THE EFFECTS OF MEFLUIDIDE TREATMENT ON HYBRID PEARL MILLET AND NUTRIENT UTILIZATION BY SHEEP

by

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GENERAL INTRODUCTION

Mefluidide is a plant growth regulator-herbicide that has shown the potential to delay flowering and suppress seedhead formation of grasses, control broadleaf weeds and increase forage quality by enhancing sugar and nitrogen content and reduce cell wall fraction.

Hybrid pearl millet, when used as a grazing crop, often grows rapidly making management difficult. This research was undertaken to determine the influence of a single application of mefluidide on the quality of pearl millet and its nutrient utilization by sheep.

LITERATURE REVIEW

Plant Description and Use

Hybrid pearl millet (Pennisetum americanum (L.) K. Schum.) is utilized primarily as a pasture crop in late summer (July thru August) but may also be harvested as hay or silage (Martin et al., 1976). Pearl millet can be a valuable component for developing year-round livestock forage grazing systems because it can survive moisture stress which is common in late summer. However, as for other forages, pearl millet will perform better if optimum precipitation is available (Fribourg, 1985).

Pearl millet is an erect summer annual grass which may grow to a height of 2 to 5 m (Fribourg, 1985). Leaf blades are long and pointed with finely serrated margins, while stems become pithy when mature (Martin et al., 1976).

Most regrowth occurs from nonbasal tillers and is largely dependent on the amount of total nonstructural carbohydrate reserves available (Stephenson and Posler, 1984).

The feeding value of pearl millet is high due to its low stem to leaf ratio ratio (Kilgore, 1975; Posler et al., 1983), high productivity, superior chemical composition, and lack of danger of prussic acid (HCN) poisoning (Hedges et al., 1978). Protein levels average 16% (Boyle and Johnson, 1968) while in vitro digestibility and acceptability to sheep have been found to be superior to sorghums (Hedges et al., 1978).

Morphological Development of Pearl Millet

The feeding value of a forage differs greatly depending on its growth stage at harvest. Table 1 describes the various growth stages of pearl millet as modified from Metcalfe and Nelson (1985).

Nutritive Value of Forages

Forage quality can be defined as the kind and amount of digestible nutrients available per unit of time, thus forage quality is a function of the rate and level of intake, the rate and extent of digestion and the efficiency of utilization of specific nutrients (Barnes and Marten, 1979).

Feeds can be individually evaluated and divided into two major fractions: cellular contents and cell wall components. Cellular contents includes the highly digestible proteins, sugars, starch and organic acids. The fibrous plant cell wall contains cellulose, hemicellulose, lignin, cutin and silica (Van Soest, 1985).

Nutritive value depends greatly on the intake and digestibility of these nutrients. In 1957, Crampton found that the feeding value of a forage was largely dependent on the amount consumed and not the chemical composition. Thus in 1960, Crampton et al. suggested a nutritive value index for forages based on their voluntary intake and digestibility by the ruminant animal. Reid et al. (1959) stated that the main function of forages was to supply energy, thus the nutritive value of a forage depends on the intake and energy density of that feed.

TABLE 1. MORPHOLOGY OF PEARL MILLET

Growth Stage	Definition
First growth	
Vegetative	Leaves only, stems are not elongated. Seedling to older plant depending on extended leaf length.
Stem Elongation	Stems are elongated. Early or late jointing depending on the percent of leaves exposed. Less than 50% exposed would be early stem elongation, more than 50% exposed would be late elongation.
Boot	Inflorescence enclosed in flag leaf sheath and not showing.
Heading	Inflorescence emerging or emerged from flag leaf sheath but not shedding pollen.
Anthesis	Flowering stage and anthers are shedding pollen.
Milk stage	Seeds are immature and endosperm is milky.
Dough stage	Well-developed seeds and endosperm has become doughy.
Ripe seed	Seed is mature and leaves are green to yellow brown in color.
Postripe seed	A few seed heads are shattered and some brown dead leaves.
Stem-cured	Most seed is cast from the heads and leaves are cured on stems.
Regrowth	
Vegetative	Leaves only, no stem elongation.
Jointing	Green leaves and elongated stems.
Late growth	Leaves and stems weathered

In 1982, Van Soest concluded that intake and digestibility were directly related but not always positively. He pointed out the positive correlation between intake and digestibility when poor quality, bulky feeds are fed and a negative correlation exists when high quality rations with a high caloric density are fed. The point at which fiber mass becomes limiting occurs when cell wall content reaches 50 to 60% of the forage dry matter (Van Soest, 1965).

Research shows that the chemical composition of a plant changes with advancing maturity, therefore, digestibility and voluntary intake change (Ademosum et al., 1968). Crude protein and cell contents have been found to decline with advancing age in pearl millet and sorghum (Chaudhry et al., 1973), oats (Dua et al., 1973), and non-legume forages (Gupta and Pradhan, 1975). A steady increase in percent dry matter and cell wall material with advancing maturity was noted by Gupta and Pradhan (1975) in non-legume forages and Khurma et al. (1972) in pearl millet. Gupta and Pradhan (1975) also noted that with advancing maturity structural material increased at a faster rate than soluble cell contents. Nitrogenous compounds were steadily a smaller percentage of the dry matter and there was a net loss of crude protein content after early stages of plant growth. This was explained by a decrease in the leaf to stem ratio (Blaser, 1964). Various studies have also shown that in vitro dry matter digestibility (IVDMD) and in vitro cell wall digestibility (IVCWD) decrease with maturity (Thompson and Rogers, 1968; Barnes et al., 1971; Gupta and Pradhan, 1975). This decrease in IVCWD was explained by Mowat et al. in 1969 as an accumulation of lignin with advanced maturity; which formed an incrustation layer that interfered with rumen microbial attack on cellulose and parts covered by cellulose (Khurma et al., 1972).

Generally speaking forage intake is influenced by its quality and is reflected in a positive relationship (r = .512) between digestibility and intake (McCullough, 1956). In 1964, Gangstad reported palatability in grass sorghum varieties was positively correlated with leafiness, percent moisture and total sugar concentration. In a subsequent study, Gangstad (1966) found that the grazing preference of cattle for several sudangrass varieties and hybrids was positively associated with leafiness, percent crude protein and total sugar concentration and negatively correlated with crude fiber.

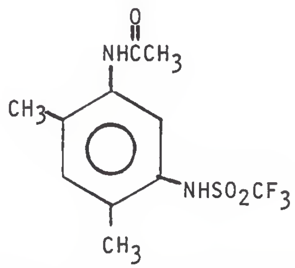
Intake can also be influenced by other factors such as animal, environment and management. There are several animal factors that can influence daily consumption. There is a .98 correlation between body size and forage intake (MacLusky, 1955). Various research trials have also shown a positive relationship between dry matter intake and animal production (Jarl, 1952; Cox, 1956; McCullough, 1956; Wallace, 1956).

Management practices can play an important role in forage intake and animal production values. MacLusky (1955) reported a 21% coefficient of variation associated with free-grazing cows. He also noted that the individuality of animals adds factors which are hard to evaluate and measure.

Environmental factors can also influence the rate of forage intake in a ruminant animal (Winchester and Morris, 1956; MacDonald and Bell, 1958; Ragsdale et al., 1958). It has been reported that a rise in ambient temperature will decrease voluntary intake (Wayman et al., 1962). Other research has indicated a decrease in temperature will lead to increased intake.

Mefluidide

Mefluidide, N-(2,4-dimethyl-5-(((trifluoromethyl)sulfonyl)amino)phenyl)acetamide, is a fairly new plant growth regulator from 3M Chemical Corporation, St. Paul, Mn. The chemical structure is:



It has shown the potential to increase weight gains in cattle and sheep by enhancing the quality of forages. Quality improvement has been measured as a reduction in nondigestible cellulose and a increase in total sugar and crude protein (Sullivan and Hargroder, 1981).

Mefluidide has also been found to inhibit seedhead production (Freeborg and Daniel, 1975; Gates, 1975; Hield and Henstreet, 1975; Chappell et al., 1977) and enhance color and root growth of many cool season grasses (Gates, 1975). In 1980, Glenn et al. reported that mefluidide treatment of tall fescue (Festuca arundinacea Schreb. cv. Ky-31) decreased the percent cellulose and increased the percent sugar and crude protein. Dry matter yields were reduced as a result of inhibiting floral development of the plant. Robb et al. (1982) reported digestibilities of dry matter, nitrogen, acid detergent fiber and neutral detergent fiber in tall fescue by lambs were increased by mefluidide application. Treated forage also contained greater amino acid concentrations, with a smaller amount of the N as non-protein N. Mefluidide treatment of tall fescue has also significantly increased weight gains of cattle and animal productivity/ha (Paterson et al., 1983; Robb et al., 1983; Lomas and Moyer, 1985).

Similar results have been reported in smooth brome (Bromus inermis Leyss.) (Wimer et al., 1985); orchardgrass (Dactylis glomerata L.) (Allen et al., 1983), and bahiagrass (Paspalum notatum Flugge) and bermudagrass (Cynodon dactylon (L.) Pers.) (DeRamus and Bagley, 1982).

Rouquette et al., 1983 reported that leaf to stem ratios were enhanced and seed heads were inhibited with increased rates of mefluidide application on pearl millet. Mefluidide also decreased neutral detergent fiber, hemicelluloses and lignin while stimulating cellulose content.

Although some physiological effects of mefluidide have been studied, the mechanism of action is still unknown. In 1979, Glenn et al. found that less than 3% of the radioactivity that remained in the treated leaf was associated with the nucleus, chloroplast, mitochondria and ribosomes. Ninety percent remained in the supernatant, indicating association with the cytoplasm and soluble enzymes.

At low concentrations, mefluidide treatment stimulated corn coleoptile elongation and increased protein synthesis by incorporating ^{14}C-leucine into protein. It was also suggested that mefluidide treatment may stimulate the activity or production of auxins or act as an auxin since auxins have been reported to stimulate protein synthesis (Glenn et al., 1979).

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THE EFFECTS OF MEFLUIDIDE TREATMENT ON HYBRID PEARL MILLET AND NUTRIENT UTILIZATION IN SHEEP

SUMMARY

Mefluidide, N-(2,4-dimethyl-5(((trifluoromethyl) sulfonyl) amino)-phenyl) acetamide, a plant growth regulator, has shown the potential to increase forage quality by inhibiting floral development. This delay in plant maturity results in increased animal weight gains. An application of .56 kg ai/ha was made when plants were approximately 30 cm high in the experiment 1. Applications of .28 and .56 kg ai/ha were made with harvesting at the boot stage to use in experiment 2.

