undulatum*	0	0	0	4	0	2
APCA	*Apocynum cannabinum*	0	0	0	12	12	12
CRCA6	*Croton capitatus*	0	0	0	16	0	8
ERST3	*Erigeron strigosus*	0	0	0	4	0	2
CAAL	*Callirhoe alcaeoides*	0	0	0	0	4	2
PLLA	*Plantago lanceolata*	0	0	0	0	12	6
LISU4	*Linum sulcatum*	0	0	0	0	4	2
TRDU	*Tragapogon dubius*	0	0	0	0	12	6
PSORA	*Psoralea* spp.	0	4	2	0	0	0
	Unknown B	0	0	0	0	4	2
	Unknown C	0	0	0	0	4	2
	Unknown U-1	8	0	4	0	0	0
	Unknown U-2	4	8	6	0	0	0
Number of species				36			37

Total number of species present this date: 49

Total number of species identified to date: 71

are listed along with their percent frequency in Table 32. It is noteworthy that the percent of frequency of the 15 most important species on the grazed area are much higher, as a group, than the ungrazed. Of the five most important grasses only *Sporobolus asper* and *Panicum virgatum* have increased frequencies on the grazed treatment. To date a total of 71 species have been identified on the Osage Site. An updated list of species appears as Appendix II in this report.

Table 32. Percentage frequency values (in parentheses) for the 15 most frequent species from 50, 0.5 m^2 quadrats taken in each treatment on 6 June 1972 at the Osage Site.

Ungrazed Treatment	Grazed Treatment
Andropogon scoparius (100)	*Bromus japonicus* (100)
Panicum scribnerianum (74)	*Sporobolus asper* (88)
Andropogon gerardi (54)	*Andropogon scoparius* (78)
Panicum virgatum (36)	*Panicum scribnerianum* (72)
Poa pratensis (34)	*Ambrosia psilostachya* (64)
Psoralea tenuiflora (33)	*Panicum virgatum* (64)
Sorghastrum nutans (32)	*Hordeum pusillum* (48)
Sporobolus asper (28)	*Psoralia tenuiflora* (38)
Carex spp. (24)	*Oxalis* spp. (32)
Bromus japonicus (24)	*Andropogon saccharoides* (24)
Physalis pumila (16)	*Asclepias viridis* (22)
Bouteloua curtipendula (16)	*Euphorbia corollata* (22)
Oxalis spp. (10)	*Carex* spp. (18)
Hordeum pusillum (10)	*Poa pratensis* (18)
Koelaria macroantha (8)	*Andropogon gerardi* (18)

ACKNOWLEDGMENT

The authors wish to express appreciation to Mr. Bob Bourlier, Mr. Forrest Johnson, and Mr. Tony Dvorak for their contributions to this study.

LITERATURE CITED

Risser, P. G. 1970. Comprehensive Network Site description, Osage. US/IBP Grassland Biome Tech. Rep. No. 44. Colorado State Univ., Fort Collins. 5 p.

Risser, P. G., and R. K. Kennedy. 1972. Herbage dynamics of a tallgrass prairie, Osage, 1971. US/IBP Grassland Biome Tech. Rep. No. 173. Colorado State Univ., Fort Collins. 75 p.

Swift, D. M., and N. R. French. 1972. Basic field data collection procedures for the Grassland Biome, 1972 season. US/IBP Grassland Biome Tech. Rep. No. 145. Colorado State Univ., Fort Collins. 86 p.

Swift, D. M., and U. G. Bokhari. 1972. Basic sample collection and handling procedures for the Grassland Biome, 1972 season. US/IBP Grassland Biome Tech. Rep. No. 146. Colorado State Univ., Fort Collins. 17 p.

U.S. Department of Agriculture, Soil Conservation Service. 1971. National list of scientific plant names. Lincoln, Nebraska.

