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Hydrocyanic Acid Potential of Black Cherry Leaves

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HYDROCYANIC ACID POTENTIAL OF BLACK CHERRY LEAVES

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Black cherry (Prunus serotina L.) leaves have been known to be a source of hydrocyanic acid poisoning of cattle since the late 1800's. Results of early studies indicated that the black cherry was one of the most toxic of the cyanogenetic plants. An early idea which has persisted to the present has been that black cherry leaves must be wilted before they are toxic to cattle.

Black cherry trees are found throughout the eastern United States and as far west as Arizona and North and South Dakota. In the spring of 1972, the author of the present study conducted a survey of County Agricultural Extension Agents in Kentucky to determine the distribution of black cherry trees in agricultural areas, and to evaluate the concern which cattle producers have about the threat of hydrocyanic acid poisoning from cherry trees. Survey questionnaires were returned by agents in 97 counties (Appendix A). Some of the findings were: (1) black cherry trees are common occurrences in most counties; (2) several ruminant animals have died following the consumption of black cherry leaves, presumably from hydrocyanic acid poisoning; (3) approximately 83 percent of the respondents believed that black cherry

leaves must be wilted before they are toxic; and (4) a majority of county agents indicated that their cattle producers either remove black cherry trees from pastures or check pasture areas after summer storms and remove any fallen cherry trees or branches.

Objectives of the present study included: (1) to determine the levels of hydrocyanic acid potential (HCN-p) in black cherry leaves; (2) to determine whether there are HCN-p differences among black cherry trees; (3) to study the effect of aging of leaves on HCN-p; and (4) to ascertain the effect of wilting or drying of leaves on HCN-p.

CHAPTER II

REVIEW OF LITERATURE

Black cherry (*Prunus serotina* L.) leaves were reported to be a cause of hydrocyanic acid poisoning in the late 1800's. Muenscher (11) reviewed the early literature on HCN poisoning. He cited Chesnut as reporting that wilted black cherry leaves were the cause of poisoning when consumed by cattle. He also cited work by Howard in which *Prunus serotina* was found to be the most toxic of three prunus species investigated in New Hampshire. In 1932 Couch (3) listed black cherries as one of the most dangerous of the cyanogenetic plants. Other species of the *Prunus* genus have been found to be cyanogenetic.

Black cherry trees have been described by Fernald (4). The trees have reddish-brown branches and an aromatic inner-bark. The leaves are oblong, taper pointed, and serrated with short, callous teeth. The racemes are elongated, and the mature fruits are purplish-black. Black cherry trees are found from Maine to Florida, and westward to Arizona and the Dakotas.

Relatively little research on HCN-p of black cherry leaves has been reported in the literature. Prunasin and amygdalin are both glucosides which have been reported to be the precursors of HCN in black cherry leaves (7, 11).

Much information has been reported in the literature concerning the HCN-p of sorghum. Due to the limited available information on the HCN-p of black cherry leaves, the remainder of this review will concern literature pertaining to HCN-p of sorghum.

Toxicity of HCN

Hydrocyanic acid poisoning of livestock has been called prussic acid-, HCN-, hydrogen cyanide-, and cyanide-poisoning. Hydrogen cyanide is one of the most powerful toxins found in nature (6). When a ruminant animal consumes the precursor of HCN, dhurrin in sorghum, prunasin (7) or amygdalin (7, 8) in black cherries, the HCN is liberated in the stomach, then absorbed by the blood and carried to body tissue, where it inhibits the utilization of oxygen. The animal will die if enough of the HCN has been absorbed. HCN is a fast-acting poison, which causes respiratory paralysis. Symptoms from sub-lethal doses include: increased respiration, irregular pulse, frothing at the mouth, and staggering gait.

Previous research has shown that a dose of about 1 gram of HCN can prove fatal to a 1,000 pound cow (6). A 1,000 pound cow is believed to be able to detoxify about 0.5 g per hour. Poisoning occurs when HCN is liberated at a faster rate than can be detoxified.

Genetic Differences in HCN-p

Gray et al. (6) at Tennessee found that there were differences in the HCN-p of different cultivars of sorghum.

They found sudangrass types were lower in HCN-p than sorghum-sudangrass hybrids. The genetic basis for difference in the HCN production from sorghum and sudangrass was not well defined in the literature (1).

Location Effects on HCN-p

Benson[1] cited work by Franzke et al. concerning the effects of geographic location on the HCN-p in sorghum. According to them, there were some differences in conditions of growth at two locations in South Dakota which resulted in corresponding differences in the HCN content of 13 strains grown at both locations. He also cited an experiment by Hogg and Ahlgren in which they tested ten inbred lines in six different locations in the Midwest and Canada and discovered differences as great as 1200 ppm in the HCN content of the same line grown at different locations.

Effect of Stage of Growth on HCN-p

According to Gray et al. (6), the HCN-p of leaves of sorghum decreased rather consistently with age of the plant. Similarly, the HCN-p of stem tissue generally decreased as the stems increased in age. The HCN-p of roots increased through the second and third weeks after emergence of the

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[1]Jim Allen Benson. 1964. Estimating hydrocyanic acid potential of sorghum plants from leaf samples. Unpublished M.S. Thesis, The University of Tennessee.

seedling, then decreased as the plants became older. The HCN-p of plant heads was low for all cultivars and there was no great change during the short period of observation.

In a similar experiment, Loyd and Gray (9) found that concentration of HCN-p in above ground plant parts was highest one week after emergence and gradually decreased as the plant parts became older. The HCN-p of roots was highest at the first sampling, tended to decrease during the next three weeks, and then remained around this level as the plants became older.

Wolf and Washko (14) found that the HCN-p in the total plant decreased during the season as the percentage of dry matter increased. The leaf blade, not including the midrib, was higher in HCN-p concentration than any other part of the plant, and continued to be high throughout the entire growth period. The other parts of the plant decreased in HCN-p as the season progressed.

Effect of Drying

The literature contains conflicting reports on the effects of drying on HCN-p of sorghum plants. Several researchers (5, 8) have reported that drying of plants resulted in a decrease in level of HCN-p. According to Gray et al. (6) estimates of HCN-p in the dried plant material were about one-third to one-half of those for the fresh material. They found no consistent differences in HCN-p associated with oven- or air-drying or with light or dark conditions under which

air-drying occurred. Thompson (12) reported that dry sorghum did not contain the precursor of prussic acid.