Sixty crossbred lambs, approximately four months of age and weighing an average of 28.35 kg, were assigned to six groups by weight and sex in experiment 1. These groups were randomly assigned to two treatments, with three replicates per treatment. Treatments were hybrid pearl millet sprayed with mefluidide at .56 kg/ha (T) and no mefluidide application (C). There were no differences in animal weight gains or forage production as measured by grazing days/ha. Laboratory analyses on clipped and esophageal forage samples were variable with a general trend toward increased forage quality.

For experiment 2, forty-eight crossbred lambs weighing an average of 34.65 kg were assigned by weight and sex to 12 groups, then randomly assigned to one of three treatments: pearl millet sprayed with 0 (Control), .28 (Low) or .56 kg ai/ha (High) of mefluidide. Hay produced from these three treatments was fed. ADG was higher ($P<.05$) for lambs on the High treatment than those on the

Control treatment. Forage intake increased ($P<.05$) with mefluidide application. Yields were similar for Control and Low treatments while production for the High treatment was severly reduced. Laboratory analysis indicated that forage quality was improved by mefluidide application.

INTRODUCTION

Pearl millet (Pennisetum americanum (L.) K. Schum.) could become an important forage crop for late summer use in the United States if managed properly. Sound management is necessary for maximum utilization by ruminant animals.

Pearl millet is a summer annual, superior to sundangrass and sorghum-sudangrass hybrids because it doesn't accumulate prussic acid (Hedges et al., 1978) and has a higher leaf to stem ratio (Kilgore, 1975; Posler et al., 1983). Proper management requires utilizing the forage at highest quality without reducing yields dramatically.

Mefluidide is a relatively new plant growth regulator, marketed by 3M Chemical Corporation, under the trade name Embark. It has been used successfully to control plant growth on highway right-of-ways. Mefluidide also regulated tree and ornamental shrub growth in parks and golf courses, as well as inhibiting seedhead formation on grasses (Hurto, 1981; Jagschitz, 1982; Watschke, 1981).

Previous research has also shown that mefluidide has the potential to improve forage quality in cool-season grasses and selected warm-season grasses (Glenn et al., 1980; Robb et al., 1982; Wimer et al., 1985; Allen et al., 1983; DeRamus and Bagley, 1982). Quality improvements have been measured as a reduction in non-digestible cellulose and an increase in total sugar and nitrogen content. Applications in the spring have also inhibited seedhead formation and maintained the forage in an immature and vegetative state throughout the summer (Chappell et al., 1977; Freeborg and Daniel, 1975; Rouquette et al., 1983).

When these agronomic characteristics were altered, dry matter production was not altered and animals consumed greater amounts of forage and utilized this consumed forage more efficiently. Cattle and sheep grazing mefluidide-treated forage have shown significantly higher weight gains than those grazing non-treated forage (Paterson et al., 1983; Robb et al., 1983; Wimer et al., 1985).

Limited information is available regarding the effects of mefluidide on the quality of pearl millet and subsequent animal weight gains. This study was designed to determine whether the effects of mefluidide applications on hybrid pearl millet were similar to those found with other grasses.

MATERIALS AND METHODS

Experiment I : Grazing Trial

On July 14, 1984, a 1.2 ha field of hybrid pearl millet (Pennisetum americanum 'Millhy 99') was divided into 6, 0.2-ha plots, three of which were treated with mefluidide at 0.56 kg ai/ha when plants were 30 cm tall. The remaining three were left untreated as a control.

Two weeks following application, 60 crossbred lambs weighing an average of 28.35 kg were assigned to six groups by weight and sex. These six groups were randomly assigned to two treatments: control and treated forage. Lambs were weighed at the beginning of the trial and every two weeks following until completion at six weeks. Lambs were held off feed and water for 12 hours prior to weighing. Grazing was continued for another two weeks after the last weighing to determine possible forage production differences among treatments. Forage production was measured in grazing days per hectare. All treatments were supplied with a free-choice trace mineral salt mixture and shade.

Clipped samples of forage were taken weekly from each pasture and stored frozen. These samples were allowed to thaw, dried at 55° C in a forced air oven, and ground in a Wiley mill (1 mm screen). Crude protein was determined by AOAC (1984) methods while water-soluble carbohydrates (WSC) were obtained by the methods as modified from McDonald and Henderson (1964). Analyses for nuetral detergent fiber (NDF), acid detergent fiber (ADF), cellulose, hemicellulose and lignin were by the technique of Goering and Van

Soest (1970). In Vitro dry matter digestibility (IVDMD) was determined for each sample using the Tilley and Terry (1963) two-stage technique.

Esophageal fistulated wethers were utilized to obtain actual diet samples for each pasture. Diet samples were taken at vegetative, preboot and mature forage growth stages to determine the quality of forage actually being selected by the animals. Samples were analyzed for crude protein, WSC, ADF, NDF, cellulose, lignin and IVDMD using the same techniques as described for clipped samples.

Experiment 2: Feeding Trial

A 1.6 ha field of hybrid pearl millet was divided into six 0.278 ha plots. Applications of mefluidide at 0.0 (Control), 0.28 (Low) and 0.56 (High) kg ai/ha were made on July 25, 1984. Plant height varied from 30 to 37.5 cm at the time of application. Forage was harvested on Aug. 13 and baled for use in a feeding trial. This hay was ground in a grinder-mixer (12.5 mm screen) and analyzed for crude protein using the techniques described in experiment 1. Forage regrowth was estimated four weeks following the initial harvest.

Forty-eight crossbred lambs weighing an average of 34.65 kg used in the previous grazing trial were assigned to 12 groups by weight and sex. These 12 groups were randomly assigned to three treatments: Control, Low and High. Crude protein values determined for each treatment of hay were used to formulate three supplements. These supplements were formulated so all rations would be isonitrogenous and supply all minerals and vitamins needed (NRC, 1975). Ration supplement ingredients are listed in Table 2. Lambs were fed supplement daily and all the hay they would consume morning and night. Excess hay in the bunks was removed and weighed two times per week. Hay samples and weigh back forage were analyzed for crude protein, WSC, NDF, ADF, cellulose, lignin and IVDMD utilizing the same techniques as in experiment 1.

Lambs were weighed at the beginning of the trial on Oct. 8, 1984, and every 14 days following until completion at 42 d. Lambs were held off feed and water for 12 hours prior to weighing.

RESULTS AND DISCUSSION

Experiment 1: Grazing Trial

Results of this trial showed no differences in daily gains of lambs grazing mefluidide treated and non-treated forage. ADG were 180 and 184.5 g respectively, for C and T groups. No other grazing trials have been conducted with mefluidide treated pearl millet, but similar studies performed with beef cattle on cool season grasses have shown significant gain responses with mefluidide treatment (Paterson et al., 1983; Robb et al.,1983; Stokes et al., 1985; Ely et al., 1985; Ely et al., 1985; Wimer et al., 1985). Forage yields were 504 grazing days/ha for both treatments. Although forage production in grazing days/ha was not suppressed by mefluidide treatment, there were more stalks left in the non-treated forage at the end of the trial indicating a difference in palatability and an improvement in utilization of the available forage. Rouquette et al. (1983) found that increasing rates of mefluidide application decreased dry matter production in pearl millet, Wimer et al. (1985) obtained similar results with smooth brome. Data obtained in this study agreed more closely with the results discovered in a trial with cool season grasses (Glenn et al., 1980).

Results of chemical analyses performed on hand clipped and diet (esophageal collected) samples are presented in tables 3 and 4. These are average values from samples taken throughout the entire grazing period. Although not significantly different, crude protein was higher for T than C forage in hand clipped samples and was greater ($P<.0005$) for T than C among diet samples. Glenn et al. (1980) and Robb et al. (1983) obtained similar results with tall fescue, Rouquette et al. (1983) with pearl millet, Wimer et al. (1985) with smooth brome. No season long differences were found between treatments in WSC, but as shown in figure 1, WSC was greater (P<.07) for T than C among diet samples. This coincides with work done by Glenn et al. (1980) and Robb et al. (1983). When comparing hand clipped and diet samples, lower WSC values for diet samples might be explained by nutrients being released from the ingested feed during the mastication process (Church, 1976). Percent ADF of T was lower (P<.04) than C forage among diet samples and is illustrated in figure 2. Rouquette et al. (1983) also found that mefluidide application to pearl millet reduced percent ADF. Clipped sample NDF values were slightly lower for T forage, but not enought to be significant. Diet sample NDF values were lower (P<.09) for T than C forage. No differences were discovered between treatments with the lignin analysis although a trend toward lower lignin with T forage did occur (figure 3). In general, forage NDF and lignin were not altered by mefluidide application which agrees with data collected by Robb et al. (1982) utilizing tall fescue. Cellulose content was reduced (P<.01) with mefluidide treatment in hand clipped samples and, although not significantly different in diet samples, cellulose values exhibited a lower trend than treated forage. Glenn et al. (1980) observed reduced percent cellulose by applying mefluidide to tall fescue. In tables 3 and 4 the differences in IVDMD values for T forage when compared to C might be explained by the lower amount of WSC present in T forage. IVDMD values for the T diet samples increased (P<.01) before dropping during the last period of grazing unlike C samples which steadily decreased over time (figure 4). The 15% difference in IVDMD values between clipped and diet forage samples could be explained by the lower WSC and higher lignin data collected. After mastication of selected leaves high in soluble carbohydrate, a higher content of lignin and lower percent WSC would be present in the food bolus (Church, 1976) lowering IVDMD. Increased IVDMD values have been obtained by treating cool season grasses with mefluidide (Paterson et al., 1983; Wimer et al., 1985).

Forage analysis data collected in this study are variable and inconclusive. Results of mefluidide treatment may have been more favorable with higher rainfall leading to an increase in regrowth and tillering. Overal results of this study indicate mefluidide contains the potential to increase forage quality, improve nutrient utilization and increase animal weight gains.

Experiment 2: Feeding Trial

Results of mefluidide treatment on forage production are shown in table 5. Hay production was similar for the Control and Low application rate while the High application rate severely reduced initial production. Regrowth production was increased by the initial application of mefluidide. Little difference was noted between Control and Low treatments while the High treatment greatly reduced total production of forage. These results agree with data collected in other studies involving tall fescue, pearl millet and smooth brome (Glenn et al., 1980; Rouquette et al., 1983; Wimer et al., 1985). Total forage yields were also depressed for all treatments due to late planting and little rainfall.