APPENDIX I

EXAMPLE OF PHENOLOGICAL DATA SHEETS

G R A S S L A N D B I O M E

U.S. International Biological Program

Phenology

Site _____ Date_____ Time_____ Investigators_____

Remarks: _____

_____

PHENOLOGY

01 Germinated or sprouted
02 Early vegetation
03 Immature vegetative (non-flowering plants)
04 Prebud
05 Bud stage
06 Early bloom
07 Mid-bloom
08 Full bloom
09 Late bloom
10 Milk stage
11 Dough stage
12 Ripe seed
13 Past ripe
14 Mature vegetative (non-flowering plants)
15 Stem cured
16 Vegetative regrowth
17 Winter dormant

Genus 29-30	Species 31-32	Subspecies 33	Phenology 35-36	Percent 38-40
AN	SC	2		
AN	SC	2		
AN	SC	2		
AN	SC	2		
PA	VI	2		
PA	VI	2		
PA	VI	2		
PA	VI	2		
SO	NU	2		
SO	NU	2		
SO	NU	2		
SO	NU	2		
SP	AS			
SP	AS			
SP	AS			
SP	AS			

Phenology (Supplement)

PHENOLOGY

01 Germinated or sprouted
02 Early vegetation
03 Immature vegetative (non-flowering plants)
04 Prebud
05 Bud stage
06 Early Bloom
07 Mid-bloom
08 Full-bloom
09 Late bloom
10 Milk stage
11 Dough stage
12 Ripe seed
13 Past ripe
14 Mature vegetative (non-flowering plants)
15 Stem cured
16 Vegetative regrowth
17 Winter dormant

Genus 29-30	Species 31-32	Subspecies 33	Phenology 35-36	Percent 38-40
AN	GE			
AN	GE			
AN	GE			
AN	GE			
M1	GR			
M1	GR			
M1	GR			
M1	GR			
BR	JA			
BR	JA			
BR	JA			
BR	JA			
AC	MI	2		
AC	MI	2		
AC	MI	2		
AC	MI	2		
BO	CU			
BO	CU			
BO	CU			
BO	CU			
M1	FO			
M1	FO			
M1	FO			
M1	FO			
AM	CA	6		

APPENDIX II

OSAGE SPECIES LIST, 1972

Species	Family	Treatment	
Achillea millefolium	Compositae	G	U
Ambrosia psilostachya	Compositae	G	U
Aster ericoides	Compositae	G	U
Cacalia plantaginea	Compositae	G	U
Cirsium undulatum	Compositae	G	U
Coreopsis grandiflora	Compositae		U
Echinacea pallida	Compositae		U
Erigeron strigosus	Compositae	G	U
Gutierrezia dracunculoides	Compositae	G	
Ratibida columnifera	Compositae	G	U
Rudbeckia amplexicaulis	Compositae	G	U
Rudbeckia hirta	Compositae	G	U
Solidago canadensis	Compositae	G	U
Solidago missouriensis	Compositae		U
Tragopogon dubius	Compositae	G	U
Vernonia baldwinii	Compositae	G	U
Xanthium strumarium	Compositae	G	
Amorpha canescens	Leguminoseae	G	U
Artemisia ludoviciana	Leguminoseae		U
Dalea cadida	Leguminoseae	G	U
Dalea purpurea	Leguminoseae	G	U
Desmodium illinoiense	Leguminoseae	G	U
Medicago lupulina	Leguminoseae		U
Melilotus alba	Leguminoseae	G	
Psoralea tenuiflora	Leguminoseae	G	U
Rhynchosia latifolia	Leguminoseae		U
Strophostyles leiosperma	Leguminoseae	G	U

Species	Family	Treatment	
Asclepias stenophylla	Asclepiadaceae	G	U
Asclepias tuberosa	Asclepiadaceae	G	
Asclepias verticillata	Asclepiadaceae		U
Asclepias viridis	Asclepiadaceae	G	U
Croton capitatus	Euphorbiaceae	G	U
Euphorbia corollata	Euphorbiaceae	G	U
Euphorbia marginata	Euphorbiaceae	G	
Physalis pumila	Solanaceae	G	U
Solanum rostratum	Solanaceae	G	
Nemastylis geminiflora	Iridaceae		U
Sisyrinchium campestre	Iridaceae	G	U
Ruellia humilis	Acanthaceae	G	U
Penstemon tubaeflorus	Scrophulariaceae		U
Apocynum cannabinum	Apocynaceae	G	U
Verbena stricta	Verbenaceae		U
Rumex crispus	Polygonaceae	G	U
Callirhoe alcaeoides	Malvaceae		U
Tradescantia ohiensis	Commelinaceae		U
Salvia azurea	Labiateae	G	U
Galium texense	Rubiaceae		U
Linum sulcatum	Linaceae	G	
Plantago lanceolata	Plantaginaceae	G	

