EFFECT OF HARVEST FREQUENCIES AND VARIETIES ON YIELD, QUALITY, AND STAND LIFE

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Large differences in climate, particularly temperature and frost-free days, affect the number of cuttings that are taken in the various alfalfa climate zones in California. The cold northern California mountain valleys take from two to four cuttings, the Sacramento Valley from five to six, the San Joaquin Valley from six to eight, the southern California high desert from four to six, and the southern California low desert from eight to ten. This wide range in numbers of cuttings, and the dormancy differences in the varieties that are grown between climate zones prompted the initiation in the early 1960s of a statewide program designed to provide growers reliable information on the proper cutting schedules in their area.

The total seasonal production of alfalfa, its quality produced, the ability of a stand to persist over a long period of time, its vigor and subsequent ability to resist invasion of weeds and the Egyptian alfalfa weevil (EAW) are all affected by the frequency with which alfalfa is harvested in a given climate zone. Proper harvest frequency is related to genetic characteristics of alfalfa varieties and how the varied climates of California affect the rate of alfalfa growth. Alfalfa varietal characteristics have been reviewed in this and past symposia (Marble, Proc., Calif. Alfalfa Symposia 1977, 1978, 1980), as has been information developed up until 1974 on proper cutting intervals on alfalfa quality (Marble, Proc., Calif. Alfalfa Symposia 1971 and December 1974).

To date cutting interval trials have been conducted in six locations in the mountain counties of northern and eastern California, at the University of California Davis campus in Yolo County, the West Side Field Station in Fresno County, the UC Riverside Agronomy Farm in Merino, Riverside County, and are currently underway in Imperial Valley at the Imperial Valley Field Station, Holtville, Imperial County. When this program has been completed it should provide reliable information that producers can use to predict the overall effect of imposed harvest frequencies in their area, as they relate to production, quality and stand persistence. This discussion will review results typical of the northern mountain counties, the Sacramento Valley, the San Joaquin Valley, and some preliminary results from Imperial Valley.

Alfalfa Quality Factors

The factors which have been shown to influence alfalfa quality include: 1) stage of maturity, 2) leafiness, 3) foreign material (weeds, dirt), 4) condition of the hay (moldy, dustiness, dryness), and 5) green color. The interrelationship of these factors with one another has been discussed previously (Marble, Proc. Calif. Alfalfa Symposium, Dec. 1971). It is important for producers and users to realize that maturity is difficult to determine once alfalfa has been packaged. Leafiness is the best estimate of maturity since 65 to 75% of the protein and digestible nutrients are found in the leaves. Factors that we have discovered which influence leafiness (Table 10) include the dormancy of alfalfa varieties (generally winter dormant exceed non winter dormant), resistance to leaf diseases (high resistance reduces leaf drop at higher maturities), the genetic background (strongly axillary branching varieties are leafier), time of harvest (spring and fall cuttings are leafier than summer cuts), and stage of maturity at cutting.

Harvest Frequency Studies

Northern Mountain Counties. Mountain areas with elevations in excess of 2500 feet where cold winters prevail and where growing seasons range from 85 to 125 days of frost-free weather, normally make 2-4 cuttings per season. Much of the hay produced in these areas (approximately 13% of the state's acreage) is consumed locally by livestock. Recently there has developed an export market for high-quality hay to dairies in northern California and southern Oregon. Elevation differences from 2500 to 5000 feet in mountain valleys drastically affects the growing season available, and has required that cutting frequency trials be placed in a number of locations to adequately determine cutting schedules for the area. Data from two locations, McArthur, Shasta County at 3300 feet elevation, and Cedarville, Modoc County at 4500 feet elevation, have been used in this paper to typify this production area (Table 1 and Table 2).

In both locations, the optimum time of cutting for Vernal alfalfa (a winter dormant variety) was 10% bloom for maximum yield. Both locations, as have every other location tested, have shown that alfalfa harvested in the flower-bud stage of maturity is slightly higher quality - using quality indicators of crude protein and total digestible nutrients (TDN). At these high elevations, the slower growth of alfalfa means that quality is not reduced very much if one cuts a little later at the 10% bloom stage and that total production per acre of crude protein and TDN is higher--an important consideration for those using alfalfa to maintain their own livestock. Numerous trials by Cooperative Extension farm advisors have demonstrated that very high quality hay is extremely important in providing high weight gains to weiner calves, which would justify reducing yields slightly and cutting in the bud stage where such a practice is followed. There doesn't seem to be any justification for cutting alfalfa later than the 10% bloom stage in any of the locations tested, since both yield and quality are reduced.

Stand persistence was not affected over the 4-year period that most trials were conducted It was noted, however, that cuttings made from mid September to early October were normally very weedy the next spring, regardless of how frequently cuttings were made previously.

In developing a proper strategy for mountain areas, I plotted the yield of the McArthur cuttings for the third year of the trial (Fig. 1). It is immediately obvious that cutting five times, on a monthly basis, reduces vigor drastically and affects overall production. The same situation exists for treatment No. 1 cut four times in the bud stage of development. Treatment No. 2, three cuts taken early, provided maximum yield of clean, weed-free hay. By making the first cutting as soon as blooms show in the field, usually around the 1st-10th of June, allows the second cutting to be made by the fourth week in July, permitting the third cutting to develop before night temperatures and daylengths are reduced sufficiently to delay growth and reduce yield. This effect can be seen by comparing treatment No. 2 with treatment No. 3 in Figure 1. The effect of these five cutting schedules on forage quality, for each individual cutting through the season, are expressed as %TDN in Figure 2.

In general, for the high elevation mountain counties it is recommended that alfalfa be cut in the 10% bloom stage throughout the season with the first cutting taken no later than early June despite the stage of maturity. Cutting in the flower bud stage of growth during this part of the season should increase quality without sacrificing total seasonal yield.

<u>Sacramento Valley-UC Davis</u>. Harvest frequency studies using varieties of different dormancy have been conducted at UC Davis since 1970. The first such trial, utilizing five varieties of widely different dormancy ratings, was begun in 1970 utilizing five different harvest frequencies of 21, 25, 29, 33 and 37 days. These schedules approximated, respectively, hay cut in the pre-bud, mid-bud stage, 10% bloom, 50% bloom, and 100% bloom. This study was summarized previously (Marble, Proc., 4th Calif. Alfalfa Symposium, p. 47-57, Dec. 1974). Briefly, this trial provided an insight into how varieties that have different dormancies respond to different cutting intervals. The trial allowed me to draw preliminary conclusions of:

Cutting intervals influence the yielding ability of different varieties.