CHAPTER III

MATERIALS AND METHODS

The HCN-p of black cherry (Prunus serotina) leaves was studied at Bowling Green, Kentucky during the 1971 growing season. Six black cherry trees located along a roadside on the Western Kentucky University Farm were used in this study. No particular selection criteria other than approximate size and location were used in selecting the trees. Basal diameter of the trees varied from about 10 to 15 cm and all trees were located within a distance of approximately one kilometer. Leaf samples were taken at weekly intervals from the time leaves first appeared on the trees (April 16) until after the first killing frost (November 8).

Laboratory Analysis

The sodium picrate method Anderson[2] and Gilchrist et al. (5) for estimating HCN-p of sorghum was used to estimate the HCN-p of the cherry leaves. A sample of leaf material weighing between 0.20 and 0.30 g was chopped into 0.5- to 1.0- cm

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[2]Laurens Anderson. 1960. Precise estimation of hydrocyanic acid in sudangrass and sorghum. Unpublished mimeograph. Univ. of Wisconsin, Dept. Biochem., Col. of Agr. and Agr. Exp. Sta.

pieces and placed in a test tube. Sufficient chloroform was added to wet the leaf material and to provide one or two drops in the bottom of the test tube. A strip of filter paper approximately 1 cm wide and saturated with sodium picrate solution was suspended in the test tube. A rubber stopper was used to hold the filter paper in place and to prevent the escape of the HCN. After a 24-hour incubation period, the filter paper was removed and the HCN was eluted in 20 ml of distilled water. A second strip of filter paper saturated with sodium picrate solution was suspended in the test tube for another 24-hour incubation period. The solutions resulting from eluting the HCN in distilled water were read in a colorimeter as prescribed in the sodium picrate method. Results of the two readings were combined to give a total HCN-p for each sample.

A standard curve was prepared by determining light absorption of solutions containing different known amounts of cyanide. From these observations, values were calculated for the linear regression equation, $Y = a + bX$. The amount of HCN in an unknown quantity of cherry leaves was calculated by the equation, $X = \frac{Y - a}{b}$ (dilution factor) / sample weight.

Sample Preparation

Leaves were taken at random from each of the six trees. Leaves from the different trees were kept separate and packed in plastic containers for transport to the laboratory. Three different drying treatments were studied. These were: (1)

fresh leaves were chopped, weighed, and treated with chloroform usually within 0.5 to 1.0 hour from the time the leaves were detached from the tree; (2) leaves were spread thinly over a laboratory table and permitted to dry for 24 hours at approximately 24 C before being chopped, weighed, and treated with chloroform; and (3) leaves were permitted to dry for 48 hours at approximately 24 C before being chopped, weighed, and treated with chloroform. Five leaf samples from each tree were subjected to each of the three drying treatments. Samples of the fresh leaves and the leaves air-dried for 24 and 48 hours were oven-dried at 70 C for converting HCN-p to a uniform dry weight basis.

In addition to the weekly samples which were analyzed fresh and after 24 and 48 hours of drying, an attempt was made to study the effect of additional intervals of drying time on HCN-p. During June, sufficient leaves were taken from two of the six trees to permit five samples from each tree to be analyzed as fresh material and after 2, 4, 6, 8, 10, 12, 16, 20, 24, 30, 36, 42, and 48 hours of air-drying. This experiment was repeated and the results combined.

A second supplementary study consisted of cutting branches from two trees and permitting the leaves to air-dry for intervals of time while attached to the branch. These branches did not come from the six trees used in other parts of this study. The branches were not taken into the laboratory. Five leaf samples were taken from branches of each of the trees as fresh material and 3, 6, 9, 12, 24, and 48 hours after branch removal.

Statistical Analysis

The analysis of variance has been considered inappropriate for HCN-p data in sorghum by Wattenbarger et al. (13) and Benson et al. (2) because of a lack of homogeneity among sample variances; therefore, confidence intervals were used to compare treatment means in this study. Confidence intervals at the .05 level of probability were calculated. If the confidence intervals for two means had no common values, the means were considered to be statistically different.

CHAPTER IV

RESULTS AND DISCUSSION

Fresh Leaves

HCN-p data for the fresh black cherry leaves from each of the six trees are given in Table 1. Average HCN-p levels for each of the 31 weekly sampling periods are presented graphically in Figure 1. HCN-p of the leaves averaged 2472 ppm at the beginning of the growing season, and 40 ppm at the end of the growing season. The decrease in HCN-p during the season was rather consistent except for an increase which occurred between weeks 7 and 11. The average level of HCN-p approached or exceeded 750 ppm for 12 weeks during the spring and early summer, but did not exceed this level after week 17. This level in sorghum has been reported to be dangerous for consumption by cattle (5).

Although the season average HCN-p levels of the different trees did not differ significantly (Table 1), there were significant differences among the trees at various sampling periods. For example, at week 2 the HCN-p of fresh leaves from tree 5 was significantly lower than that for tree 1 or 3. Also, at week 31 the HCN-p level of tree 4 was significantly higher than that of tree 2, 3, 5, or 6.

Table 1. HCN-p (ppm dry weight) of fresh black cherry leaves at weekly intervals during 1971 at Bowling Green, Kentucky.