Grasses

Species	Family	Treatment	
Agrostis hyemalis	Gramineae		U
Andropogon gerardi	Gramineae	G	U
Andropogon saccharoides	Gramineae	G	
Andropogon scoparius	Gramineae	G	U
Aristida oligantha	Gramineae	G	
Bouteloua curtipendula	Gramineae	G	U
Bouteloua gracilis	Gramineae	G	
Bromus japonicus	Gramineae	G	U
Buchloe dactyloides	Gramineae	G	
Chloris verticillata	Gramineae	G	
Elymus virginicus	Gramineae	G	U
Festuca octoflora	Gramineae	G	U
Hordeum pusillum	Gramineae	G	U
Koeleria macroantha	Gramineae		U
Leptoloma cognatum	Gramineae	G	U
Muhlenbergia sobolifera	Gramineae		U
Panicum scribnerianum	Gramineae	G	U
Panicum virgatum	Gramineae	G	U
Paspalum setaceum	Gramineae	G	
Poa pratensis	Gramineae	G	U
Setaria geniculata	Gramineae	G	
Sorghastrum nutans	Gramineae	G	U
Sporobolus asper	Gramineae	G	U
Tripsacum dactyloides	Gramineae	G	U
Tridens flavus	Gramineae	G	

APPENDIX III

FIELD DATA

The Osage Site aboveground herbage data are Grassland Biome data set number A2U00E9. They are recorded on form NREL-01 as per the modified instructions in Technical Report No. 145. A sample listing of these data follows.

IBP

GRASSLAND BIOME

U.S. INTERNATIONAL BIOLOGICAL PROGRAM

FIELD DATA SHEET – ABOVEGROUND BIOMASS

DATA TYPE	SITE	INITIALS	DATE			TREATMENT	REPLICATE	PLOT SIZE	QUADRAT	CLIP-EST.	GROWTH FM.	GENUS	SPECIES	SUBSPECIES	CATEGORY	WEIGHT ESTIMATE	SACK NO.	DRY WEIGHT	CROWN PLOT SIZE	CROWN WEIGHT
			DAY	MO.	YR.															
1-2	3-4	5-7	8-9	10-11	12-13	14	15	16-19	21-23	25	27	29-30	31-32	34	35	36-40	42-45	47-52	54-57	59-64
01																				

DATA TYPE
- 01 Aboveground Biomass
- 02 Litter
- 03 Belowground Biomass
- 10 Vertebrate - Live Trapping
- 11 Vertebrate - Snap Trapping
- 12 Vertebrate - Collection
- 20 Avian Flush Census
- 21 Avian Road Count
- 22 Avian Road Count Summary
- 23 Avian Collection - Internal
- 24 Avian Collection - External
- 25 Avian Collection - Plumage
- 30 Invertebrate
- 40 Microbiology - Decomposition
- 41 Microbiology - Nitrogen
- 42 Microbiology - Biomass
- *3 Microbiology - Root Decomposition
- 4 Microbiology - Respiration

SITE
- 01 Ale
- 02 Bison
- 03 Bridger
- 04 Cottonwood
- 05 Dickinson
- 06 Hays
- 07 Hopland
- 08 Jornada
- 09 Osage
- 10 Pantex
- 11 Pawnee

TREATMENT
- 1 Ungrazed
- 2 Lightly grazed
- 3 Moderately grazed
- 4 Heavily grazed
- 5 Grazed 1969, ungrazed 1970
- 6 Grazed 1970, ungrazed 1971
- 7
- 8
- 9