2 Harvesting on a 33-day schedule (50% bloom) produced 13% more yield than a 29-day schedule (10% bloom) and 23% more than a 25-day schedule (mid-bud stage).

3 Stand persistence was reduced drastically by cutting schedules of 29, 25, or 21 days in a 3-year period.

By the second year weed contamination was up to 50% of the total dry weight of alfalfa harvested on the 25-day and 21-day schedules, 8% at the 29-day schedule and no contamination at 33 or 37 days.

Alfalfa quality is affected drastically by cutting interval, variety and season of harvest. Winter dormant and semi dormant varieties resist quality decline better than intermediate and non dormant varieties, and can be cut less frequently in order to maintain stand persistence, yield, and quality.

6. Vigor of the alfalfa plant is increased with wide intervals of 33 and 37 days

Egyptian alfalfa weevil (EAW) damaged wide cutting intervals much less than short intervals.

Cutting frequencies followed the previous year affect the yield of the first cutting with the 21- and 25-day intervals yielding about 0.4 T/A less than the other three cutting intervals. Summer yield response during June, July and August was dramatically superior for the three late intervals, with early cuttings not responding.

In the fall of 1974 an 8 variety, 6 harvest frequency study was initiated at UC Davis to investigate the full array of dormancy types available, and study their reaction to harvest frequencies of 3-, 4-, 5- and 6-week intervals. In addition two treatments were included to represent physiological development--cutting when Moapa 69 (non dormant) reached 10% bloom, and cutting when DeKalb Brand 131, a winter dormant variety, reached 10% bloom. Cutting schedules of the last two treatments corresponded approximately to a 4- to 4-1/2-week and 6-week interval, respectively, with some change in cutting dates due to the fact they were scheduled on a plant development basis.

This trial covered a wider range of dormancy types of alfalfa varieties from the very non dormant UC Salton to a dormant variety, Dawson. It was planted in the fall of 1974 and was harvested for four production years, 1975-1978, with a first cutting taken in the fifth year to evaluate persistence, weediness, weevil damage and their effect on yield of the first cutting. Measurements taken included yield, chemical analysis for quality determination (crude protein, modified crude fiber, TDN, calcium, phosphorus), leaf to stem ratio, dry matter, maturity at cutting, height at cutting, vigor, insect infestation, and a limited number of root carbohydrate samples.

Results, 1975-1978 Trial, UC Davis--Yield. Four-year average yields are given in Table 3. Each of the four weekly cutting intervals were significantly different from one another, with yields increasing linearly with each week of added growth. The differences between weekly intervals were not unexpected. What is interesting is the variety differences between the cutting intervals. UC Salton and Moapa 69, the most non dormant varieties, did not yield significantly different at five or six weeks from the four-week schedule. In contrast, all the other varieties increased significantly between 4- and 6-week cutting intervals The slower recovering varieties in order of increasing recovery capability (Dawson, 131, WL 318, and Lahontan) each showed a significant response for each weekly increase in cutting frequency from three to six weeks. Obviously, there is a correct cutting interval for maximizing the yield of each type of dormancy evaluated. Table 4 lists yield by cutting schedules for each individual year. The difference between the yield of the 3- and 6-week intervals widened each year for each of the first three years, but the fourth year the margin between the two was reduced slightly. This averaged, for all 8 varieties, approximately 1 ton for each weekly interval of increased growth. The variety performance for the four years is summarized in Table 5. At the Davis location, WL 318 and WL 512 were clearly superior when one averages all cutting intervals, closely followed by N-78 Brand.

It is important to recognize the differences between total seasonal yields and the yields per cutting throughout the season, as influenced by cutting intervals. Figure 3 summarizes the 1977 season for all six frequencies. It is readily apparent that harvesting at 5- and 6-week intervals produces tremendous tonnage during the summer months. Harvesting at 4-week intervals provided steady yields through the year until August when yields dropped off sharply. The 3-week interval was drastically affected so that virtually no production occurred after September. Apparently the root carbohydrate storage capacity of the plants harvested each 3 or 4 weeks was sharply diminished, greatly limiting production during the mid May through mid August period.

Stand Persistence. Stand persistence was measured each year. No differences due to harvest frequency were detected through the second harvest year. By the spring of the third year, differences as measured by "the % of a normal stand remaining", were observed with significant declines in the frequent cutting intervals. Stand decline measurements taken in the third, fourth and spring of the fifth year are summarized in Table 6. By the end of the third year approximately 50% of the stand of the 3- and 4-week cutting intervals remained, significantly affecting yield and weed invasion. Approximately 70% of the stand of the other intervals remained. This decline continued into the fourth and fifth year with the final stand estimates of 33, 40 and 60% for the 3-, 4-, 5- and 6-week schedules, respectively, indicating a direct relationship between better stands and wider cutting intervals.

The ability of varieties to persist under different cutting intervals was highly significant. UC Salton, for example, had an average stand remaining over all cutting frequencies in March of the fourth year of production of 39.2%. However, only 20 and 22% of its stand remained for the 3- and 4-week cutting intervals, respectively. In contrast, WL 318, with an average of 70% stand remaining over all cutting intervals, had 60, 58, 72, and 76% stand remaining at the 3-, 4-, 5- and 6-week schedules, respectively. Those varieties that were able to maintain stand and productivity at this location were those with Phytophthora root rot resistance even though their stands also declined at the shorter intervals.

Weeds. Weediness was also related to harvest frequency and varieties, with the response being very similar to stand decline. As stands and vigor were reduced, weeds invaded. Critical measurements were taken on weed percentage of total weight on the first cuttings of 1978 and 1979. The percentages for 1979 are illustrated in Table 7. As with stand persistence, there is an extremely strong interaction between varieties and harvest frequencies, with the lower frequencies and the varieties with poor stands having highest weed content, i.e. UC Salton and Moapa 69 at the 3- and 4-week schedule. By the spring of the fifth year weeds had invaded most treatments to a certain extent, but much less so for the wider intervals, especially the varieties that had better stands such as WL 318 and WL 512. Reducing cutting interval from 5 to 4 weeks had the most dramatic effect on increasing weed content from 19.5 to 50%. The 5- and 6-week schedules remain weed free through the third production year and showed their first slight weediness in the spring of the fourth year, 1978.

First cutting yields of the fourth and fifth harvest year were hand separated in order to determine the percent of weed contamination and the quantity of weed-free hay produced. Fifth year information is contained in Table 8. Both varieties and harvest frequencies were significantly different with the wide cutting intervals producing the most weed-free hay, although not the most production when weeds were added.