TREES	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7
1	3274±740*	2050±243	1936±324	1042±121	754±383	545±190	494± 45
2	1913±723	1693±567	1429±199	1160± 55	396±146	535±137	331±177
3	2613±431	2432±247	1652±515	1266±266	440±181	374± 52	165± 98
4	2378±688	1369±386	1669±542	1305±150	624±398	449±105	418± 85
5	2187±242	916±317	1316±330	960±173	415±221	258± 98	380±143
6	2376±555	1257±353	1510±412	1250±375	541± 87	444±113	517± 62
Average	2472±484	1620±582	1586±229	1164±144	569±143	434±112	384±134

Table 1 continued

TREES	WEEK 8	WEEK 9	WEEK 10	WEEK 11	WEEK 12	WEEK 13	WEEK 14
1	393±136	784± 93	778±355	1105±254	1000±365	1030±150	810± 56
2	617±159	1190±157	953±260	623±122	732± 75	919± 72	825± 79
3	337± 34	528± 90	432±103	377± 22	432±127	516±132	452± 39
4	588±108	858±237	538±286	630±134	604±139	601±102	709±209
5	349± 70	629± 69	300± 23	586±128	608± 14	625± 53	522± 45
6	564± 22	720±117	700±108	620± 60	677±158	692±155	731±120
Average	475±135	785±241	617±251	657±252	676±198	731±210	675±161

Table 1 continued

TREES	WEEK 15	WEEK 16	WEEK 17	WEEK 18	WEEK 19	WEEK 20	WEEK 21
1	624±151	589±180	1141±173	424±110	646±147	294± 52	302± 61
2	635± 87	659±137	1228±133	847±185	649± 58	399± 48	352± 30
3	445±111	245± 53	378±169	194± 34	215± 23	152± 23	132± 27
4	554±125	460± 75	565±132	418±203	384± 32	325± 23	270± 63
5	649±147	368± 94	542±240	457±134	565± 56	349± 21	221± 39
6	799±141	672±265	369± 37	572±188	278± 29	339± 34	328± 33
Average	618±123	499±180	704±401	485±226	456±199	310± 89	268± 85

Table 1 continued

TREES	WEEK 22	WEEK 23	WEEK 24	WEEK 25	WEEK 26	WEEK 27	WEEK 28
1	375± 33	311± 34	276± 24	203± 13	378± 55	165± 23	132± 16
2	522± 34	300± 49	366± 51	327± 61	503± 50	238± 26	302± 24
3	139± 20	187± 57	129± 28	61± 12	61± 29	415± 13	41± 7
4	307± 42	218± 34	154± 9	181± 29	257± 93	123± 19	34± 2
5	137± 46	134± 35	225±120	80± 11	132± 98	54± 8	170± 36
6	413± 78	296± 51	267± 35	196± 31	319± 57	188± 45	167± 38
Average	316±162	241± 76	236± 91	175±101	275±170	136± 80	141±104

Table 1 continued

TREES	WEEK 29	WEEK 30	WEEK 31	AVERAGE
1	123± 13	136± 57	49± 24	715±248
2	71± 13	32± 6	33± 6	670±169
3	134± 36	47± 18	32± 9	485±235
4	97± 7	75± 7	69± 14	556±188
5	89± 16	55± 16	34± 16	462±159
6	60± 15	40± 7	40± 4	579±176
Average	96± 30	64± 40	43± 15	

*Confidence intervals, $\bar{x} \pm t_{(.05)} S\bar{x}$. Each tree average is based upon five HCN-p determinations. If the confidence intervals for two means do not overlap, the means are considered to be different at the .05 level of probability.

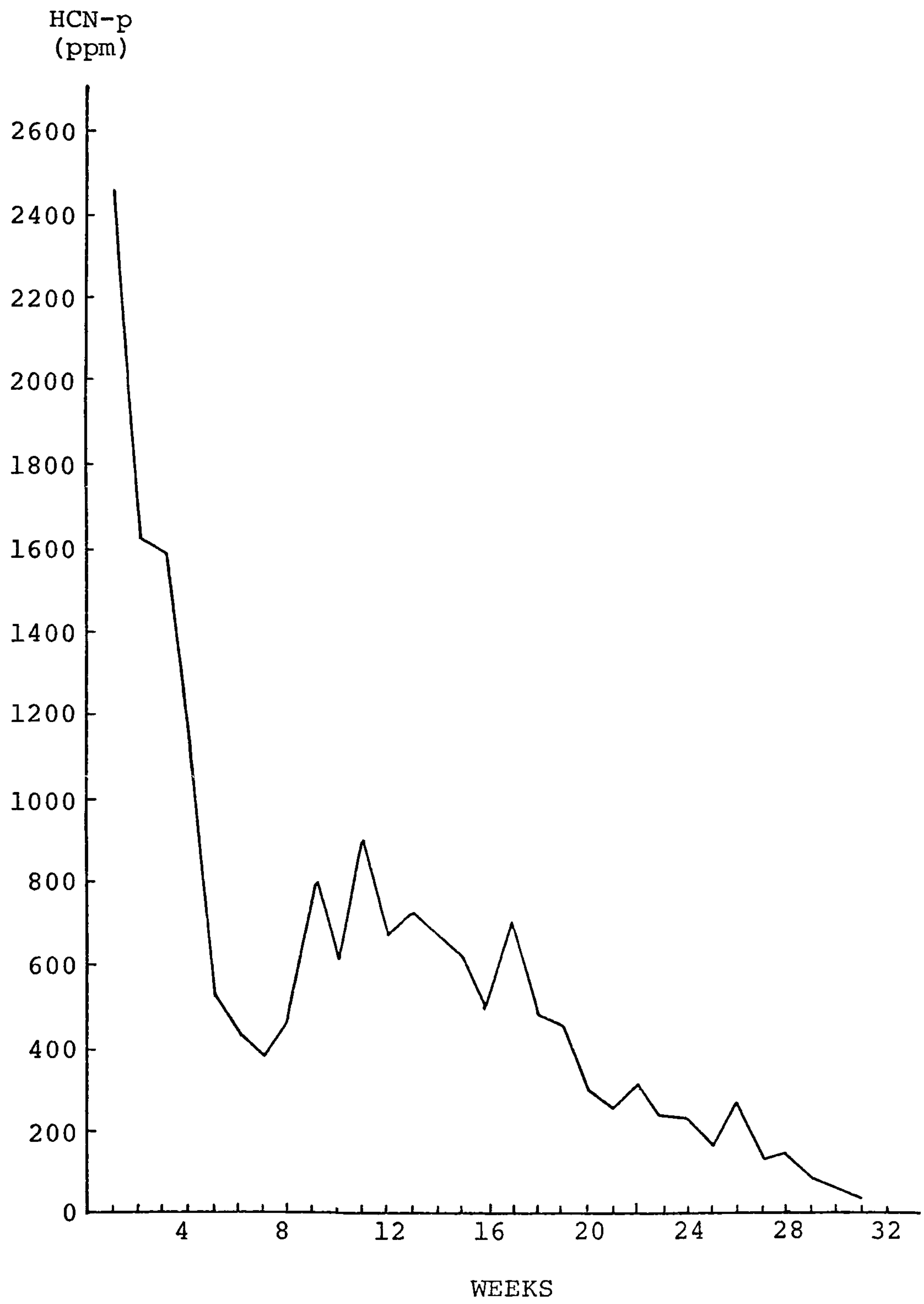

Figure 1. Average HCN-p of fresh black cherry leaves during the growing season, 1971.