Daily intake and gain values are presented in table 6. Intake of hay was higher (P<.05) for lambs consuming treated forage than those fed non-treated forage. Lambs fed non-treated forage were more selective in their eating habits as indicated by a larger amount of feed left in their bunks. Although no other intake data had been collected, DeRamus and Bagley (1982) found an increase in dry matter digestibility with warm season perennials indicating a possible increase in intake. ADG was higher (P<.05) for lambs on the High treatment than those consuming Control forage. Gains for lambs on the Low treatment were greater but not significantly better than those on the Control treatments. This increase in animal weight gains agrees with various studies conducted with beef cattle in tall fescue and smooth brome (Paterson et al., 1983; Robb et al., 1983; Stokes et al., 1985; Ely et al., 1985a; Ely et al., 1985b; Wimer et al., 1985).

Chemical composition of the hay fed is shown in table 7. Analyses were done on composite samples for each treatment so no statistical analysis could be performed. Percent crude protein and WSC increased with mefluidide treatment while a reduction in ADF and cellulose was found. No apparent differences were seen in NDF, lignin and IVDMD. These results agree with most mefluidide studies conducted as Glenn et al. (1980) and Robb et al. (1983) discovered increased nitrogen and total sugar content and a reduced cell wall fraction in tall fescue. Rouquette et al. (1983) found an increase in cellulose content of mefluidide treated pearl millet forage which disagrees with data obtained in this study and those done with cool season grasses (Glenn et al., 1980). Rouquette et al. (1983) explained that this increase in cellulose might be due to mefluidide slowing the rate of hemicellulose formation in leaf portions, yet an opposite relationship is found in stem sections.

Results of the chemical analysis of hay weigh backs is presented in table 8. As with the hay, since a composite sample of each treatment was used, statistical analysis was not possible. Differences were evident, however. Percent crude protein and WSC were higher with mefluidide treatment while NDF, ADF and cellulose were lower. Percent lignin increased while IVDMD remained constant. At this time, the author offers no explanation for an increase in lignin.

Chemical composition of the regrowth is shown in table 9. Once again, a composite sample was taken for each treatment, with no statistical analysis conducted. As shown, the chemical composition of samples was similar, with the exception of IVDMD, where the control was higher. This coincides with a nutrient utilization study done with mefluidide treated tall fescue by Robb et al. (1982).

Overall, forage quality was improved by mefluidide treatment, enhancing nutrient utilization and increasing animal weight gains. Forage yields were severely suppressed with the high application rate as floral development was prevented.

TABLE 2. SUPPLEMENT FED PER HEAD DAILY.

Ingredient[1]	Treatment		
	Control	Low	High
Grain sorghum, g	112.5	144.0	157.5
Soybean meal, g	94.5	63.0	49.5
Salt, g	4.5	4.5	4.5
Limestone, g	4.5	4.5	4.5
Aureomycin, mg	50	50	50
Trace mineral, mg	25	25	25
Vit. A, I.U.	12,000	12,000	12,000
Vit. D, I.U.	1200	1200	1200

[1]As fed basis.

TABLE 3. FORAGE COMPOSITION (CLIPPED), EXP. 1.

Item[1]	Forage	
	Control	Treated
Crude protein, %	10.5	11.8
Water soluble carbohydrate, %	7.1	5.1
NDF, %	61.4	60.9
ADF, %	30.9	29.4
Lignin, %	3.7	3.8
Cellulose, %	25.2[a]	23.0[b]
IVDMD, %	53.3[a]	48.4[b]

[1] Dry matter basis.

[a,b] Values in same row with different superscripts differ ($P<.05$).

TABLE 4. FORAGE COMPOSITION (DIET), EXP. 1.

Item[1]	Forage	
	Non-treated	Treated
Crude protein, %	11.9[a]	14.1[b]
Water soluble carbohydrate, %	2.4	2.3
NDF, %	64.9	62.2
ADF, %	37.6[a]	34.7[b]
Lignin, %	5.1	5.1
Cellulose, %	25.3	24.3
IVDMD, %	33.2	37.2

[1] Dry matter basis.

[a,b] Values in same row with different superscripts differ ($P<.05$).

TABLE 5. FORAGE PRODUCTION, EXP. 2

Item[1]	Treatment		
	Control	Low	High
Hay, kg/ha	4383	4059	2654
Regrowth, kg/ha	1374	2009	1799
Total production, kg/ha	5757	6068	4453

[1] Dry matter basis.

TABLE 6. DAILY INTAKE AND GAIN VALUES, EXP. 2

Item[1]	Treatment		
	Control	Low	High
No. lambs	16	16	16
ADG, g	162.0[a]	184.5[ab]	202.5[b]
Average daily consumption, kg[1]	1.39[a]	1.57[b]	1.64[b]

[ab] Values in same row with different superscripts differ (P<.05).

[1] As fed basis.

TABLE 7. FORAGE COMPOSITION (HAY), EXP. 2.

Item[1]	Treatment		
	Control	Low	High
Crude protein, %	8.5	10.5	11.5
Water soluble carbohydrate, %	4.0	4.4	6.1
NDF, %	63.6	64.6	62.3
ADF, %	34.3	30.4	30.1
Lignin, %	2.9	1.8	2.8
Cellulose, %	28.2	25.5	24.2
IVDMD, %	60.5	57.5	59.6

[1]Dry matter basis.

TABLE 8. FORAGE COMPOSITION (WEIGH BACK), EXP. 2.

Item[1]	Treatment		
	Control	Low	High
Crude protein, %	9.1	13.0	14.1
Water soluble carbohydrate, %	2.6	4.0	4.7
NDF, %	63.4	61.2	59.5
ADF, %	36.6	30.2	29.3
Lignin, %	2.3	2.9	3.6
Cellulose, %	29.2	23.3	17.8
IVDMD, %	55.4	56.6	56.5

[1] Dry matter basis.

TABLE 9. FORAGE COMPOSITION (REGROWTH), EXP. 2.

Item[1]	Treatment		
	Control	Low	High
Crude protein, %	13.7	16.3	12.3
Water soluble carbohydrate, %	8.3	5.0	7.7
NDF, %	54.6	58.8	53.4
ADF, %	26.0	27.2	27.1
Lignin, %	2.9	2.5	2.6
Cellulose, %	21.0	21.8	21.2
IVDMD, %	62.6	54.6	53.9

[1] Dry matter basis.

FIGURE 1. WATER SOLUBLE CARBOHYDRATE (WSC CONTENT) IN DIET SAMPLES TAKEN AT DIFFERENT PLANT GROWTH STAGES.

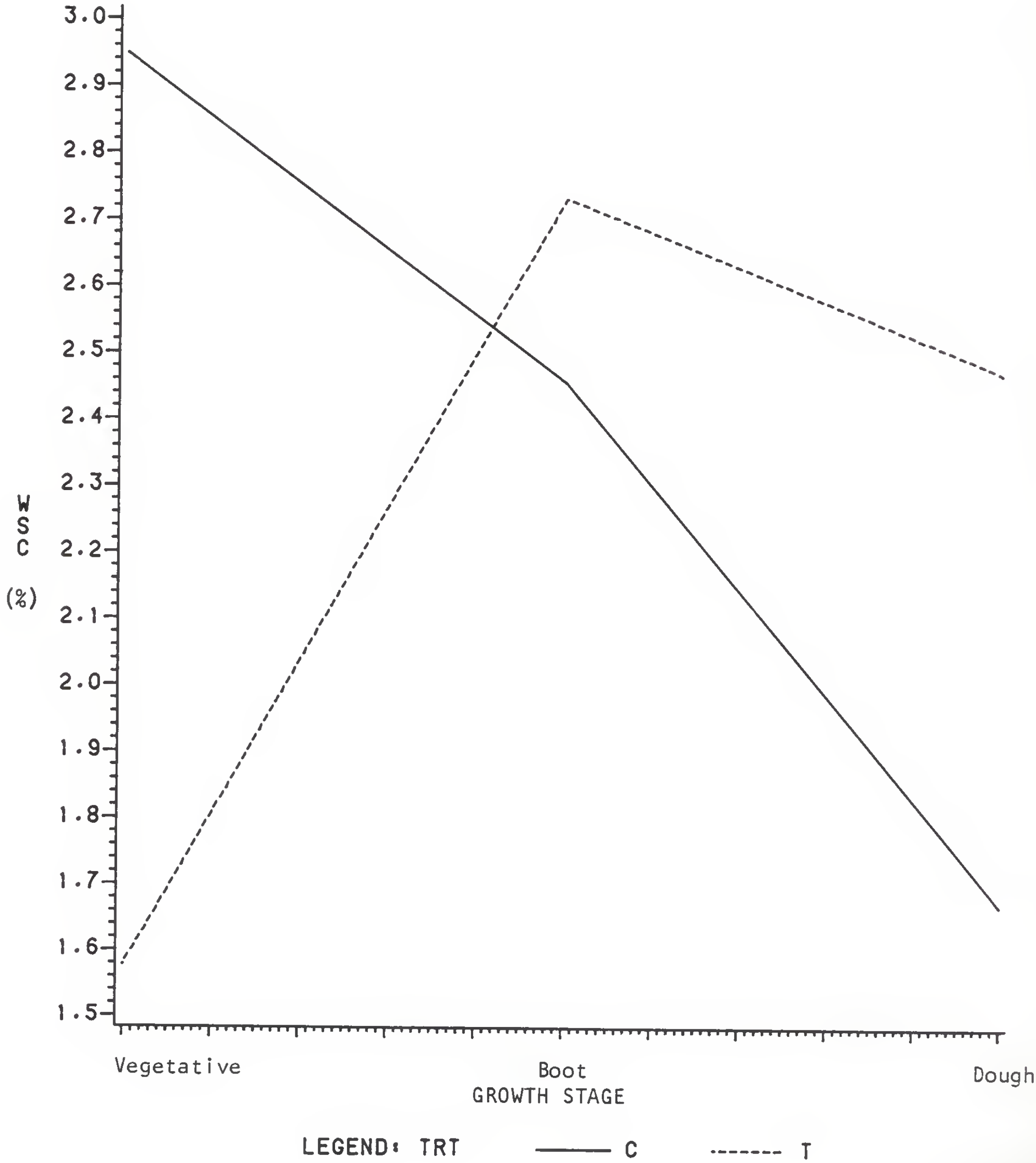


FIGURE 2. ACID DETERGENT FIBER (ADF) CONTENT IN DIET SAMPLES TAKEN AT DIFFERENT PLANT GROWTH STAGES.