Egyptian Alfalfa Weevil. Cutting intervals of less than one month had severe damage from the EAW. Readings were taken each spring and all showed the same trend of modest damage for 6 weeks cutting intervals and extremely heavy damage for 3- and 4-week intervals, with 5-week interval being intermediate (Table 8). All dormant and semi dormant varieties had much less damage scores than intermediate and non dormant varieties. Lahontan was an exception with very heavy damage occurring in three out of the five years scores were made. Varieties that were badly damaged seemed to lack the ability to continue growing after heavy damage, with all terminal and axillary bud growth stopped. New growth eventually came from the crown buds. The three varieties that had low scores, especially WL 318, continued terminal and axillary bud growth throughout the period of heavy attack, thus diluting the damage. Damage was almost nonexistent for WL 318 and DeKalb Brand 131 when these varieties were harvested on a 6-week schedule. Varieties that were heavily damaged, such as Lahontan, Moapa 69, N-78 Brand and UC Salton, were much more devastated at the short cutting intervals of three and four weeks indicating that the harvest schedules used in previous years influence vigor and the ability of varieties to withstand weevil damage. In most years, WL 318 and 131 harvested at the 6- or 5-week schedules produced a normal first cutting without an application of insecticide.

Quality. Alfalfa quality is as important as production. Chemical analysis for all four years has not been completed but quality data for 1977 are shown in Tables 9 and 10. Only the 3- and 4-week cutting schedule, averaged over the season, produced hay of sufficient quality to be considered dairy hay (54% TDN or better). Examining the TDN for different cutting intervals through the season, Figure 4, illustrates even more sharply the difficulty in producing high quality hay at cutting intervals of 4 weeks or more during the summer months (when yield potential is at its greatest). The sharp decline in quality of the 5- and 6-week cutting intervals suggests that 6 weeks is not an acceptable cutting interval during the summer unless growers are prepared to find other uses outside the dairy industry for such hay, the horse industry for example. Differences between varieties appear related to dormancy with the most dormant variety the highest quality as measured by TDN, crude protein and percent leaves. The interaction of cuttings and varieties indicates that the dormant varieties, Dawson and 131, and the semi dormant WL 318 and Lahontan, are always higher quality (TDN, leaves and protein) than the non dormant varieties with WL 512 being the best of the non dormants. This relationship holds for all harvest frequencies and was particularly evident for the 4-week schedule when Moapa 69 was cut in 10% bloom. The dormant and semi dormant varieties in the 4-week schedule all average 55% TDN, WL 512--54% and the three other non dormants averaged 52%. When one examines the yield data for 1977 and relates this to quality it is apparent that if a producer cuts when the non dormant varieties are at 10% bloom he cannot produce dairy quality hay throughout the season except with superior semi dormant varieties such as WL 318. In order for the non dormant varieties to produce dairy quality hay they must be cut at harvest frequencies of less than 4 weeks during the summer months. This will severely restrict yield, increase weeds, reduce vigor, accelerate death of plants, and eliminate the possibility of reducing chemical applications for EAW control in the spring. It seems apparent that when one considers production, quality, stand life, vigor and ability to withstand insect and weed invasions, the proper cutting strategy for the production area from Stockton-Tracy northward would be to grow semi dormant varieties, except Lahontan.

Results, San Joaquin Valley-West Side Field Station. Eight varieties were harvested at two cutting frequencies for three years, 1976-1978. Yield comparisons and percent stand remaining after three production years are summarized in Table 11. Yield responses between cutting intervals were not as dramatic (0.45 vs 1.40) as at UC Davis although the 6-week was significantly superior to the 4-week schedule. Only the dormant WL 215 and the semi dormant 131 and WL 318 were significantly superior at the 6-week interval over the 4-week schedule. Stand loss was accelerated at the 4-week schedule after three production years, especially in the non-Phytophthora resistant varieties 131, Moapa 69 and UC Salton. Harvesting at the 6-week schedule did not reduce stand as drastically for these same varieties. As at Davis, persistence seems related to Phytophthora resistance and apparently has an overall effect on yield over a period of several years. Although data are not shown, the weed content of the first harvest in the third year was an exceptionally high 43% for the 4-week schedule compared to 28% for the 6-week schedule. No other cuttings of the 6-week schedule had weeds, but the 4-week schedule had weeds also in the second (7%) and the sixth (5%) cuttings. Non dormant varieties were substantially weed free with most of the contamination occurring in the winter dormant and semi dormant varieties.

Quality of alfalfa produced by the 4- and 6-week intervals for the production year 1977 are shown in Figure 5. It is apparent that the 6-week schedule produces such poor quality hay in July and August that even though yields were higher, this schedule is not practical. Even cutting on a 4-week schedule in mid summer did not improve the quality sufficient to qualify as dairy quality hay above 54% TDN. If one compares the 4- and 6-week harvest intervals from UC Davis and the West Side Field Station, it is apparent that UC Davis produces much higher quality hay in the mid summer, with the July cuttings showing a 51% TDN versus 47.4% TDN difference. All cuttings for the 6-week schedule are nearly identical with a slight increase in quality of hay produced at UC Davis. Seasonal differences at both cutting intervals do exist among varieties, with the semi dormant and dormant varieties, and WL 512 being significantly higher in quality than the non dormant varieties AS-13R, UC Salton and Moapa 69. However, no variety at either cutting interval was able to produce a high quality hay in the summer months.

Results, Imperial Valley Field Station. This trial has four cutting schedules and eight varieties, many of them equal or similar to the varieties planted at the West Side Field Station and UC Davis. The same 3-, 4-, 5- and 6-week cutting schedules have been employed. Rhsults are too preliminary to make concrete conclusions but the following observations seem warranted based on one year's results:

1 The same variety-harvest interval interaction occurs with varieties responding differently to cutting intervals. In general, very non dormant and non dormant varieties are superior yielding to dormant and semi dormant. Certain exceptions to this generalization appear possible.

2. Yields of the 8 varieties increase as cutting interval is widened to 5 weeks but decrease or stay equal at 42 days.

3. Three-week and to a certain extent 4-week schedules, are becoming weed infested after two years of the rapid cutting schedules. The 5- and 6-week schedules remain weed free.

No second-year yield or quality data are yet available from this experiment

The valuable help of farm advisors, field station personnel and staff research associates is gratefully acknowledged. Without their help, none of this work would have been accomplished.

Table 1. Yield of hay, total digestible nutrients (TDN), and crude protein (CP). Average of 4 years. McArthur, 1966-69.