The observed decrease in HCN-p of fresh cherry leaves during the season was similar to the seasonal decrease in HCN-p of sorghum reported by Loyd and Gray (9).

Air-Dried Leaves

Twenty-four hours--HCN-p levels of the leaves which were air-dried for 24 hours were much lower than those of the fresh leaves (Table 2 and Figure 2). The average HCN-p levels of the air-dried leaves varied from 233 ppm at week 10 to 2 ppm at week 28. HCN-p estimates for the leaves which were dried 24 hours were characterized by wide variation. Sampling period averages were extremely variable during the first 17 weeks. Confidence intervals for the individual tree means were large indicating that there was variation among the five sample values used to calculate the tree means. This variation was believed to be due to the method of drying. Due to inadequate laboratory space, the leaves were dried in multi-layers rather than single layers; therefore, drying was uneven.

Although HCN-p levels of the trees differed significantly at various sampling periods, there were no consistent tree differences in HCN-p of leaves which had been air-dried for 24 hours. HCN-p levels of the air-dried leaves decreased rather consistently after week 17.

Forty-eight hours--The average level of HCN-p in leaves which had been air-dried for 48 hours never exceeded 40 ppm (Table 3 and Figure 3). No HCN-p was detected at several

Table 2. HCN-p (ppm dry weight) of black cherry leaves air-dried for 24 hours at weekly intervals during 1971 at Bowling Green, Kentucky.

TREES	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7
1	387±211*	117±126	146± 60	10± 24	57± 60	154±114	146± 63
2	117±126	141±117	73±103	51± 42	26± 17	174± 37	275± 64
3	0**	121± 17	15± 26	12± 7	79± 43	111± 44	187± 58
4	59± 59	386±208	62±150	8± 17	58± 49	92±104	73± 25
5	174±158	129± 78	104±176	19± 28	94±102	100± 99	231± 55
6	120±242	75±132	157±242	0	125± 89	184± 40	142± 62
Average	143±140	168±116	76± 52	17± 19	73± 36	136± 42	176± 75

Table 2 continued

TREES	WEEK 8	WEEK 9	WEEK 10	WEEK 11	WEEK 12	WEEK 13	WEEK 14
1	147± 42	71± 73	438±100	56± 42	341±121	174±170	317± 57
2	137± 64	369± 84	318± 51	49± 26	256± 66	179± 29	335±110
3	200±114	34± 32	133± 65	14± 24	103± 22	75±119	103± 98
4	142± 56	18± 17	297±103	88± 43	90± 58	151± 33	94±163
5	120±106	389±127	20± 20	72± 60	181± 46	94± 48	198± 32
6	44± 47	73± 91	189±130	6± 9	203± 66	49± 18	140± 28
Average	132± 53	159±180	233±156	59± 28	196± 99	120± 57	198±111

Table 2 continued

TREES	WEEK 15	WEEK 16	WEEK 17	WEEK 18	WEEK 19	WEEK 20	WEEK 21
1	2± 6	90± 67	221±168	87± 30	68± 14	49± 11	61± 10
2	33± 10	147± 60	96±106	164± 82	67± 24	82± 15	51± 7
3	0	2± 5	183±196	38± 42	40± 29	35± 11	24± 6
4	0	9± 15	109±276	26± 22	31± 6	57± 30	32± 8
5	11± 22	17± 16	54±133	100± 29	64± 37	48± 6	22± 6
6	7± 17	11± 19	211±101	91± 34	48± 9	59± 38	54± 14
Average	9± 13	46± 62	146± 72	85± 52	53± 16	55± 16	41± 18

Table 2 continued

TREES	WEEK 22	WEEK 23	WEEK 24	WEEK 25	WEEK 26	WEEK 27	WEEK 28
1	42± 2	66± 27	33± 7	33± 6	35± 7	31± 8	7± 12
2	45± 19	29± 8	32± 6	27± 7	26± 5	35± 11	3± 9
3	26± 6	25± 5	30± 6	18± 3	34± 8	31± 5	0
4	33± 4	23± 5	33± 9	33± 8	29± 9	26± 5	0
5	41± 14	21± 3	27± 6	28± 11	23± 3	25± 4	0
6	34± 3	26± 7	43± 11	29± 8	33± 21	35± 9	3± 9
Average	37± 7	32± 18	33± 6	28± 6	30± 5	31± 4	2± 3

Table 2 continued

TREES	WEEK 29	WEEK 30	WEEK 31	AVERAGE
1	21± 4	26± 4	17± 6	111± 41
2	20± 3	15± 18	13± 9	109± 37
3	21± 2	20± 4	9± 10	56± 20
4	19± 2	15± 11	11± 13	68± 31
5	19± 2	12± 14	14± 10	79± 31
6	22± 2	14± 16	11± 12	72± 22
Average	20± 1	17± 5	13± 3	

*Confidence intervals, $\bar{x} \pm t_{(.05)} S\bar{x}$. Each tree average is based upon five HCN determinations. If the confidence intervals do not overlap, the means are considered to be different at the .05 level of probability