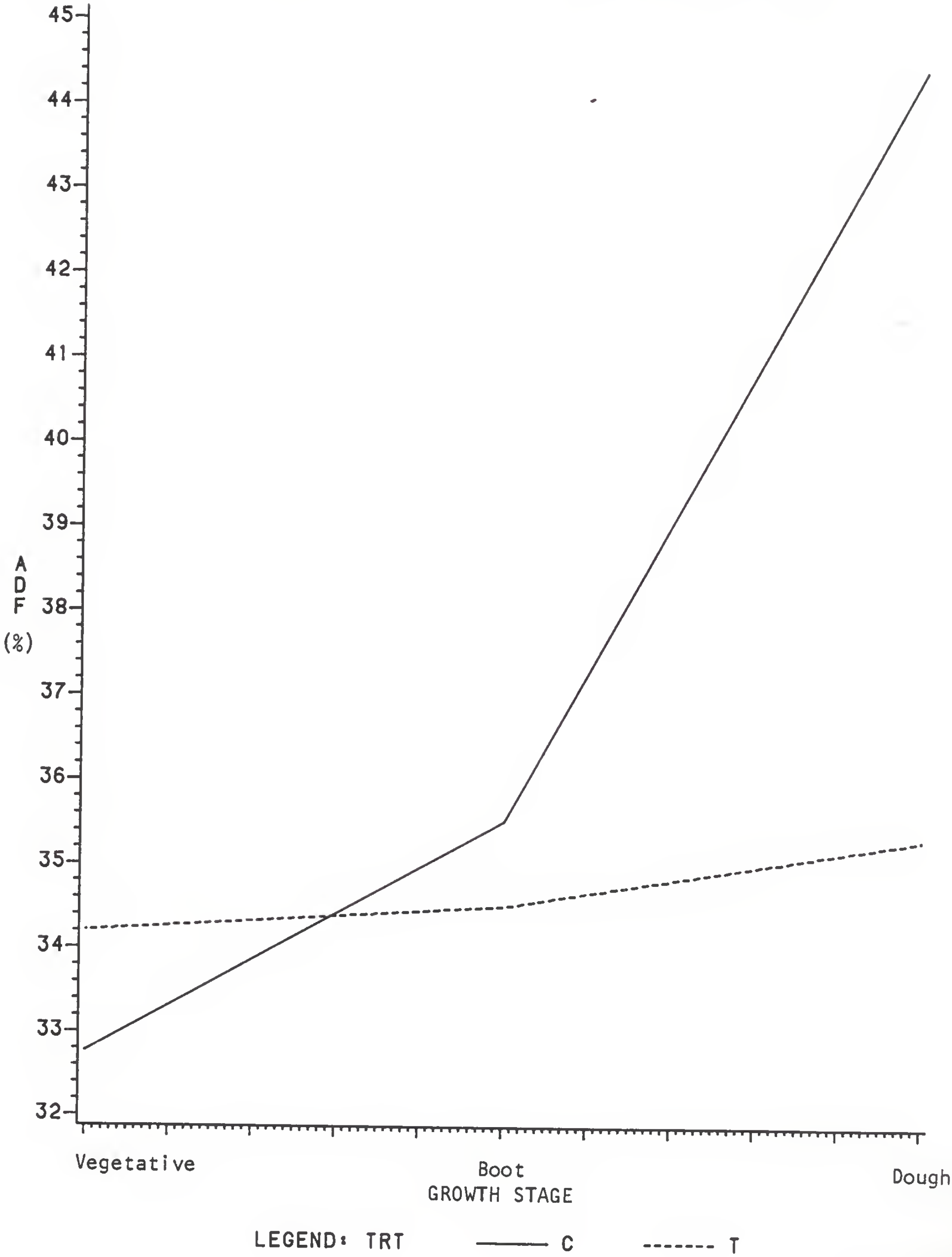


FIGURE 3. LIGNIN CONTENT IN DIET SAMPLES TAKEN AT DIFFERENT PLANT GROWTH STAGES.

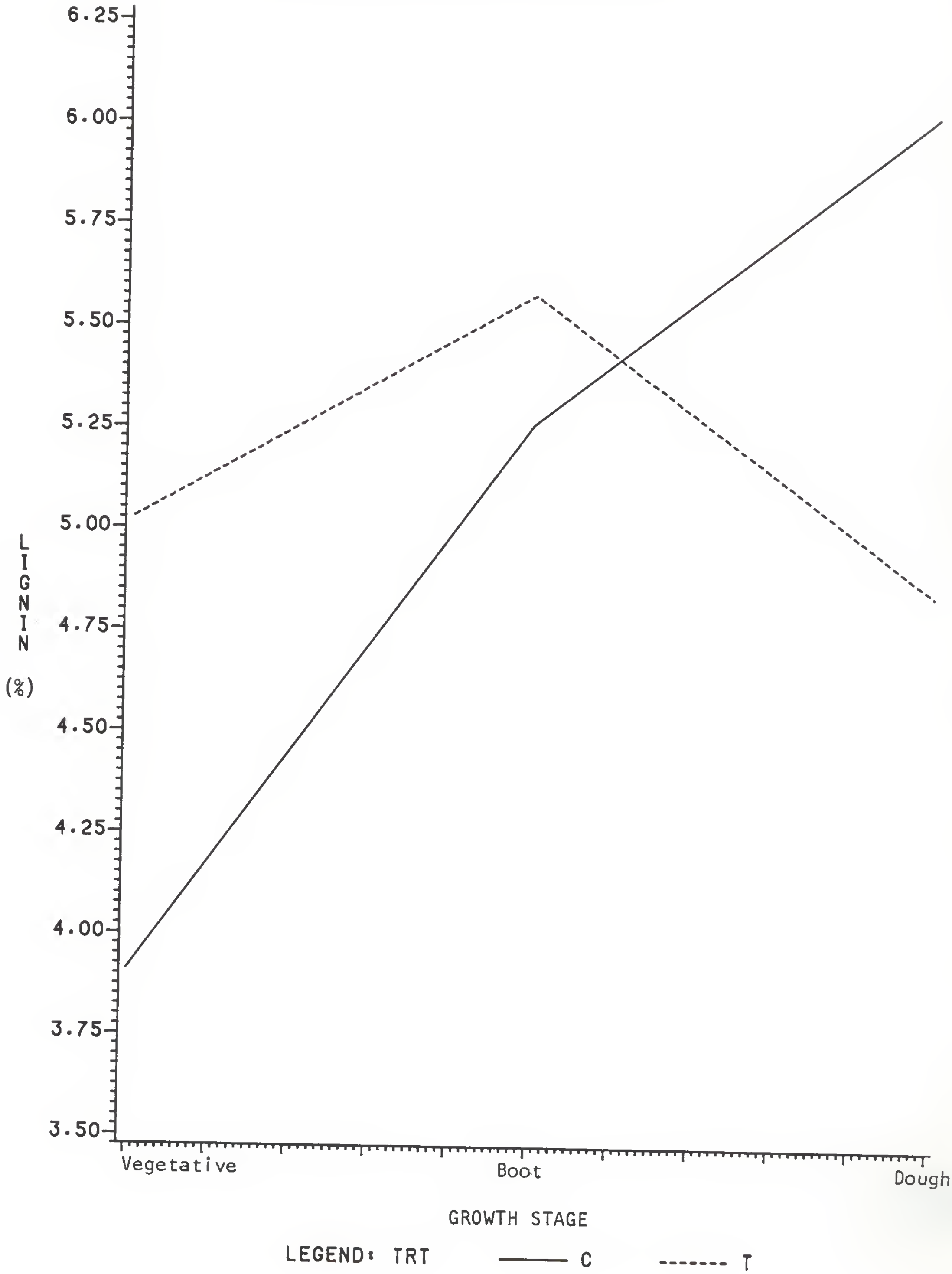
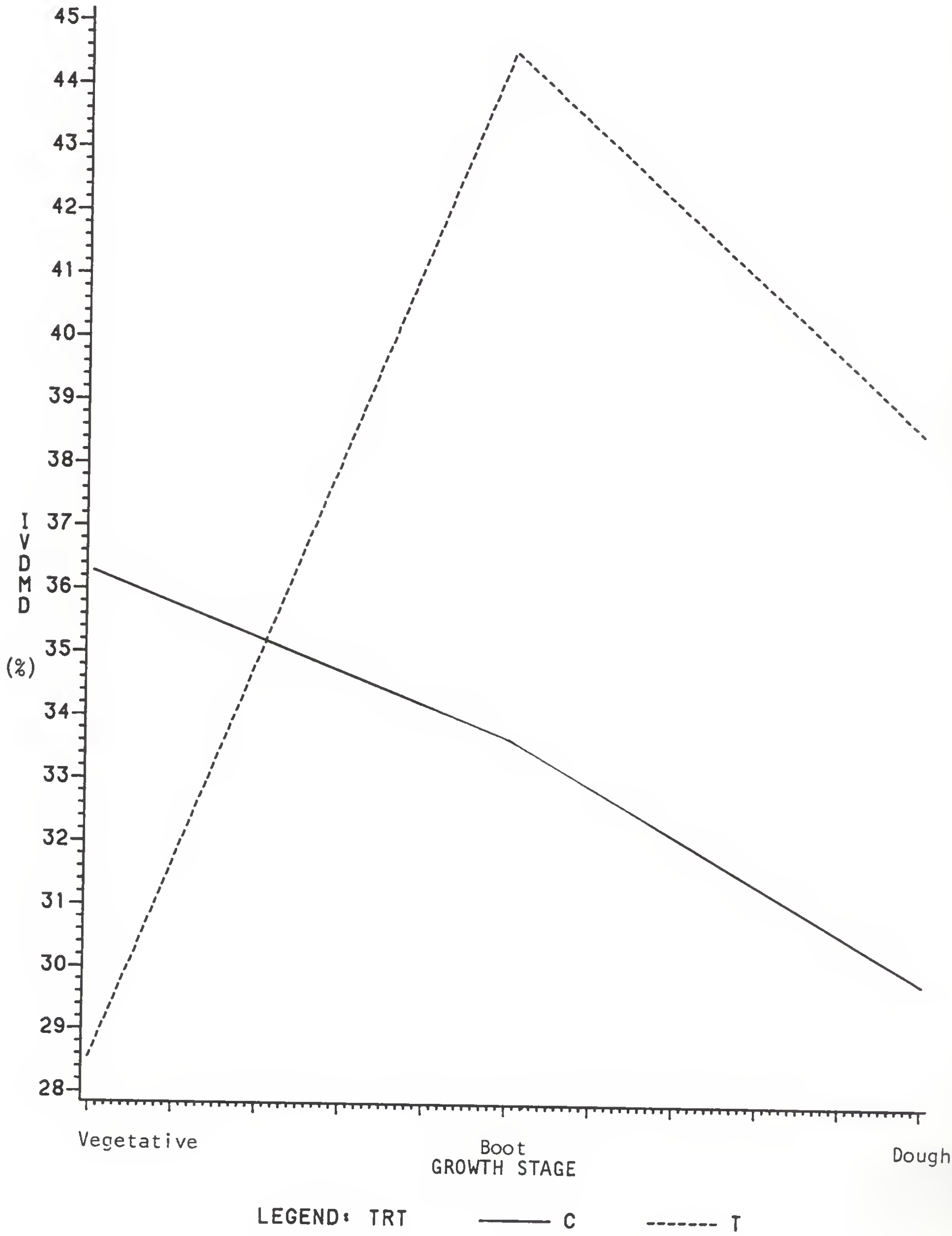


FIGURE 4. IN VITRO DRY MATTER DISAPPEARANCE (IVDMD) IN DIET SAMPLES TAKEN AT DIFFERENT PLANT GROWTH STAGES.