Treatment	Hay Yield T/A	TDN* T/A	TDN* Percent	Crude Protein* T/A	Crude Protein* Percent
4 cuts (Bud Stage)	6.6	3.8	57.7	.4	20.1
2. 3 cuts early (10% Bloom)	7.4	4.2	56.8	1.4	18.1
3. 3 cuts late (50% Bloom)	7.1	4.1	57.8	1.3	17.0
4. 2 cuts (100% Bloom)	6.4	3.5	54.8	.1	15.3
5. 5 cuts (Pre Bud)	5.6	3.5	62.5	1.4	23.7

*100% dry matter basis.

Table 2. Summary of yield and hay quality - 1964 data. Cedarville. (100% Dry Matter.)

Cutting Treatment	Average Yield T/A	Average Percent crude protein	#'s Crude Protein per acre	Average Percent TDN	#'s TDN per acre
1. Cut 3 times at Bud Stage	4.12	21.6	1780	58	4781
2. Cut 3 times at 1/10 Bloom	6.79	20.7	2811	57	7742
3. Cut 2 times at 50% Bloom	6.49	17.5	2271	56	7270
4. Cut 2 times at 100% Bloom	4.82	16.4	1583	52	5021

Table 3. 8 variety, 6 harvest interval trial, 4-year summary, 1975-1978; UC Davis (Marble).

Variety	Yield - Tons/Acre Dry Matter						4-Year Average
	3 wk	4 wk	5 wk	6 wk	1/10 Bl. M69	1/10 Bl. 131	
WL 318	7.52	9.05	9.84	10.89	9.58	11.25	9.69 a
WL 512	7.38	9.67	9.92	10.56	9.93	10.13	9.60 ab
N-78 Brand	6.92	9.49	9.85	10.49	9.47	10.16	9.40 b
UC Salton	6.26	9.28	9.50	9.82	9.43	10.23	9.09 c
DeKalb 131	6.17	8.37	9.40	10.67	8.77	10.58	8.99 c
Moapa 69	6.82	9.23	9.27	9.44	9.72	9.25	8.95 c
Dawson	5.98	7.67	8.79	10.30	8.26	10.33	8.55 d
Lahontan	6.36	8.02	8.68	9.74	8.82	9.36	8.50 d
Mean	6.68 d	8.85 c	9.41 b	10.24 a	9.25 bc	10.16 a	9.10
LSD .05							0.22
.01							0.29
C.V. %							6.8

LSD:	.05	.01
Between harvest interval	0.43	0.60
Between varieties at same harvest interval	0.54	0.72
Between varieties at different harvest interval	0.67	0.91

Table 4. Effect of harvest frequency on yield, 8 varieties averaged, 1975-1978, UC Davis (Marble).

SCHEDULE	NO. CUTS	TONS/ACRE DRY MATTER 1975	1976	1977*	1978	4-YR AVG
6 WEEKS	5	7.69 A	10.81 A	12.64 A	9.91 A	10.24 A
.10 BL 131	5	7.61 A	10.71 A	12.26 A	10.26 A	10.16 A
5 WEEKS	6	7.04 C	10.82 A	10.72 B	8.89 B	9.41 B
.10 BL M69	7	7.13 B	10.70 A	10.53 B	8.72 B	9.25 BC
4 WEEKS	7	7.22 B	9.53 B	10.41 B	8.58 B	8.85 C
3 WEEKS	9	5.35 C	7.94 C	6.86 C	6.53 C	6.68 D
LSD .05		0.41	0.60	0.54	0.53	0.44

*LATE HARVEST MADE IN 1977 FOR 4- (4/11) AND 6- (11/17) WEEK SCHEDULES.

LSD'S	0.05	0.01
DIFFERENCE BETWEEN YEARS FOR SAME OR DIFFERENT HARVEST INTERVAL	0.31	0.40

Table 5. Effect of variety on yield, 8 varieties averaged, 1975-1978, UC Davis (Marble).

Variety	Yield - Tons/Acre Dry Matter 1975	1976	1977	1978	4-Year Ave.
WL 318	7.42	10.77	11.05	9.51	9.69
WL 512	7.66	10.68	11.03	9.02	9.60
N-78 Brand	7.52	10.49	10.79	8.78	9.40
UC Salton	7.14	10.53	10.15	8.52	9.09
DeKalb 131	7.04	9.62	10.40	8.91	8.99
Moapa 69	6.84	9.91	10.31	8.76	8.95
Dawson	6.35	9.41	10.08	8.37	8.55
Lahontan	6.12	8.93	10.28	8.66	8.50
	7.01	10.04	10.51	8.82	9.10
LSD .05	0.26	0.40	0.40	0.37	0.22
.01	0.34	0.53	0.53	0.48	0.29

	.05	.01
Between years	0.12	0.16
Between varieties for same year	0.35	0.46
Between varieties for dif. year	0.38	0.50

Table 6. Effect of harvest frequency and varieties on stand decline in 3rd, 4th and 5th year of stand life; UC Davis (Marble).

Harvest frequency	1977 3rd yr May 19	1977 3rd yr Oct 13	1978 4th yr May 2	1979 5th yr Apr 20
	- - - - Percent Stand Remaining - - -			
1/10 131	81.6 a	74 a	64.7 a	58.1 a
6	78.6 ab	73 a	66.6 a	60.0 a
1/10 M69	77.6 ab	69 a	62.5 a	42.2 c
5	75.8 bc	72 a	61.6 a	49.7 b
4	71.7 cd	51 b	52.8 b	39.7 d
3	70.0 d	51 b	46.9 b	33.1 d
Varieties				
Lahontan	86.3 a	80 a	77.5 a	57.1 ab
WL 318	77.5 c	72 b	70.4 b	59.6 a
WL 512	81.8 b	71 b	64.6 c	54.2 b
131	72.0 de	56 d	49.2 d	50.0 c
Dawson	69.5 ef	58 d	58.3 d	46.7 c
N-78 Br.	74.0 d	59 d	51.2 e	39.2 d
Moapa 69	79.0 bc	66 c	52.9 e	39.6 d
UC Salton	67.2 f	56 d	39.2 f	30.8 e

Table 7. Effect of harvest frequency and variety on winter weed content of 1st harvest of 5th year, April 20, 1979, UC Davis (Marble).