**No confidence interval. HCN-p near 0.

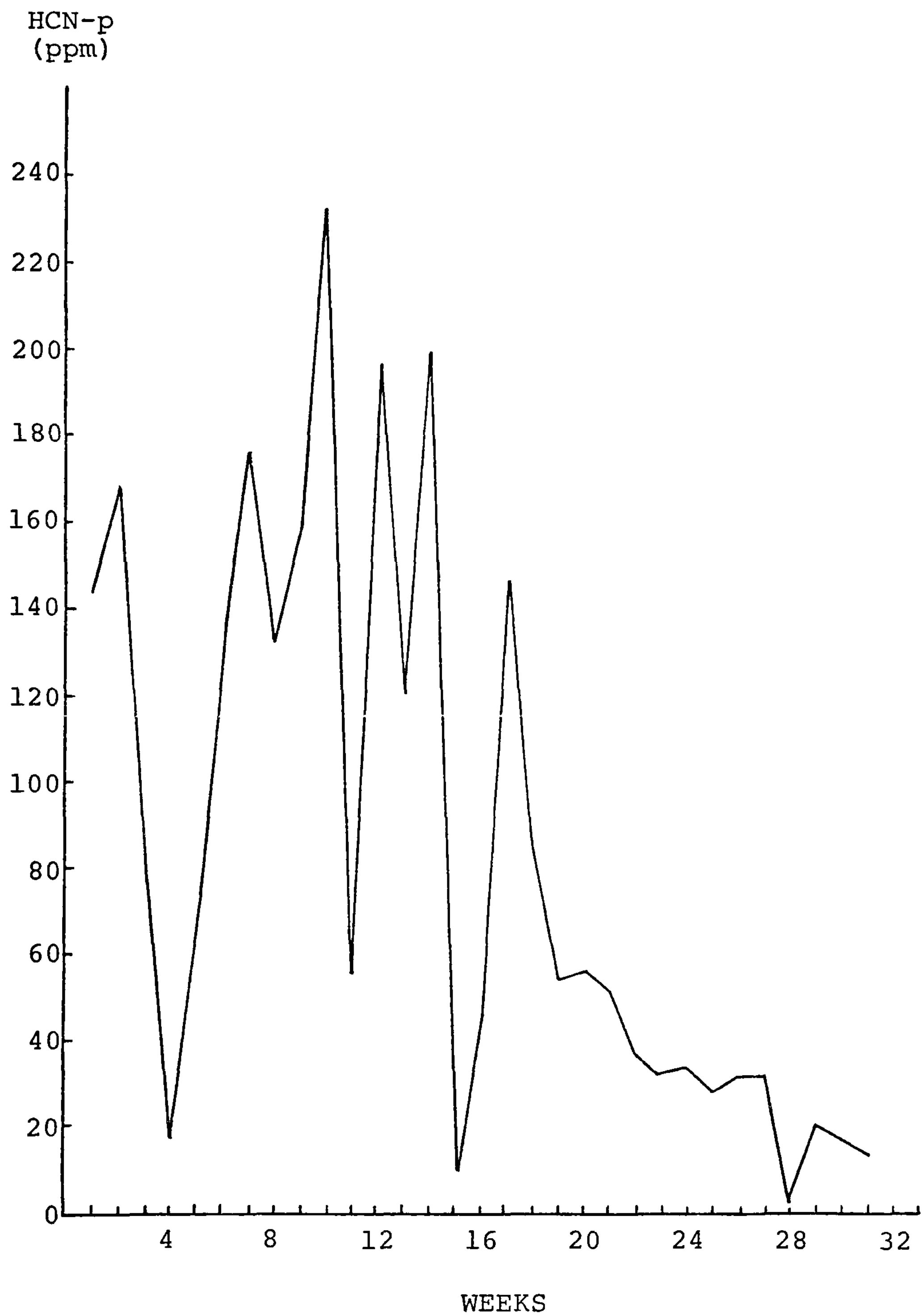

Figure 2. Average HCN-p of black cherry leaves (after 24 hours of air-drying) at intervals during the growing season.

Table 3. HCN-p (ppm dry weight) of black cherry leaves air-dried for 48 hours at intervals during 1971 at Bowling Green, Kentucky.

TREES	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 8	WEEK 11
1	0*	64± 83	4± 9	0	0	0	23± 31
2	0	26± 46	0	0	0	0	0
3	0	42± 62	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	1± 2
6	0	0	10± 14	0	0	0	0
Average	0	22± 28	3± 4	0	0	0	13± 23

Table 3 continued

TREES	WEEK 14	WEEK 18	WEEK 21	WEEK 24	WEEK 27	WEEK 31	AVERAGE
1	54± 45	4± 7	27± 11	34± 5	33± 7	19± 5	22± 12
2	49± 37	18± 15	29± 2	33± 3	30± 5	16± 2	17± 8
3	16± 22	1± 3	22± 6	29± 11	25± 4	14± 1	12± 8
4	27± 44	1± 2	25± 7	38± 7	22± 16	14± 2	11± 8
5	20± 22	2± 4	21± 5	30± 3	23± 3	12± 9	9± 6
6	26± 38	1± 2	28± 4	53± 14	43± 21	18± 1	15± 10
Average	32± 16	5± 7	25± 3	36± 9	29± 8	16± 3	

*Confidence intervals, $\bar{x} \pm t_{(.05)} S\bar{x}$. Each tree average is based upon five HCN-p determinations. If the confidence intervals for two means do not overlap, the means are considered to be different at the .05 level of probability. If confidence interval is 0, then the HCN-p is near 0.