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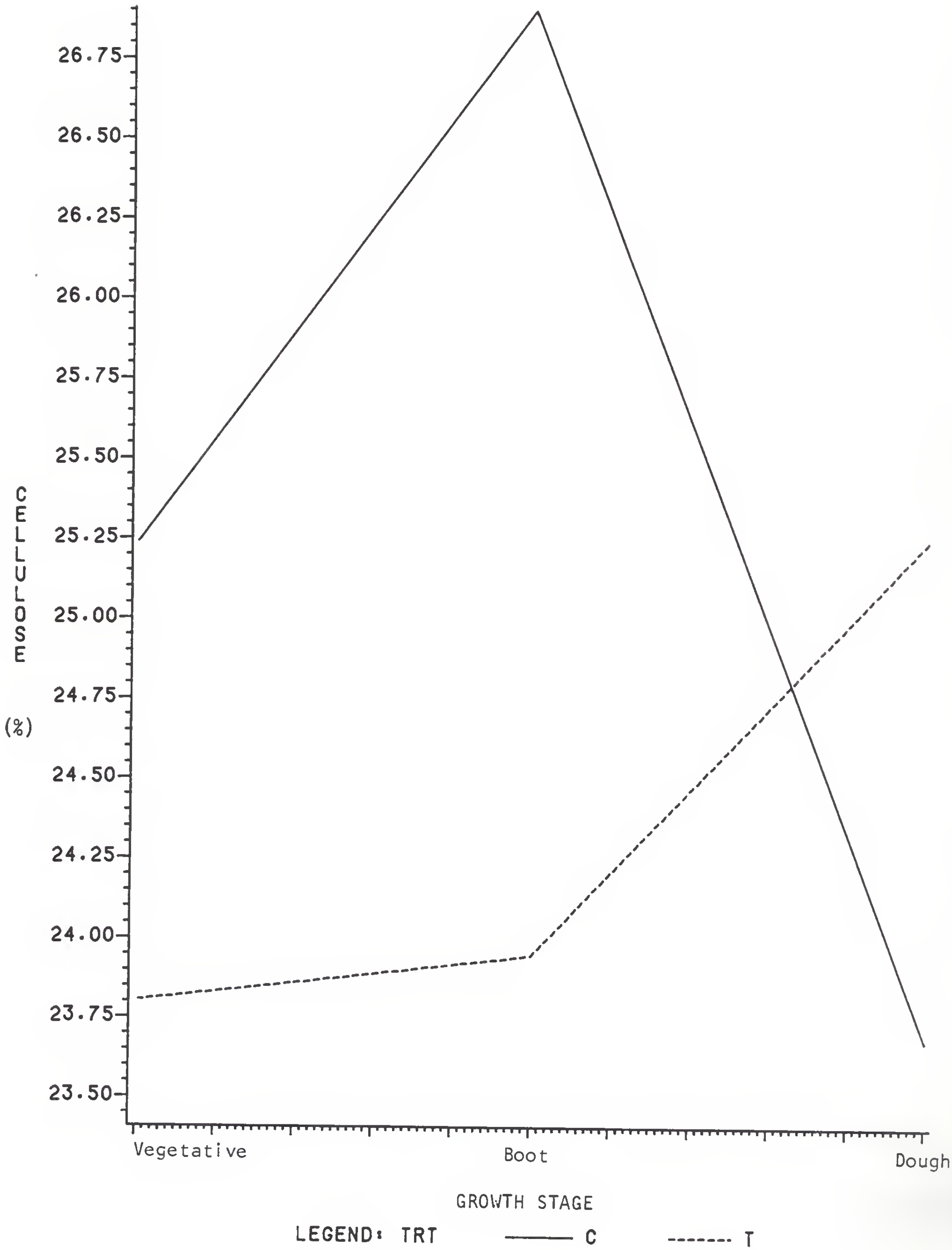
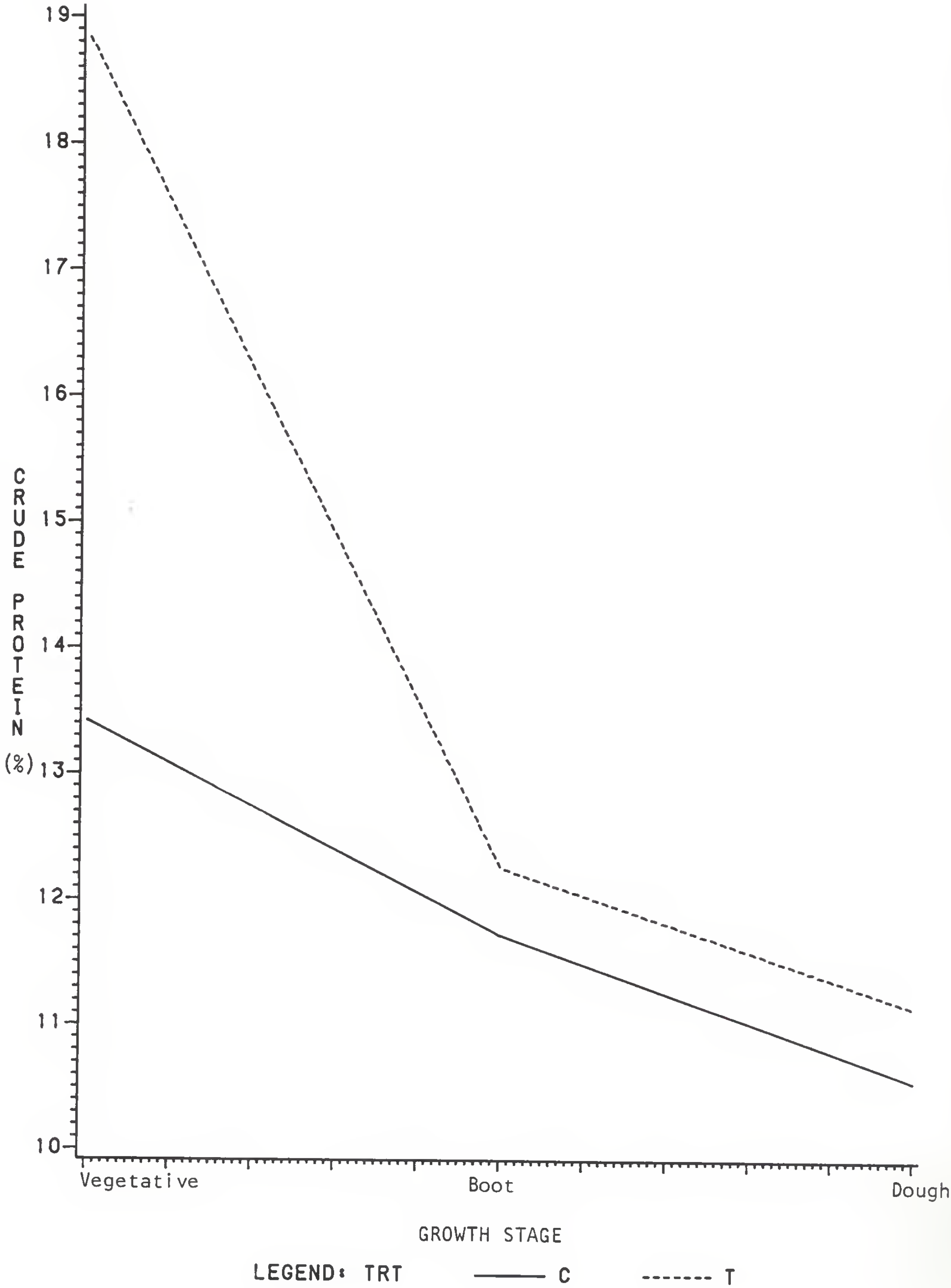
APPENDIX