Variety	Harvest frequency 3 wks	4 wks	1/10 bl M69	5 wks	6 wks	1/10 bl 131	Ave
	- - - - - - - - - - - - Percent winter weeds - dry basis - - - - - - - -						
UC Salton	93.1	67.0	47.1	27.3	26.5	33.0	49.00 a
Moapa 69	94.0	43.4	65.4	18.4	24.7	16.0	43.65 ab
Dawson	50.7	78.9	40.8	28.2	15.5	13.7	37.96 bc
DeKalb Br. 131	65.1	57.0	35.9	22.8	17.3	9.7	34.66 bcd
Lahontan	50.9	53.4	36.8	16.5	15.2	25.3	33.02 cd
N-78 Br.	77.5	43.5	31.4	14.0	17.3	8.3	32.00 cd
WL 512	53.2	35.2	39.9	17.6	7.4	12.6	27.65 cd
WL 318	64.9	21.3	35.9	11.2	7.9	5.3	24.36 d
	68.67 a	49.98 b	41.65 b	19.50 c	16.45 c	15.49 c	

Table 8. Effect of harvest frequency and variety on yield, weed contamination and Egyptian alfalfa weevil damage for 1st harvest of the 5th year, April 20, 1979, UC Davis (Marble).

Harvest frequency	Weed-free alfalfa	Weed content	Alf. + weeds	Weevil damage[1]
	T/A	%	T/A	
1/10 Bl 131	1.17 a	15.49 a	1.38 ab	2.7 a[2]
6 weeks	1.14 a	16.44 a	1.33 b	2.6 a
5 weeks	1.07 a	19.50 a	1.31 bc	3.3 b
1/10 BL Moapa 69	0.86 ab	41.65 ab	1.48 a	4.3 c
4 weeks	0.72 bc	49.98 bc	1.44 ab	5.0 d
3 weeks	0.52 c	68.67 c	1.26 c	5.0 d
<u>Variety</u>				
WL 318	1.13 a	24.36 a	1.49 b	2.4 a
Dawson	1.08 ab	37.96 abc	1.74 a	3.7 cd
131	1.05 ab	34.66 ab	1.61 a	3.5 bc
WL 512	0.93 bc	27.65 a	1.28 c	3.0 b
N-78 Brand	0.92 bc	32.0 ab	1.35 c	4.0 de
Lahontan	0.80 cd	33.02 ab	1.19 d	5.3 f
Moapa 69	0.76 cd	43.65 bc	1.35 c	4.1 de
UC Salton	0.65 d	49.0 c	1.27 c	4.4 e

[1]Weevil damage rating scale: 1 = no damage; 2 = slight webbing of leaves; 9 = complete defoliation of leaves.

[2]Values followed by same letter are not significantly different from each other at odds of 19 to 1.

Table 9. Effect of harvest frequency on alfalfa quality factors. All harvests and varieties averaged, 1977, UC Davis (Marble).

Schedule	Percent TDN[1]	Percent Crude Protein	Percent Leaves[2]	Percent Phosphorus	Percent Calcium	Ca-Ph Ratios
3 weeks	55.9 a	30.13 a	58.00 a	0.39 a	1.36 a	3.49
4 weeks	54.0 b	26.34 b	52.82 b	0.33 b	1.38 a	4.18
.10 Bl. Moapa 69	52.7 c	24.48 c	49.44 c	0.30 c	1.44 b	4.80
5 weeks	50.6 d	22.61 d	47.43 d	0.27 d	1.46 bc	5.41
6 weeks	50.4 d	22.16 e	45.69 e	0.27 d	1.50 cd	5.56
.10 Bl. DK 131	48.5 e	20.13 f	43.81 f	0.26 e	1.54 d	5.92
Average	52.0	24.31	49.53	0.30	1.45	
LSD .05	.5	.43	1.00	.01	.05	
.01	.7	.59	1.38	.01	.07	
% C.V.	4.1	3.3	5.3	4.8	6.4	

[1]Total digestible nutrients (TDN) @ 90% D.M.

[2]Average of two years, 1976 and 1977.

Table 10. Effect of varieties on alfalfa quality factors. All varieties and cutting frequencies averaged, 1977, UC Davis (Marble).

Variety	Percent TDN[1]	Percent Crude Protein	Percent Leaves[2]	Percent Phosphorus	Percent Calcium	Ca-Ph Ratios
Dawson	52.8 a	5.60 a	51.96 a	0.33 a	1.33 b	4.03
WL 318	52.4 b	5.34 a	50.45 b	0.32 b	1.34 b	4.19
DK Br. 131	52.2 b	4.89 b	50.28 b	0.32 b	1.27 a	3.97
Lahontan	52.2 b	4.72 b	50.52 b	0.32 b	1.41 c	4.41
WL 517	52.1 b	4.25 c	49.46 c	0.29 cd	1.51 d	5.21
UC Salton	51.4 c	3.24 de	48.07 d	0.28 d	1.59 e	5.68
Moapa 69	51.3 c	2.96 e	47.77 d	0.28 d	1.64 f	5.86
N-78 Br.	51.1 c	3.46 d	47.75 d	0.29 c	1.50 d	5.75
Average	52.0	24.30	49.53	0.30	1.45	
LSD .05	.4	.31	.79	0.01	0.03	
.01	.5	.41	1.04	0.01	0.04	
% C.V.	3.0	2.2	4.3	2.8	3.8	

[1]Total digestible nutrients (TDN) @ 90% D.M.

[2]Average of two years, 1976 and 1977.

Table 11. Effect of 2 harvest schedules on the yield and stand persistence of 8 varieties at the West Side Field Station, Fresno County, 1976-1978 (Marble).

Variety	Yield tons/acre			% stand remaining		
	4 wk	6 wk	Ave	4 wk	6 wk	Ave
WL 512 (ND)	8.80	9.24	9.02 a	65.0	60.0	62.5 ab
WL 318 (SD)	8.62	9.25	8.93 ab	62.5	70.0	66.2 ab
AS-13R (ND)	8.95	8.62	8.79 ab	67.5	67.5	67.5 a
UC Salton (VND)	8.45	8.62	8.54 bc	47.5	55.0	51.2 cd
Moapa 69 (ND)	8.13	8.33	8.23 cd	50.0	62.5	56.2 bc
131 (SD)	7.47	8.58	8.03 d	35.0	50.0	42.2 d
Lahontan (SD)	7.85	8.09	7.97 d	57.5	72.5	62.5 ab
WL 215 (D)	7.26	8.42	7.84 d	52.5	62.5	57.5 abc
Average	8.19 b	8.64 a		54.1 b	62.1 a	