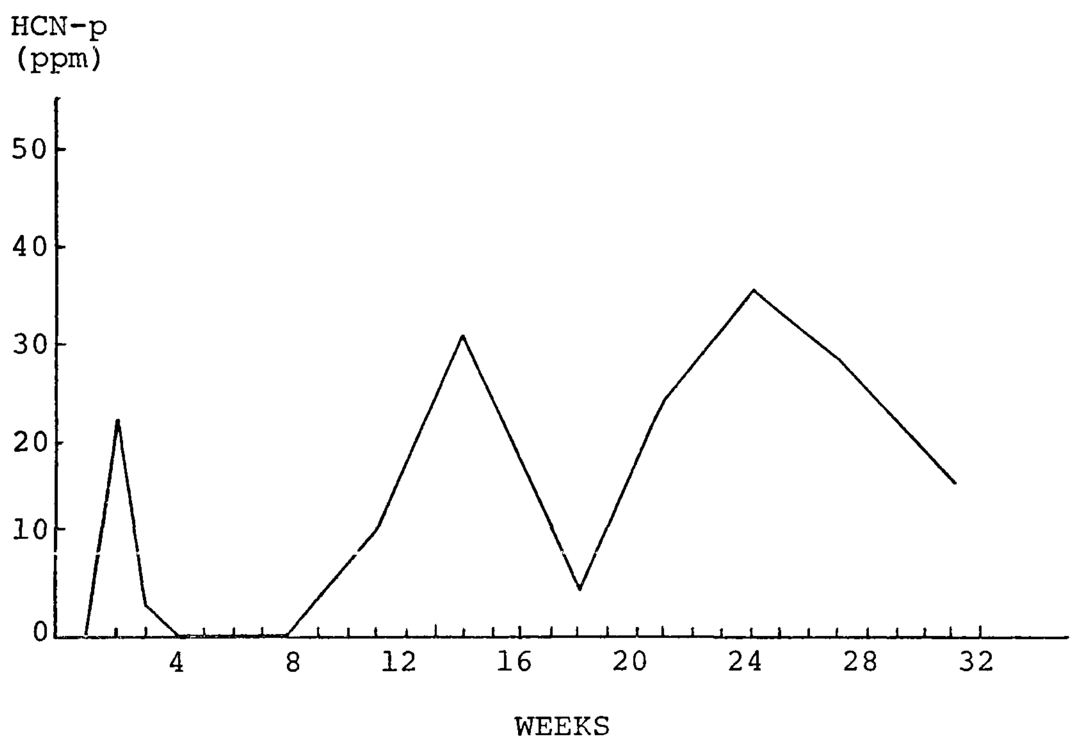

Figure 3. Average HCN-p of black cherry leaves (after 48 hours of air-drying) at intervals during the growing season.

sampling periods; therefore, the 48-hour drying treatment was not included at each sampling period. The treatment was included each time for the first five sampling periods, but was not included each sampling period during the remainder of the study. There were some tree differences at various sampling periods for this treatment, but the differences were not consistent throughout the season.

A premise of this study was that cherry leaves must be wilted before they are toxic to ruminant animals. The critical nature of the wilted condition was reported in the early literature (1), and was strongly stressed by respondents to the survey which the author conducted. Results of the present study indicate that HCN-p decreased as the extent of drying or wilting increased. Wilted leaves had lower levels of HCN-p and should be safer than fresh leaves for animal consumption. The association of HCN poisoning with wilted cherry leaves may be due to the facts that the leaves of fallen trees or branches would be more accessible to cattle than the leaves of trees in their natural position, or that cows may consume more wilted than fresh leaves. Loyd et al. (10) compared a steam distillation method, which Boyd[3] recommended for use on dried sorghum plants with the sodium picrate method. They reported a difference in level of HCN-p

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[3]Frederick Tilghman Boyd. 1938. The determination of and factors influencing the amount of cyanide in sudan grass. Unpublished Ph.D. Thesis, University of Wisconsin.

from the two methods, which can be accounted for by the possibility that the sodium picrate method of estimating HCN-p was more efficient with fresh than with air-dried leaves.

Loss curve--An attempt was made to determine the rate at which HCN-p was lost as a result of air-drying. The level of HCN-p was determined at more frequent intervals during the drying period (Figure 4). Each point on the curve represents 20 HCN-p determinations, 10 from each of 2 trees. HCN-p decreased from 440 ppm in the fresh leaves to about zero ppm in leaves which had been air-dried for 42 hours. This curve was not smooth, especially for the first 20 hours of drying. This fluctuation in estimated HCN-p was believed to be due to the uneven drying as described previously.

The HCN-p data from Figure 4 were plotted against percentage dry matter of the leaves (Figure 5). The fresh leaves contained about 440 ppm of HCN-p and about 40 percent dry matter; whereas, after 48 hours of air-drying, the leaves contained about zero ppm of HCN-p and about 85 percent dry matter. The decrease in HCN-p associated with the increase in dry matter percentage was consistent except when the dry matter was between 45 and 60 percent.

Attached leaves--All the HCN-p data which have been discussed to this point were obtained from leaves which were detached from the branches and wilted in the laboratory. Cattle consume black cherry leaves by taking them directly from the branch. If cattle consume wilted leaves, the leaves must have wilted while attached to the tree branch.