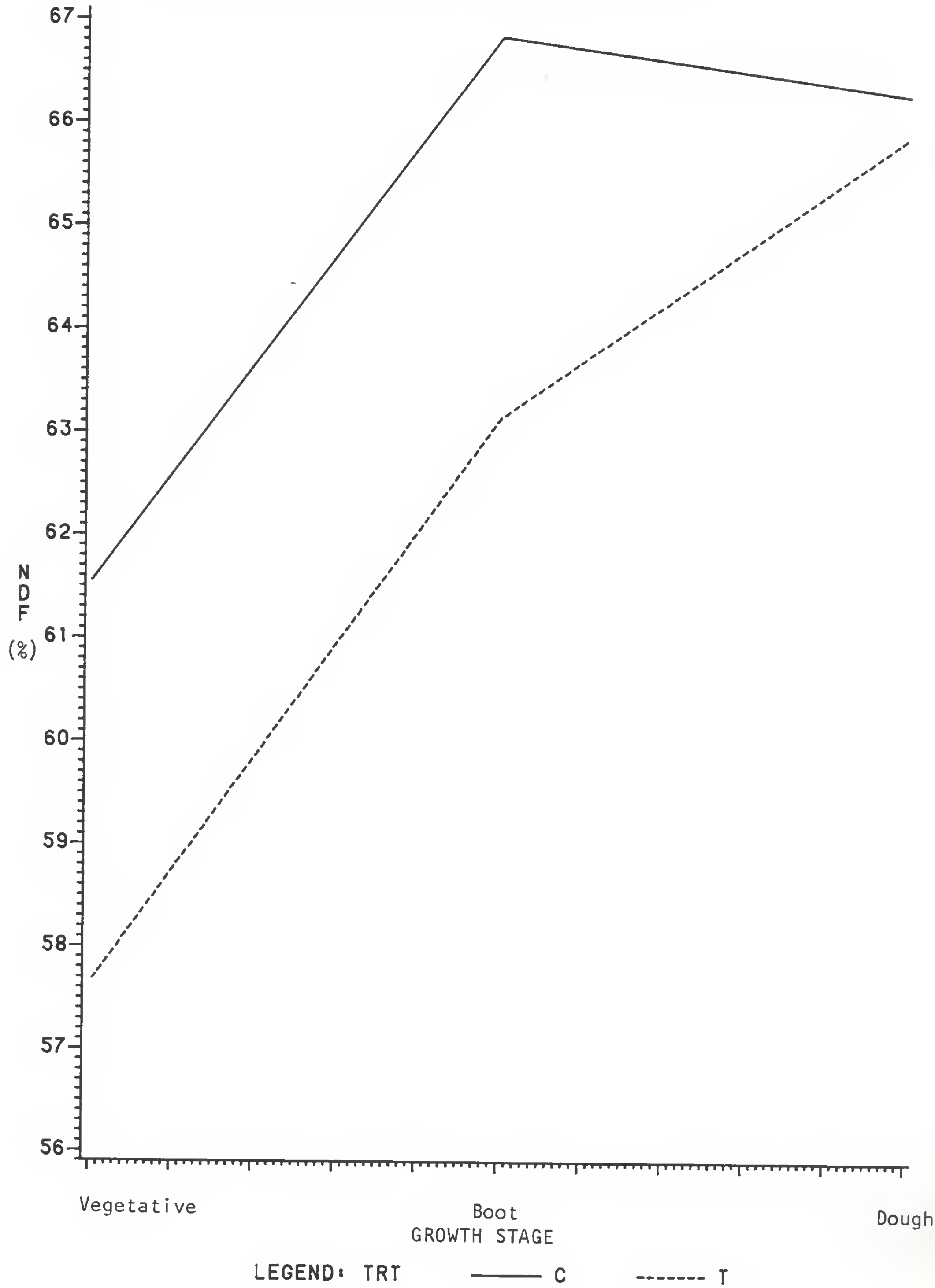
CELLULOSE CONTENT IN DIET SAMPLES TAKEN
AT DIFFERENT PLANT GROWTH STAGES



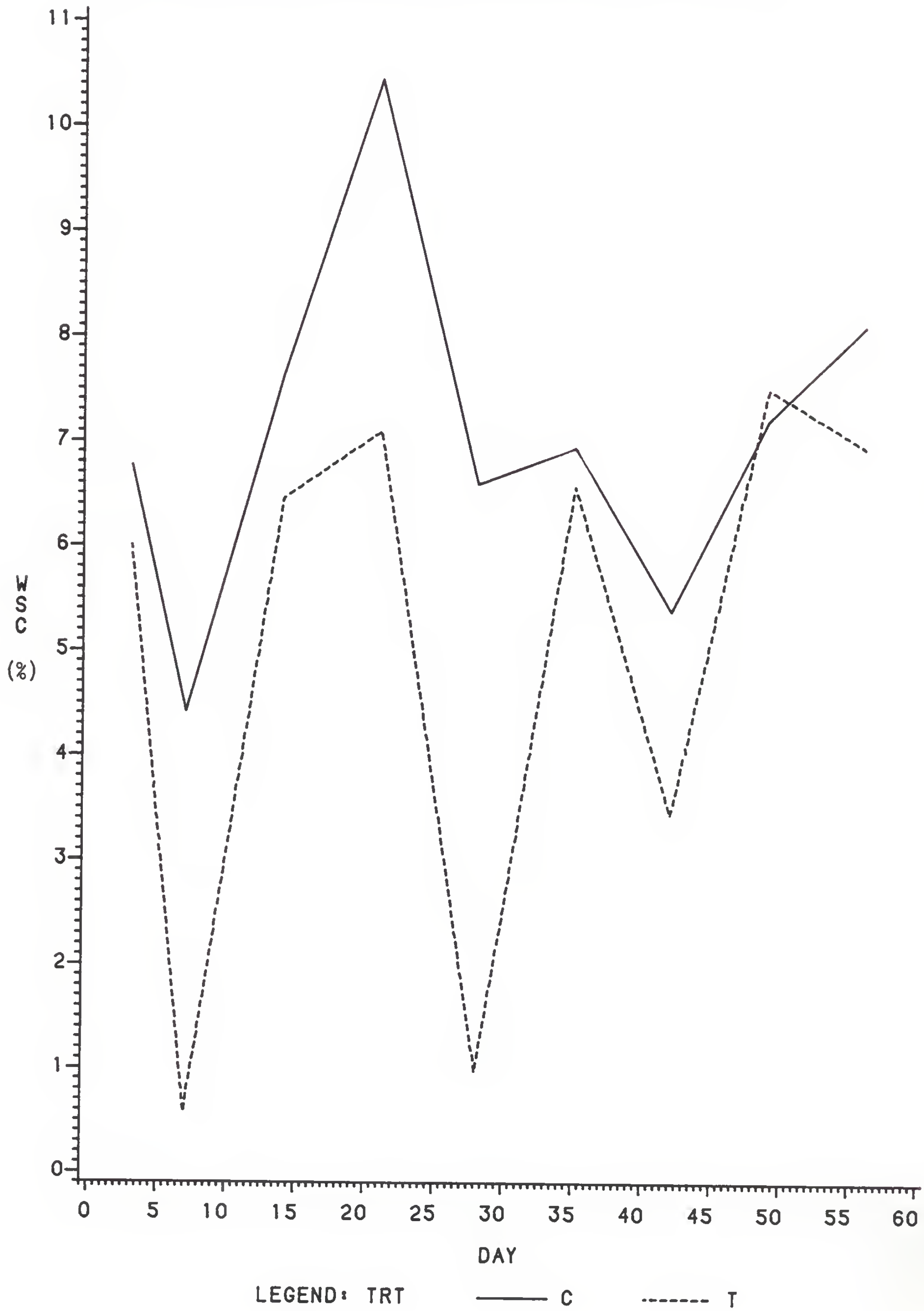
CRUDE PROTEIN CONTENT IN DIET SAMPLES
TAKEN AT DIFFERENT PLANT GROWTH STAGES



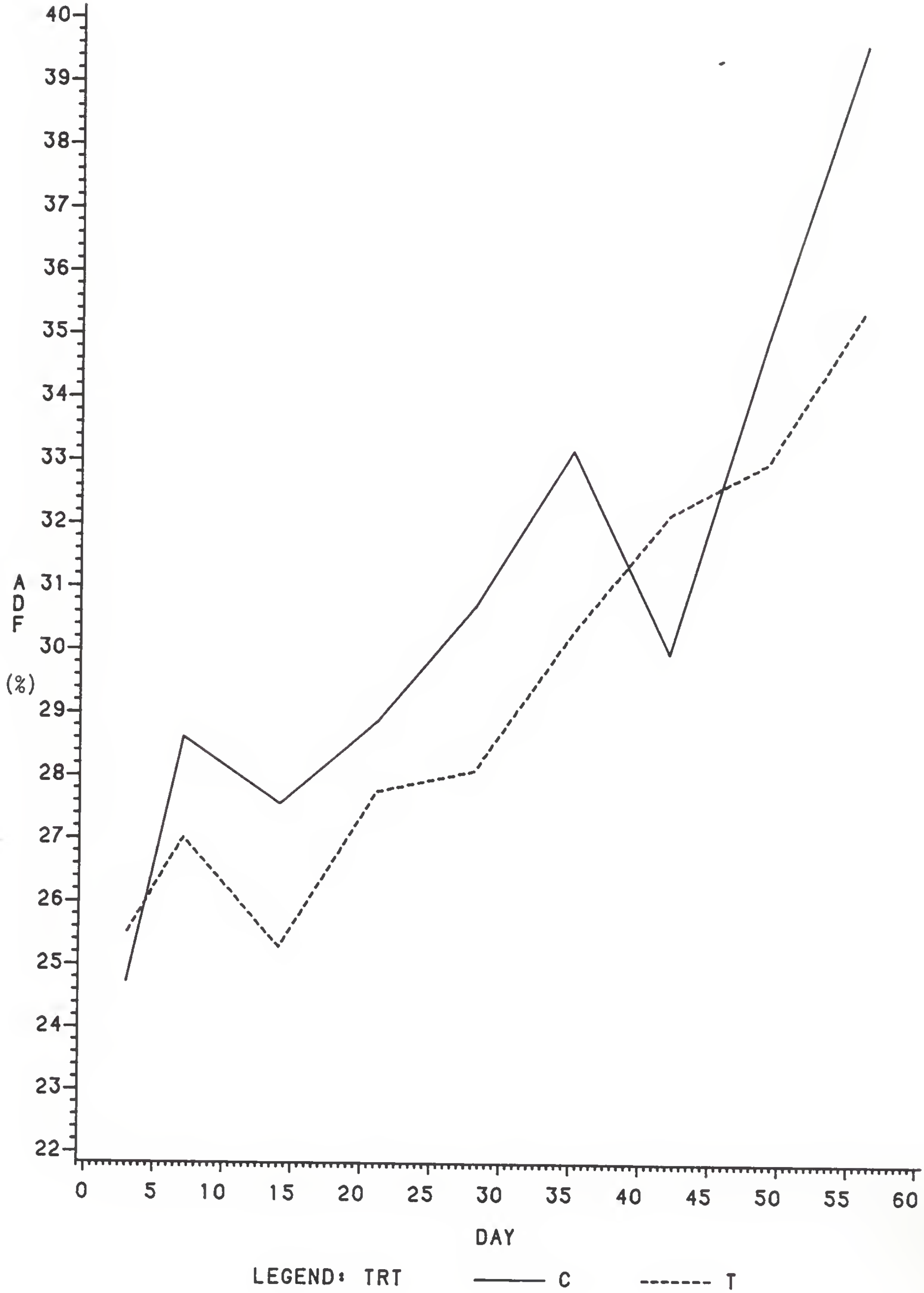
NEUTRAL DETERGENT FIBER (NDF) CONTENT IN DIET SAMPLES TAKEN AT DIFFERENT PLANT GROWTH STAGES