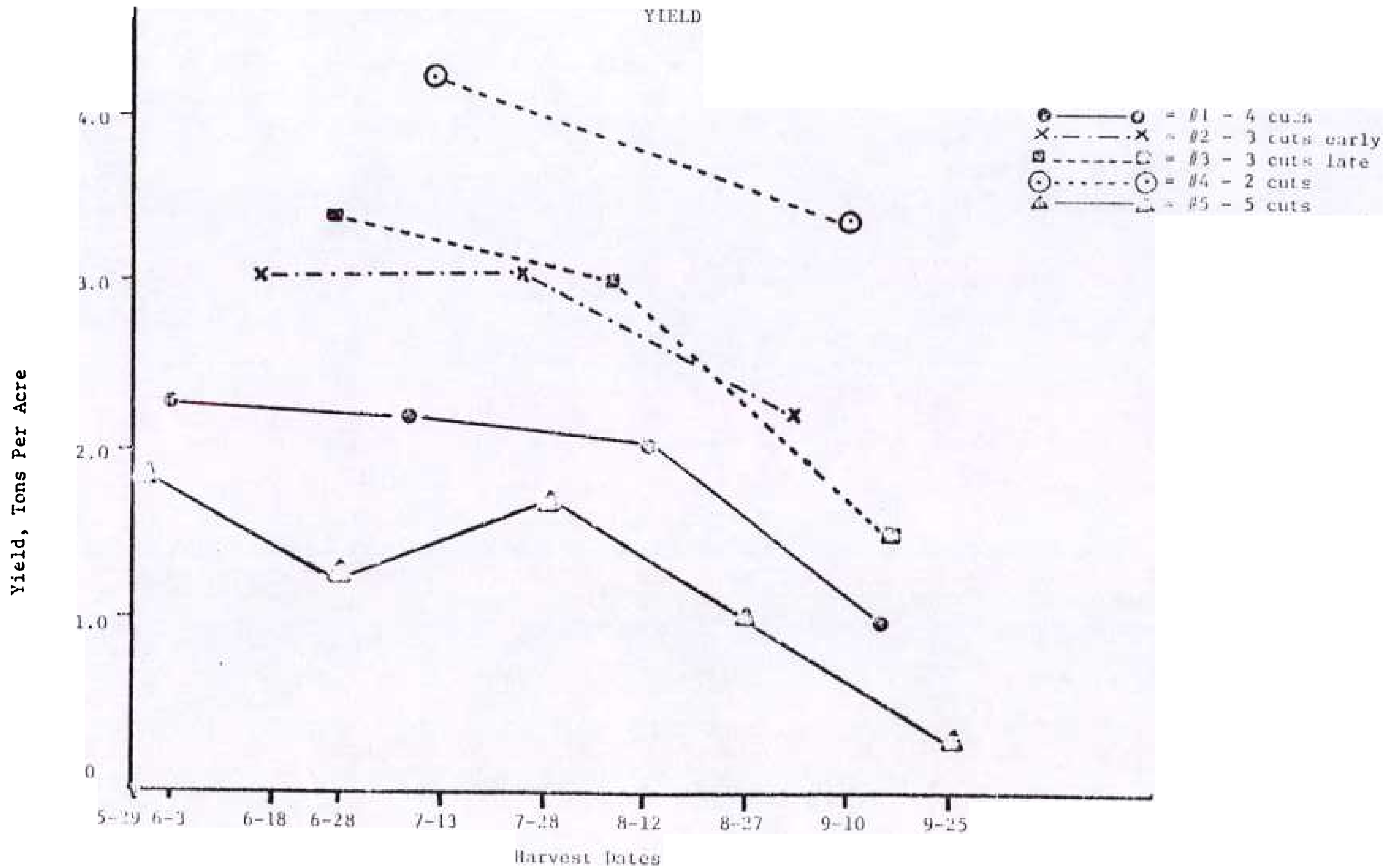

Figure Seasonal yield distribution by ttings for 5 cutting frequencies. fcArthur 968. 3rd year. (Marble)