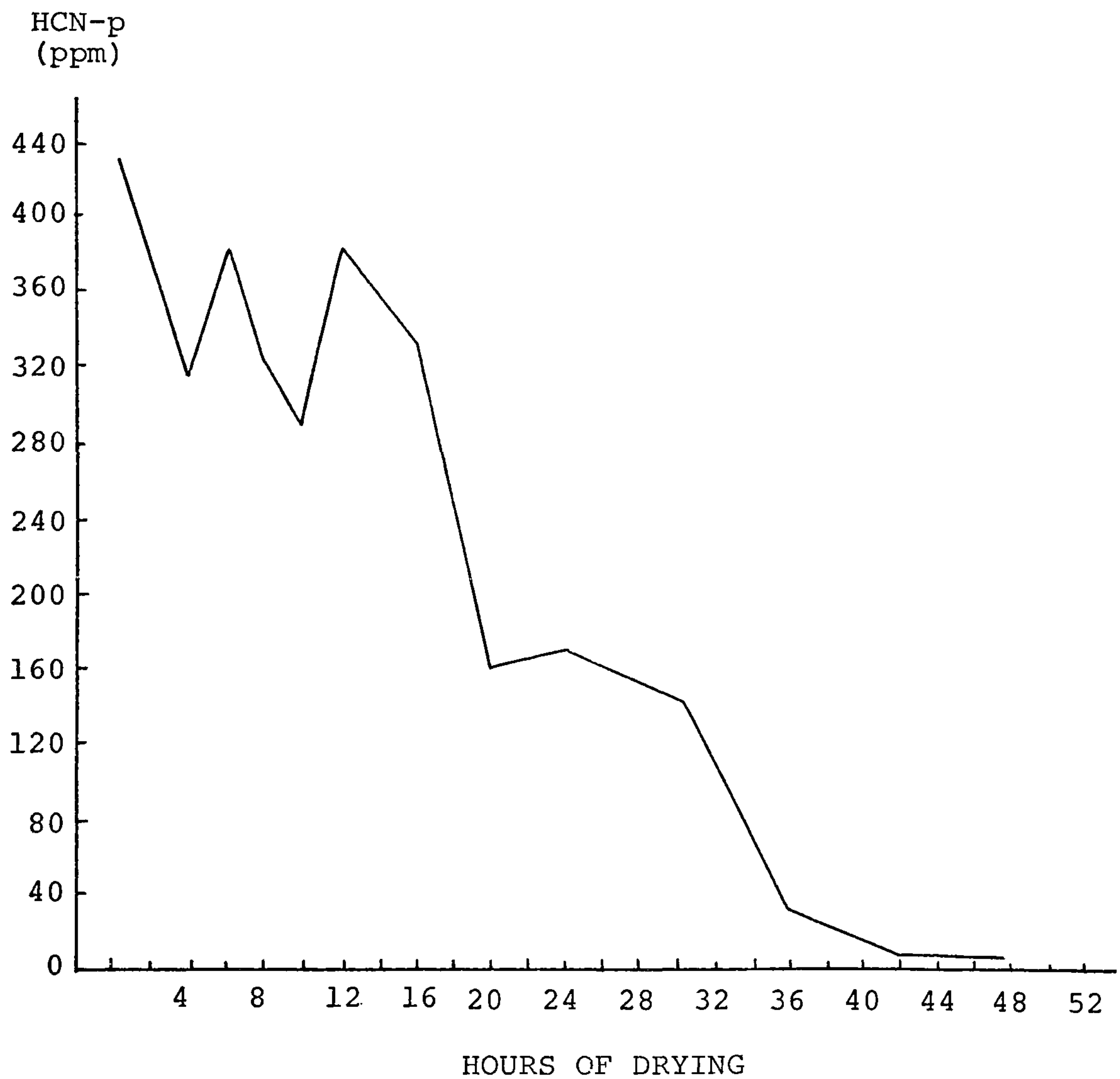

Figure 4. Average HCN-p of black cherry leaves after being air-dried for different numbers of hours.

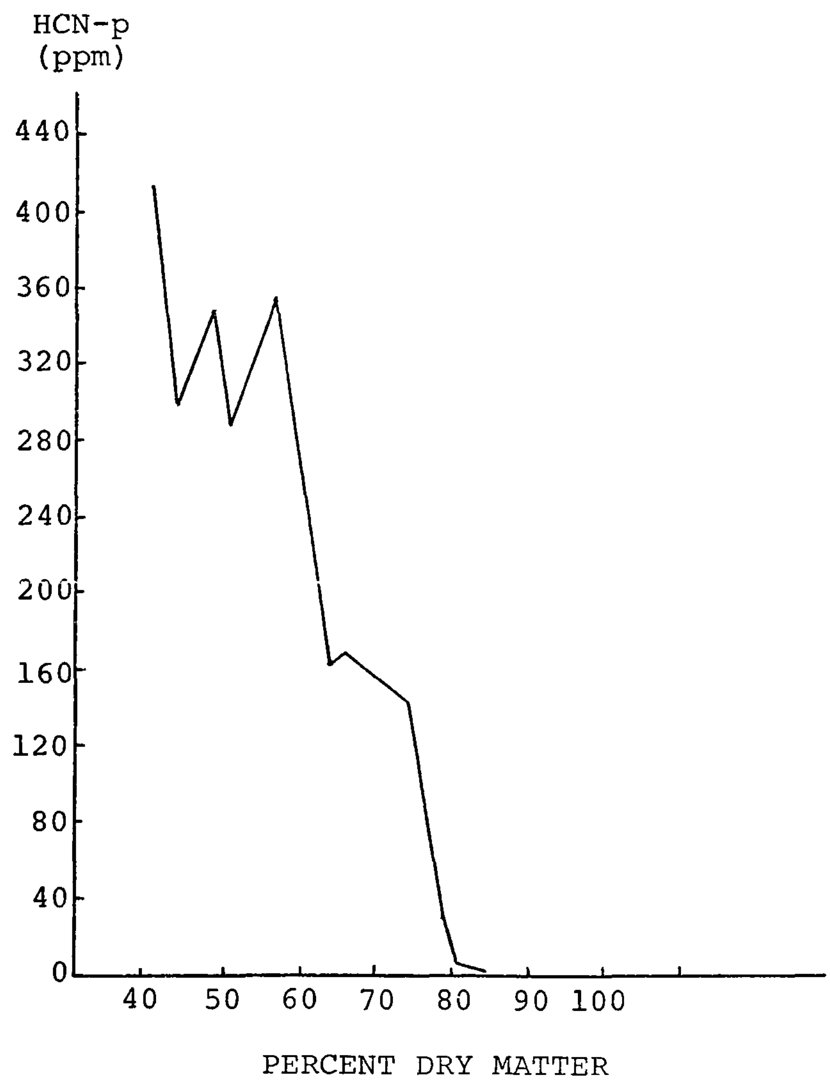

Figure 5. Relationship between HCN-p of black cherry leaves and percent dry matter.

The effect of air-drying on the HCN-p of leaves attached to the branch is shown in Figure 6. Each point on the curve is an average of 10 determinations, 5 each from 2 trees. The level of HCN-p in attached leaves decreased rapidly during the first nine hours of air-drying, but did not decrease significantly during the subsequent 39 hours of the study. There was a linear relationship between the increase in dry matter percentage and the decrease in HCN-p.

The relationship of HCN-p with hours of wilting and percentage dry matter was much more consistent when the leaves were dried while attached to the branches than when the leaves were detached and dried on the laboratory table.

The decrease in HCN-p resulting from drying of the attached leaves indicates that wilted leaves should be less dangerous to ruminant animals than fresh leaves. In this study the effect of wilting or drying, whether done before or after removal of leaves from the tree, was a reduction in the HCN-p level of the black cherry leaves. These results and those reported in the literature (5, 8) for sorghum suggest that drying of plant material results in a decrease in HCN-p.