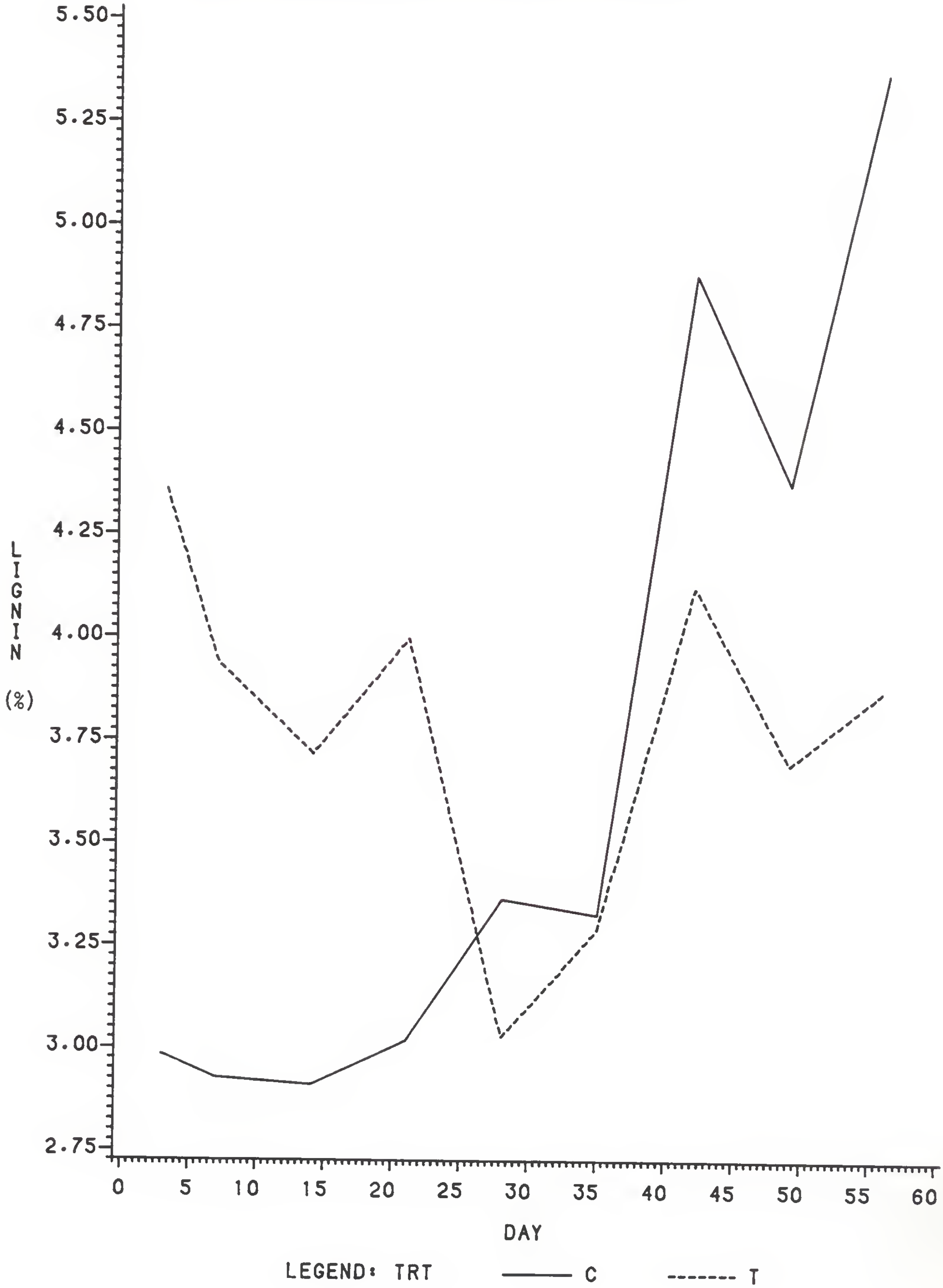
WATER SOLUBLE CARBOHYDRATE (WSC) CONTENT OF CLIPPED
FORAGE SAMPLES TAKEN ON DIFFERENT DAYS FOLLOWING TREATMENT



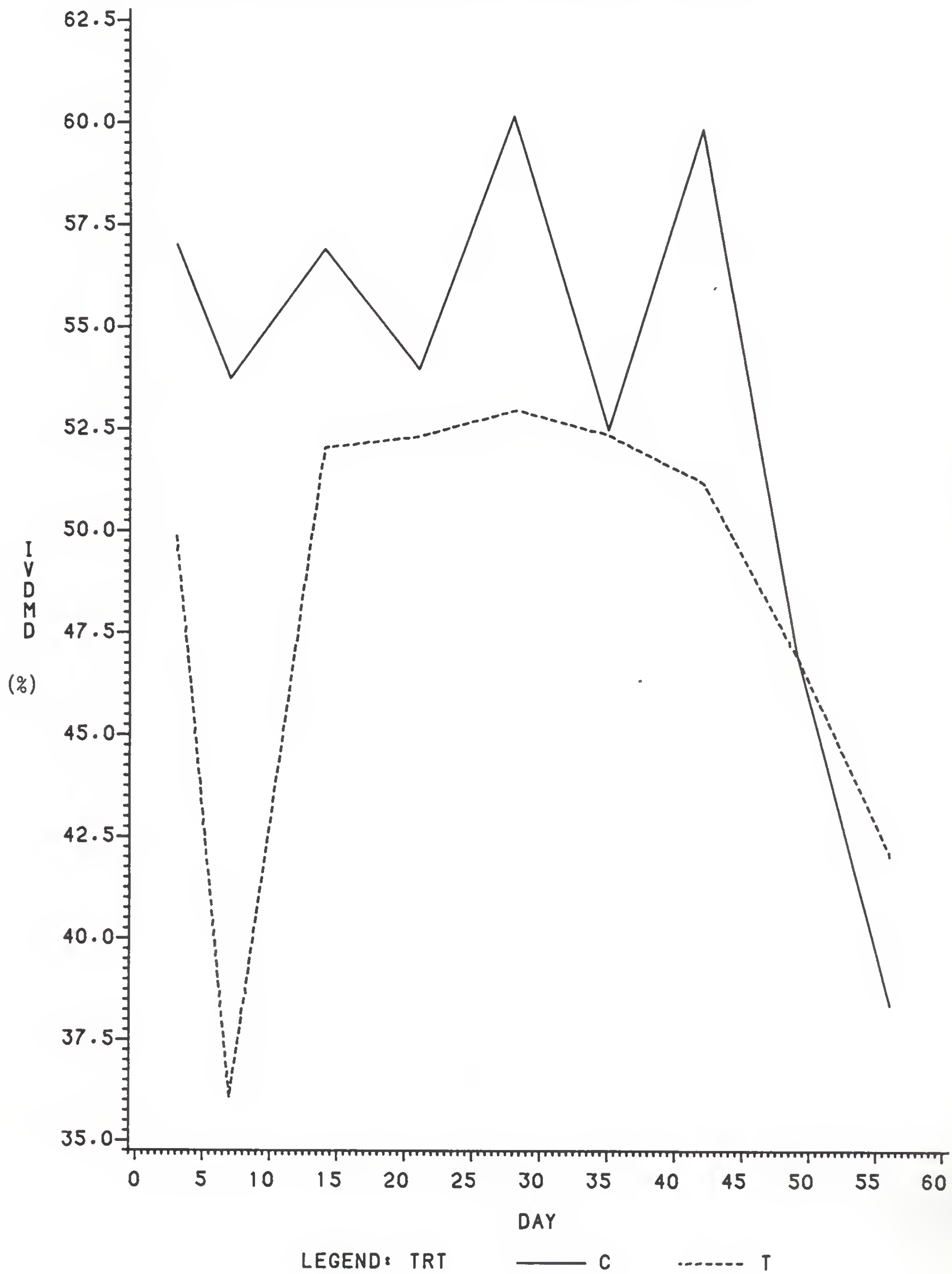
ACID DETERGENT FIBER (ADF) CONTENT OF CLIPPED FORAGE
SAMPLES TAKEN ON DIFFERENT DAYS FOLLOWING TREATMENT



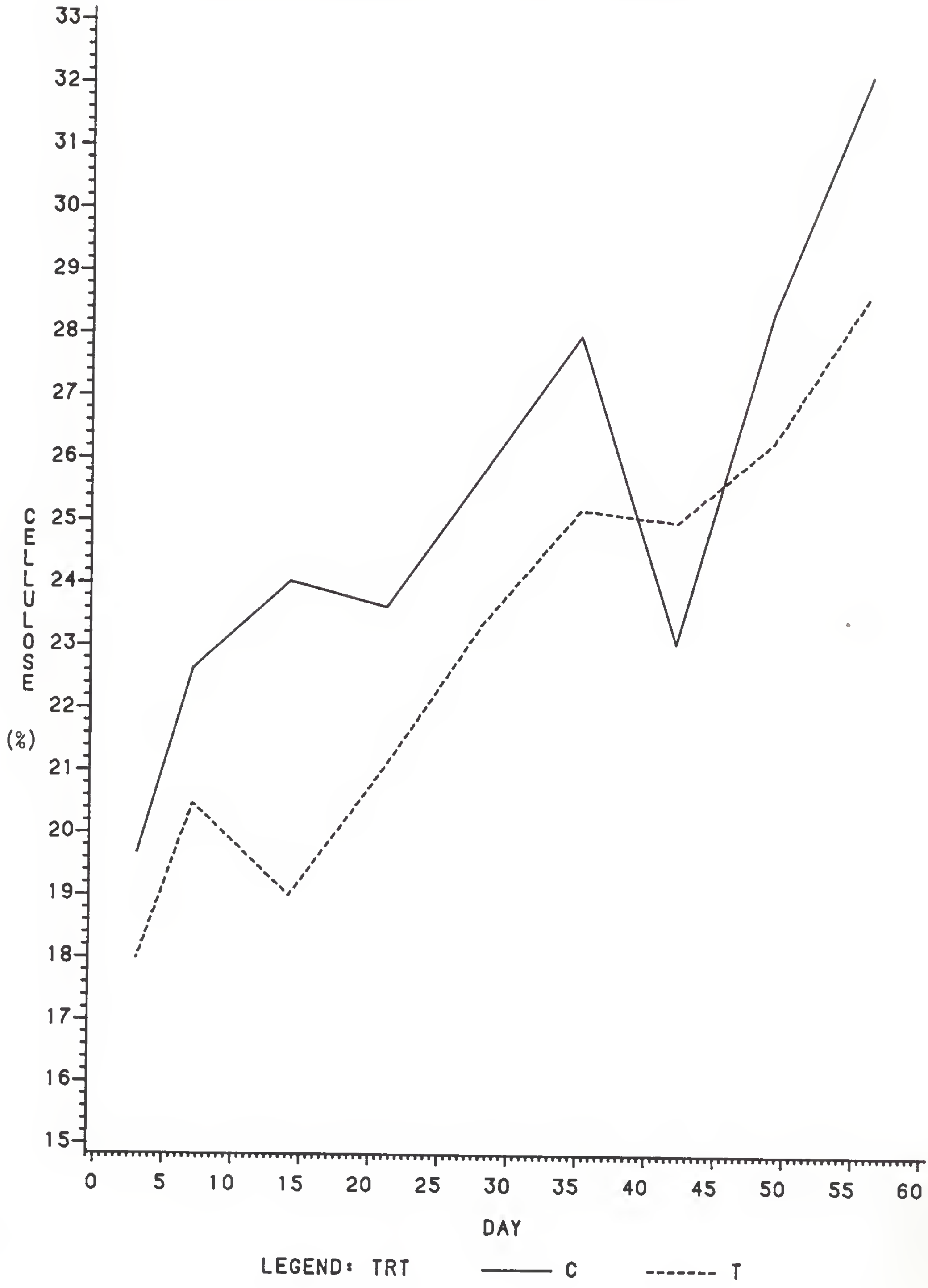
LIGNIN CONTENT OF CLIPPED FORAGE SAMPLES
TAKEN ON DIFFERENT DAYS FOLLOWING TREATMENT