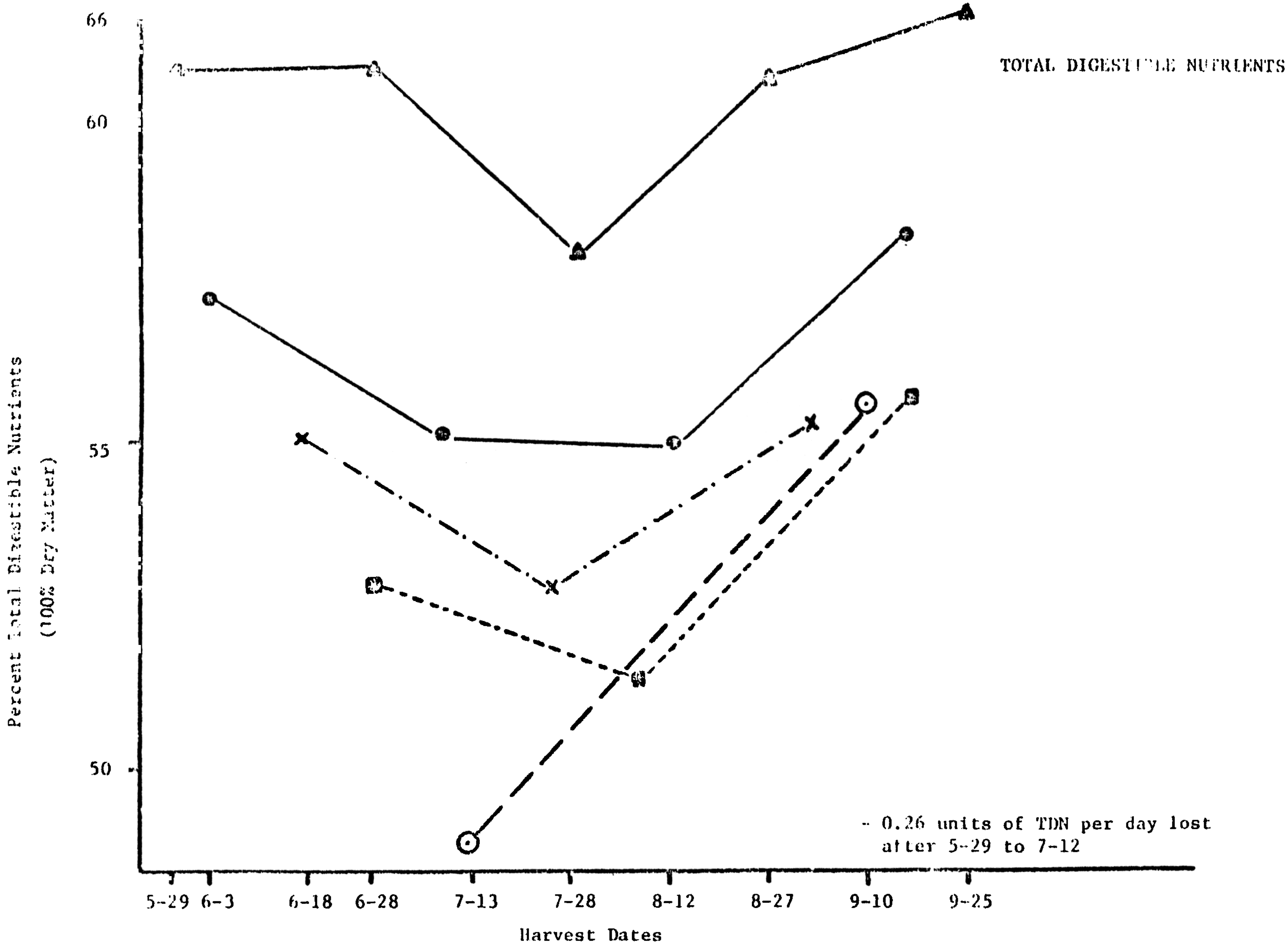

Figure 2. Seasonal distribution of TDN by cuttings for 5 cutting frequencies. McArthur. 1968. 3rd year. (Marble)

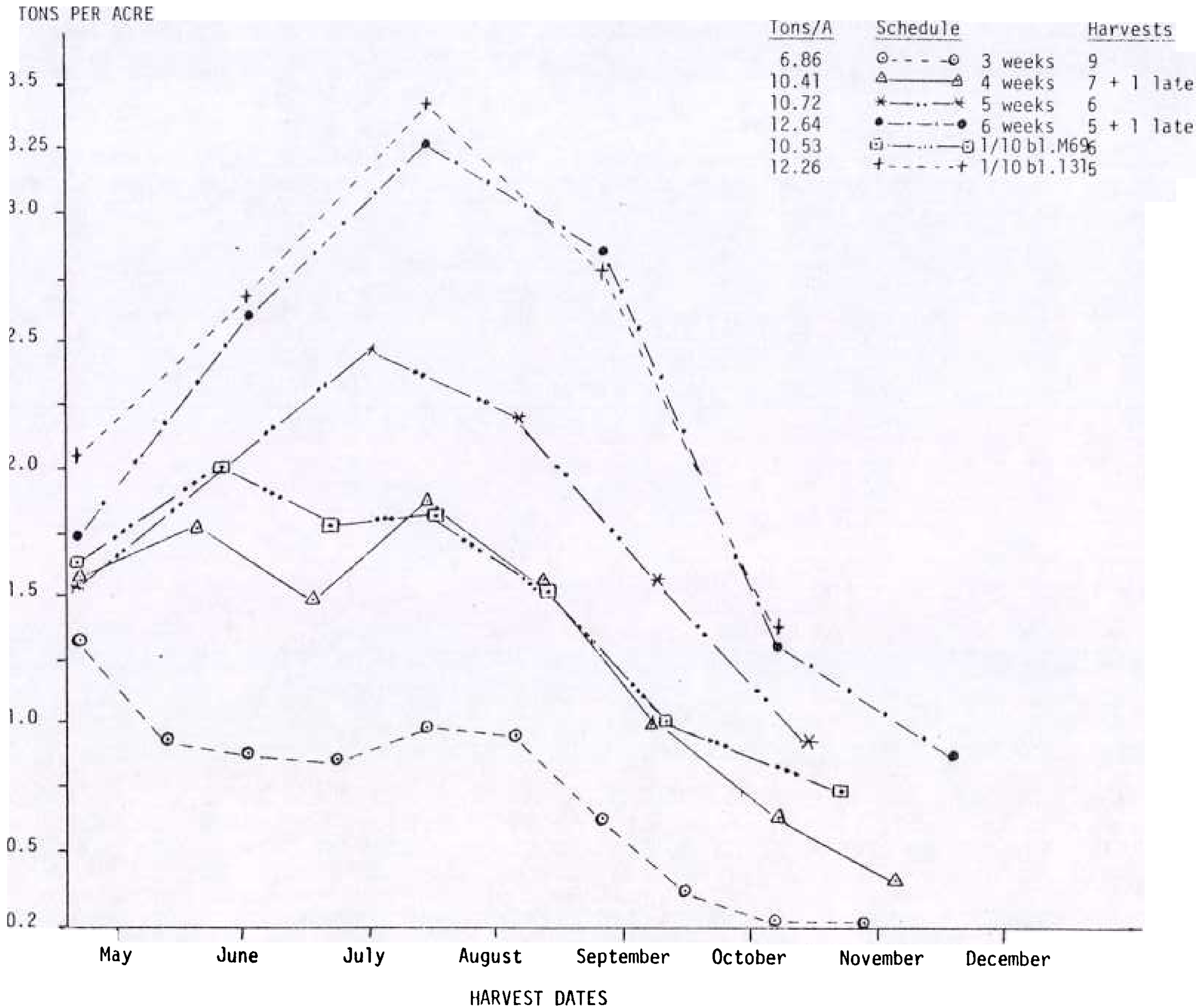

Figure 3. Seasonal yield of 6 harvest frequencies, 8 varieties averaged for each cutting frequency; 1977; UC Davis (Marble).