CLIP-ESTIMATE
- 1 Harvested
- 2 Harvest and Est.
- 3 Estimated
- 4 Est. for Insect
- 5 Est. for Reference
- 6 Est. for Future Clip

GROWTH FORM
- 1 Perennial grass
- 2 Annual grass
- 3 Sedge, rush, etc.
- 4 Annual forb
- 5 Biennial forb
- 6 Perennial forb
- 7 Half-shrub
- 8 Shrub
- 9 Tree
- 0 Miscellaneous

CATEGORY
- 1 Live
- Old dead
- 3 Recent dead

NREL-01 NATURAL RESOURCE ECOLOGY LABORATORY – COLORADO STATE UNIVERSITY – PHONE (303) 491-5571 – FORT COLLINS, COLORADO 80521

*** EXAMPLE OF DATA ***

```
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0109RKK22047211  .5 U11 2 0 MIFO  2   04  311   3.30
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0109RKK22047211  .5 U11 2 1 SONU 22       322   7.19
0109RKK22047211  .5 U11 2 1 SPAS  2       324   1.10
0109RKK22047211  .5 U11 2 1 MICR  5             24.95
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0109RKK22047212  .5 U23 2 1 ANGE  2   38             .
0109RKK22047212  .5 U23 2 0 MIGR  2   10  911   39.91
0109RKK22047212  .5 U23 2 0 MIGR  1   04  912    4.11
0109RKK22047212  .5 U23 2 0 MIFO  1   07             .
0109RKK22047212  .5 U23 2 1 SPAS  1       L56    0.70
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0109AJD22047252  .5 021 2 0 MIGR  1   04   624    9.80
0109AJD22047252  .5 021 2 0 MIGR  2   08   626   39.60
0109AJD22047252  .5 021 2 0 MIFO  2        643    2.60
0109AJD22047252  .5 021 2 1 MICR  5                    32.33
0109RKK22047252  .5 023 2 1 SPAS  1   18   551    2.10
0109RKK22047252  .5 023 2 1 PAVI 22   04   837   10.60
0109RKK22047252  .5 023 2 1 ANSC 22   20   720   39.00
0109RKK22047252  .5 023 2 1 ANSC 21   10   652    0.61
0109RKK22047252  .5 023 2 0 MIGR  1   35   804   19.60
0109RKK22047252  .5 023 2 0 MIFO  1   05   842    0.62
0109RKK22047252  .5 023 2 1 SPAS  2   09   839    1.12
0109RKK22047252  .5 023 2 0 MIGR  2   14   538   18.45
0109RKK22047252  .5 023 2 0 MIFO  2        814    0.39
0109RKK22047252  .5 023 2 1 MICR  5                     6.39
0109RKK22047252  .5 022 2 1 SPAS  2   30   919   15.20
0109RKK22047252  .5 022 2 1 SPAS  1   14   916    6.26
0109RKK22047252  .5 022 2 0 MIFO  1   01   921    1.00
0109RKK22047252  .5 022 2 0 MIGR  1   16   920    8.90
0109RKK22047252  .5 022 2 1 PAVI 21   06                .
0109RKK22047252  .5 022 2 1 ANSC 22   25   922    8.03
0109RKK22047252  .5 022 2 1 PAVI 22        917    3.40
0109RKK22047252  .5 022 2 0 MIFO  2        918    3.65
0109RKK22047252  .5 022 2 0 MIGR  2        923  149.25
0109RKK22047252  .5 022 2 1 MICR  5                     4.79
0109AJD22047252  .5 025 2 1 SPAS  1   25   L55    4.30
0109AJD22047252  .5 025 2 1 SPAS  2   20    S9    2.70
0109AJD22047252  .5 025 2 0 MIGR  1   18   651    8.40