IN VITRO DRY MATTER DISAPPEARANCE (IVDMD) OF CLIPPED FORAGE SAMPLES TAKEN ON DIFFERENT DAYS FOLLOWING TREATMENT



CELLULOSE CONTENT OF CLIPPED FORAGE SAMPLES
TAKEN ON DIFFERENT DAYS FOLLOWING TREATMENT



CRUDE PROTEIN CONTENT OF CLIPPED FORAGE SAMPLES
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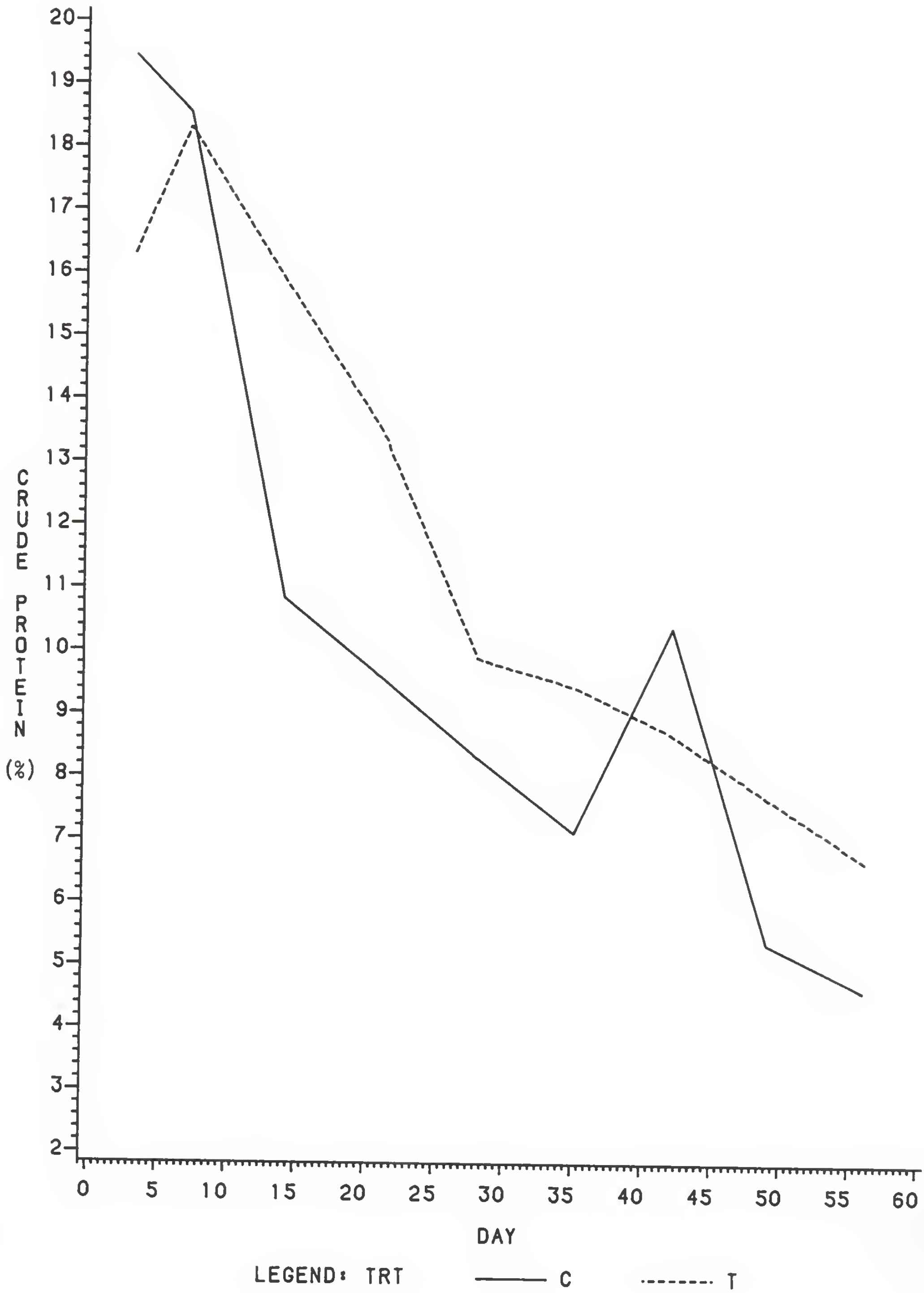
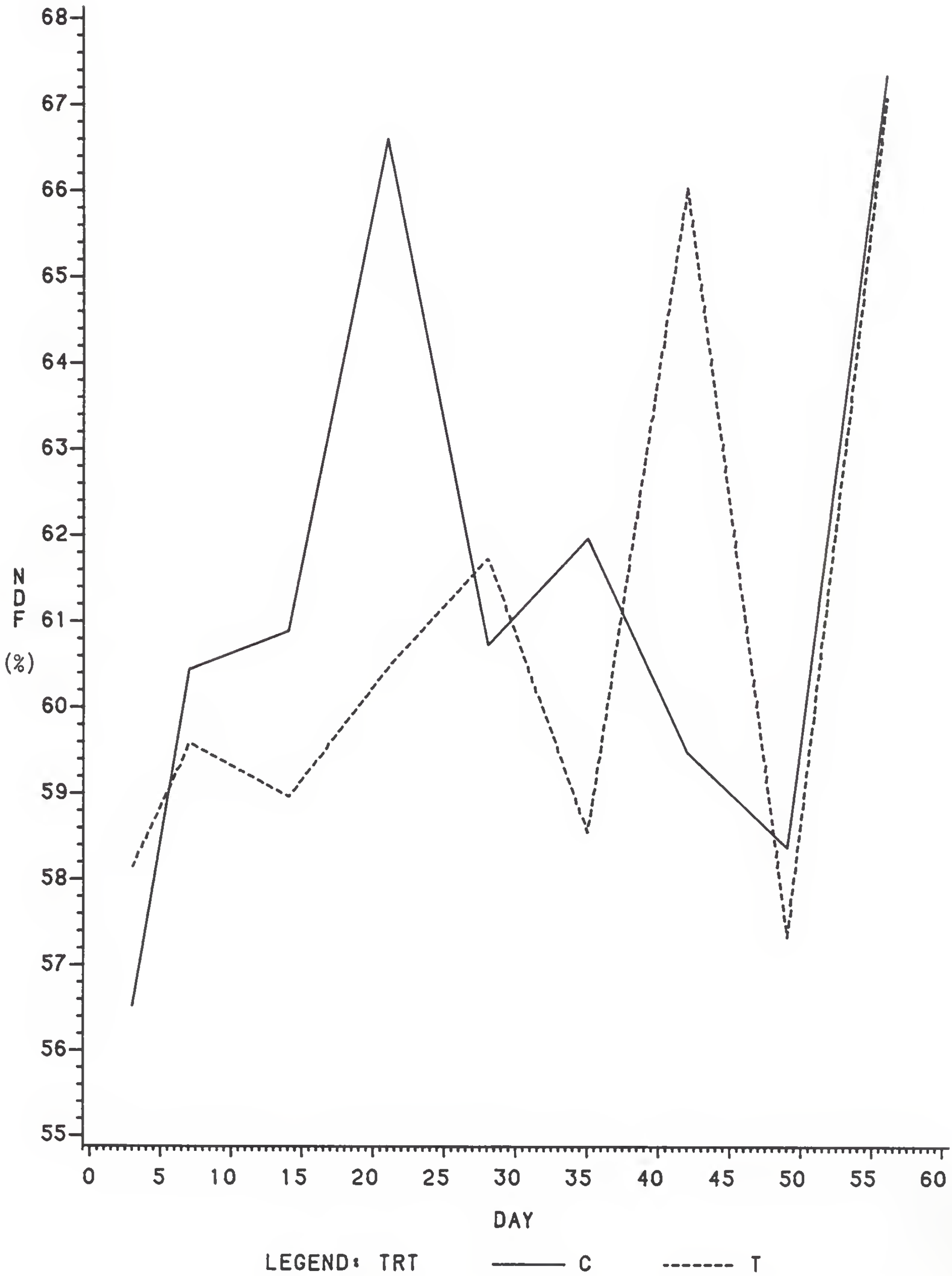


NEUTRAL DETERGENT FIBER (NDF) CONTENT OF CLIPPED FORAGE
SAMPLES TAKEN AT DIFFERENT DAYS FOLLOWING TREATMENT



THE EFFECT OF MEFLUIDIDE TREATMENT ON HYBRID PEARL MILLET AND NUTRIENT UTILIZATION BY SHEEP

by

Ronald W. Graber

B.S., Kansas State University, 1982

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Animal Sciences and Industry

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1985

Mefluidide, N-(2,4-dimethyl-5(((trifluoromethyl) sulfonyl) amino)-phenyl) acetamide, a plant growth regulator, has shown the potential to increase forage quality by inhibiting floral development. This delay in plant maturity results in increased animal weight gains. An application of .56 kg ai/ha was made when plants were approximately 30 cm high in the experiment 1. Applications of .28 and .56 kg ai/ha were made with harvesting at the boot stage to use in experiment 2.

Experiment 1

Sixty crossbred lambs, approximately four months of age and weighing an average of 28.35 kg, were assigned to six groups by weight and sex. These groups were randomly assigned to two treatments, with three replicates per treatment. Treatments were hybrid pearl millet sprayed with mefluidide at .56 kg/ha (T) and no mefluidide application (C). There were no differences in animal weight gains or forage production as measured by grazing days/ha. Laboratory analyses on clipped and esophageal forage samples were variable with a general trend toward increased forage quality.

Experiment 2

Forty-eight crossbred lambs weighing an average of 34.65 kg were assigned by weight and sex to 12 groups, then randomly assigned to one of three treatments: pearl millet sprayed with 0 (Control), .28 (Low) or .56 kg ai/ha (High) of mefluidide. Hay produced from these three treatments was fed. ADG was higher (P<.05) for lambs on the High treatment than those on the Control treatment. Forage intake increased (P<.05) with mefluidide application. Yields were similar for Control and Low treatments while production for the High treatment was severly reduced. Laboratory analysis indicated that forage quality was improved by mefluidide application.