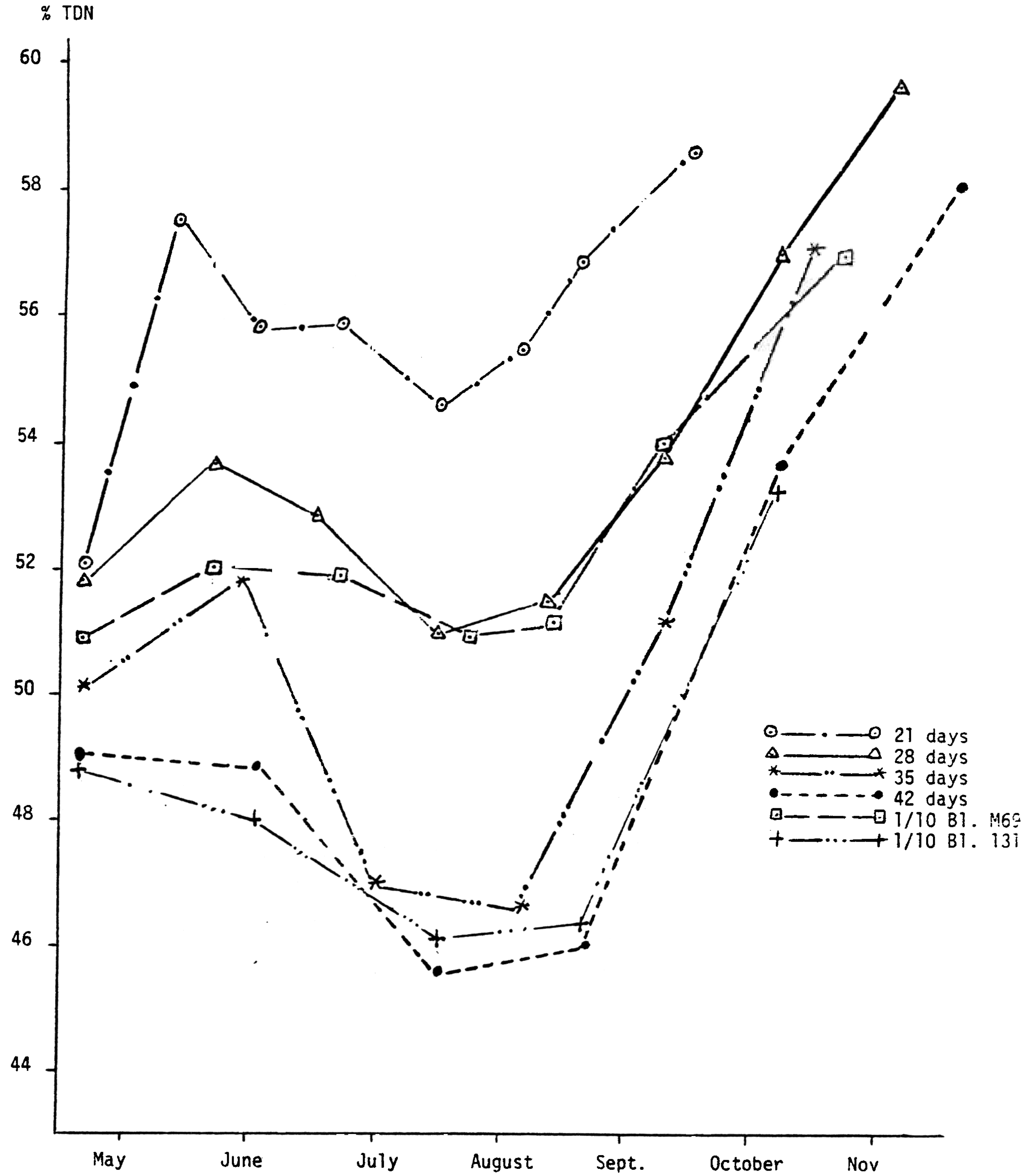

Figure 4. Seasonal changes in TDN for 6 harvest frequencies, 8 varieties averaged; 1977; UC Davis (Marble).

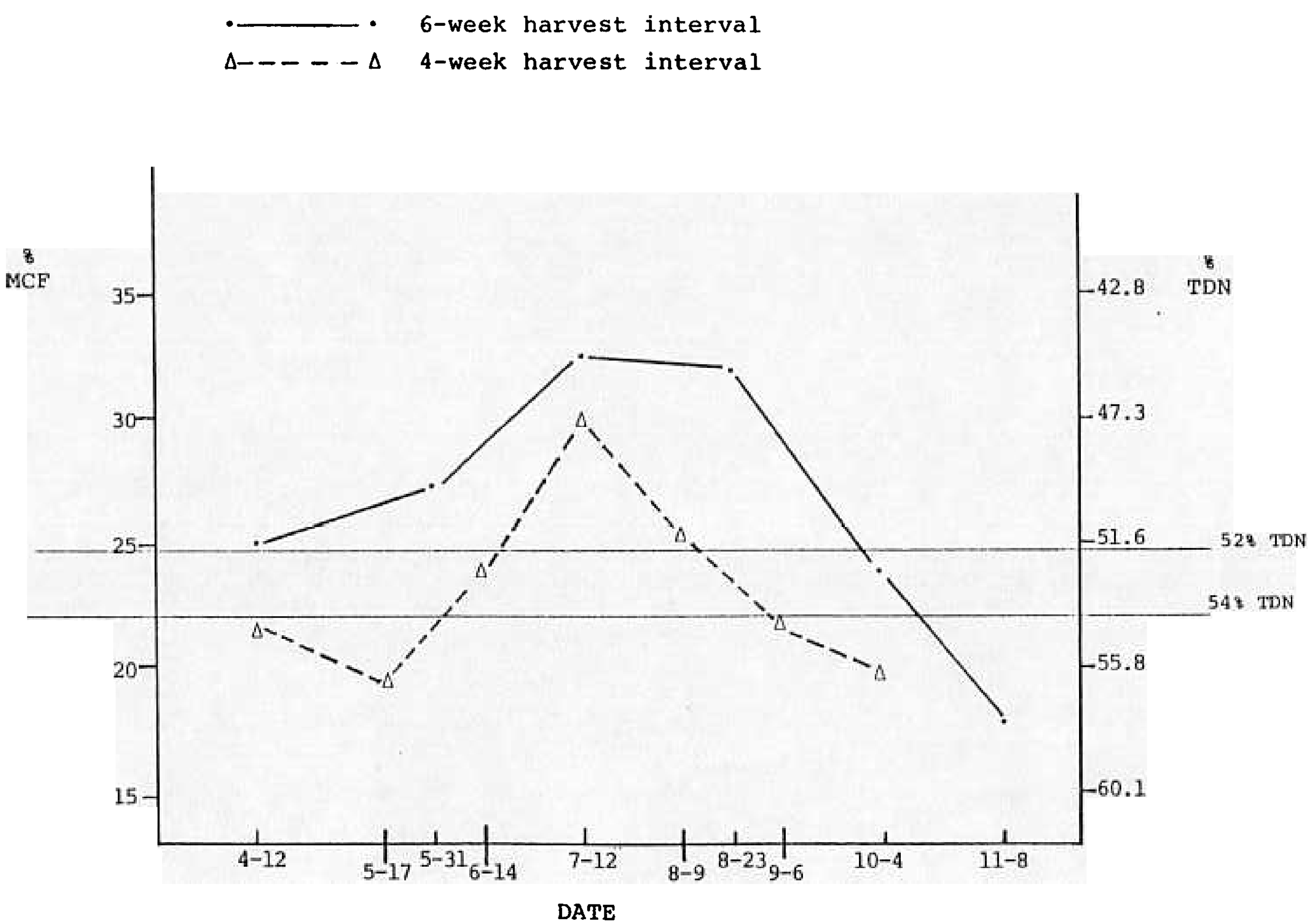

Figure 5. Seasonal changes in modified crude fiber (MCF) and total digestible nutrients (TDN) of 2 harvest frequencies, 8 varieties averaged for each frequency; 1977; West Side Field Station (Marble).