0109AJD22047252  .5 025 2 0 MIGR  2   12   638   62.26
0109AJD22047252  .5 025 2 0 MIFO  2        801    1.51
0109AJD22047252  .5 025 2 0 MIFO  1        803     .40
0109AJD22047252  .5 025 2 1 PAVI 22        L60    3.25
0109AJD22047252  .5 025 2 1 MICR  5                     4.34
0109AJD22047252  .5 024 2 1 SPAS  1   30   722    4.74
0109AJD22047252  .5 024 2 1 SPAS  2   25   818   17.78
0109AJD22047252  .5 024 2 0 MIGR  1   20   740    9.05
0109AJD22047252  .5 024 2 0 MIGR  2   14   595   40.60
0109AJD22047252  .5 024 2 0 MIFO  1   06   834    0.61
0109AJD22047252  .5 024 2 1 MICR  5                     5.51
0109AJD22047252  .5 024 2 0 MIFO  2        836    0.90
0109RKK22047252  .5 025 3 1 ANSC 22   42
0109RKK22047252  .5 025 3 1 ANSC 21   10
0109RKK22047252  .5 025 3 0 MIGR  1   18
0109RKK22047252  .5 025 3 0 MIGR  2   16
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0109RKK22047252  .5 026 3 1 ANSC 22   51
0109RKK22047252  .5 026 3 1 ANSC 21   08
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0109RKK22047252  .5 026 3 1 SPAS  1   20
0109RKK22047252  .5 026 3 0 MIGR  1   09
0109RKK22047252  .5 027 3 1 SPAS  1   30
0109RKK22047252  .5 027 3 1 SPAS  2   15
0109RKK22047252  .5 027 3 0 MIFO  1   09
0109RKK22047252  .5 027 3 0 MIFO  1   18
0109RKK22047252  .5 028 3 1 ANSC 21   12
0109RKK22047252  .5 028 3 1 ANSC 22   28
0109RKK22047252  .5 028 3 1 SPAS  1   20
0109RKK22047252  .5 028 3 1 SPAS  2   09
0109RKK22047252  .5 028 3 0 MIFO  1   03
0109RKK22047252  .5 029 3 1 SPAS  2   20
0109RKK22047252  .5 029 3 1 SPAS  1   20
0109RKK22047252  .5 029 3 0 MIFO  1   04
0109RKK22047252  .5 029 3 0 MIGR  2   10
0109RKK22047252  .5 029 3 0 MIGR  1   10
0109RKK22047252  .5 030 3 0 MIGR  1   14
0109RKK22047252  .5 030 3 0 MIGR  2   21
0109RKK22047252  .5 030 3 1 SPAS  1   15
0109RKK22047252  .5 030 3 1 SPAS  2   14
0109RKK22047252  .5 030 3 0 MIFO  1   03
0109RKK22047252  .5 031 3 0 MIFO  1   35
0109RKK22047252  .5 031 3 0 MIFO  2   09
0109RKK22047252  .5 031 3 1 SPAS  2   14
0109RKK22047252  .5 031 3 1 SPAS  1   09
0109RKK22047252  .5 031 3 0 MIGR  1   08
0109RKK22047252  .5 032 3 1 SPAS  2   19
0109RKK22047252  .5 032 3 1 SPAS  1   12
0109RKK22047252  .5 032 3 0 MIGR  1   16
0109RKK22047252  .5 032 3 0 MIGR  2   08
0109RKK22047252  .5 032 3 0 MIFO  1   02
0109AJD22047252  .5 033 3 1 SPAS  1   18
0109AJD22047252  .5 033 3 1 SPAS  2   30
0109AJD22047252  .5 033 3 1 SONU 21   04
0109AJD22047252  .5 033 3 1 SONU 22   14
0109AJD22047252  .5 033 3 0 MIFO  1   06
0109AJD22047252  .5 033 3 1 ANSC 21   14
0109AJD22047252  .5 033 3 1 ANSC 22   28
0109AJD22047252  .5 034 3 1 ANSC 21   14
0109AJD22047252  .5 034 3 1 ANSC 22   38
0109AJD22047252  .5 034 3 1 SPAS  1   14