Risk of HCN Poisoning

Several times during the study the level of HCN-p in the black cherry leaves exceeded the level reported to be dangerous in sorghum. Therefore, the presence of black cherry trees in pastures provides a potential risk to cattle producers. As was indicated by the questionnaire (Appendix A)

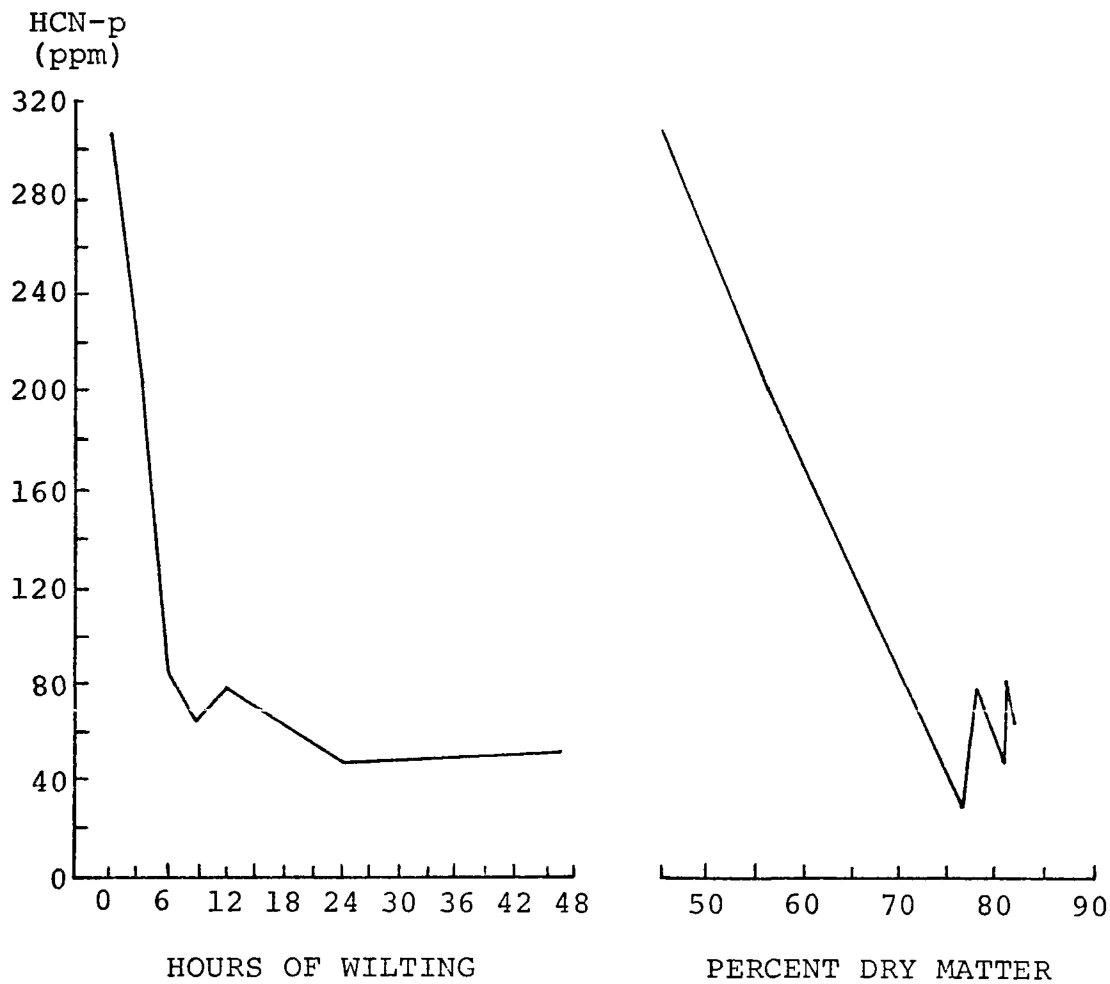

Figure 6. Relationship of average HCN-p of black cherry leaves (attached to branches) with hours of drying and with percent dry matter.

responses, the most effective way of eliminating the risk would be to remove black cherry trees from pastures. Another suggested way of reducing the risk of HCN poisoning consisted of removal of black cherry branches and trees which fall during storms. This procedure would be effective if the fallen branches were removed before cattle are permitted into the pasture. However, if black cherry branches or trees fall where the leaves are readily accessible to the cattle, this procedure would not be effective. According to the results of this study, the HCN-p level of the leaves is highest at the time the branches or trees fall, and would present the greatest danger to the cattle at that time.

CHAPTER V

SUMMARY

The hydrocyanic acid potential (HCN-p) of black cherry leaves was studied during the 1971 growing season at Bowling Green, Kentucky. The average HCN-p for leaves from six black cherry trees ranged from a high of 2472 ppm at the beginning of the growing season to a low of 43 ppm at the end of the season. The decrease in HCN-p as the leaves aged during the growing season was rather consistent except for an increase which occurred between weeks 7 and 11.

There were significant differences among HCN-p levels of the six black cherry trees at various sampling periods, but the tree differences were not consistent throughout the season.

A strong negative relationship was found between HCN-p level and dry matter percentage. HCN-p levels of fresh leaves and leaves air-dried at 24 C for 24 and 48 hours were high, intermediate, and low, respectively.

These results indicate that wilted black cherry leaves are potentially less toxic to cattle than are fresh black cherry leaves.

APPENDIX A

QUESTIONNAIRE SUMMARY*

1. Are black or wild cherry trees of common occurrence in your county? Yes 84% No 16%

2. Do farmers in your county remove cherry trees from their pastures? Yes 56% No 40%

3. Do farmers in your county check their pastures after summer storms and remove any fallen cherry trees or limbs? Yes 62% No 34%

4. Are you aware of any reports from your county of cattle being poisoned by eating cherry leaves? Yes 37% No 61% (If your answer to this question is no, your response is complete. If your answer to this question is yes, please continue.)

5. Approximately how many cases of cattle being poisoned from cherry trees have you had? 36%**

6. Approximately how many cattle have been killed? 31%**

7. Please check as many of the following statements as are true for the reported cases of poisoning from cherry trees in your county.

   72%*** occurred in the spring or summer.

   69% occurred when leaves were on the trees.

   3% occurred when the tree was in its undisturbed or natural condition

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*Responses were received from 97 of the 118 county agents who received questionnaires.

**Percentage of counties in which HCN poisoning had been reported.

***Percentages are based upon those counties in which HCN poisoning had been reported.

7. 92%___ occurred when the tree had been cut or blown down, or limbs had fallen to the ground.

   14%___ occurred while the leaves were fresh.

   83%___ occurred after leaves had wilted.

   None___ occurred after leaves had dried.

8. Comments:

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