0109AJD22047252  .5 034 3 1 SPAS  2   18
0109AJD22047252  .5 034 3 0 MIGR  1   20
0109AJD22047252  .5 034 3 0 MIGR  2   06
0109AJD22047252  .5 034 3 0 MIFO  2   04
0109AJD22047252  .5 035 3 1 SPAS  1   20
0109AJD22047252  .5 035 3 1 SPAS  2   08
0109AJD22047252  .5 035 3 1 ANSC 21   12
0109AJD22047252  .5 035 3 1 ANSC 22   40
0109AJD22047252  .5 035 3 0 MIGR  1   15
0109AJD22047252  .5 035 3 0 MIGR  2   05
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0109AJD22047252  .5 036 3 1 ANSC 21  16
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0109AJD22047252  .5 036 3 1 SPAS  1  20
0109AJD22047252  .5 036 3 1 SPAS  2  35
0109AJD22047252  .5 036 3 0 MIGR  1  09
0109AJD22047252  .5 036 3 0 MIGR  2  02
0109AJD22047252  .5 037 3 0 MIGR  1  22
0109AJD22047252  .5 037 3 0 MIGR  2  08
0109AJD22047252  .5 037 3 1 SPAS  1  24
0109AJD22047252  .5 037 3 1 SPAS  2  36
0109AJD22047252  .5 037 3 1 PAVI 21  18
0109AJD22047252  .5 037 3 1 PAVI 22  04
0109AJD22047252  .5 037 3 1 ANSC 21  12
0109AJD22047252  .5 037 3 1 ANSC 22  24
0109AJD22047252  .5 038 3 1 SPAS  1  10
0109AJD22047252  .5 038 3 1 SPAS  2  19
0109AJD22047252  .5 038 3 0 MIGR  1  35
0109AJD22047252  .5 038 3 0 MIGR  2  08
0109AJD22047252  .5 038 3 1 ANSC 21  06
0109AJD22047252  .5 038 3 1 ANSC 22  30
0109AJD22047252  .5 038 3 1 SONU 21  12
0109AJD22047252  .5 039 3 1 SPAS  1  28
0109AJD22047252  .5 039 3 1 SPAS  2  08
0109AJD22047252  .5 039 3 0 MIGR  1  14
0109AJD22047252  .5 039 3 0 MIGR  2  02
0109AJD22047252  .5 039 3 0 MIFO  1  12
0109AJD22047252  .5 039 3 1 ANSC 21  16
0109AJD22047252  .5 039 3 1 ANSC 22  08
0109AJD22047252  .5 040 3 1 SPAS  1  55
0109AJD22047252  .5 040 3 1 SPAS  2  30
0109AJD22047252  .5 040 3 0 MIGR  1  12
0109AJD22047252  .5 040 3 0 MIGR  2  06
0109AJD22047252  .5 022 4 1 ANSC 21  30
0109AJD22047252  .5 022 4 1 ANSC 22  25
0109AJD22047252  .5 022 4 0 MIFO  1  06
0109AJD22047252  .5 022 4 1 SPAS  1  18
0109AJD22047252  .5 022 4 1 SPAS  2  10
0109AJD22047252  .5 022 4 0 MIGR  1  12
0109AJD22047252  .5 023 4 1 SPAS  1  18
0109AJD22047252  .5 023 4 1 SPAS  2  22
0109AJD22047252  .5 023 4 0 MIFO  1  06
0109AJD22047252  .5 023 4 0 MIGR  1  18
0109AJD22047252  .5 023 4 0 MIGR  2  04
0109AJD22047252  .5 024 4 1 ANSC 21  14
0109AJD22047252  .5 024 4 1 ANSC 22  23
0109AJD22047252  .5 024 4 1 SPAS  1  12
0109AJD22047252  .5 024 4 1 SPAS  2  09
0109AJD22047252  .5 024 4 0 MIGR  1  20
0109AJD22047252  .5 024 4 0 MIGR  2  03
0109AJD22047252  .5 025 4 1 ANSC 21  11
0109AJD22047252  .5 025 4 1 ANSC 22  28
0109AJD22047252  .5 025 4 0 MIGR  1  16
0109AJD22047252  .5 025 4 0 MIGR  2  12
0109AJD22047252  .5 025 4 1 SPAS  1  06
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