The Wiles and Ways of

PRUSSIC ACID POISONING

By Barry N. Freeman

The finest of forage plants (grasses, legumes and browse) are periodically killers in disguise. Their lethal weapon is cyanide, commonly called prussic acid. It is only under such variable conditions as climatic change, season of year, fertilization, the stage of growth, etc; that such plants undergo a physiological change that converts the productive, nutritious Dr. Jekyll plant into a plant with the lethal potentials of a Mr. Hyde! Just such a plant is our old friend and foe — Johnson grass!

Johnson grass, *Sorghum halepense*, is a tall growing perennial (3 to 6 feet), with underground rootstalks. These underground rootstalks make it a real problem in cultivated cropland areas. It is also an excellent erosion control plant and it is relished by livestock having access to it. Under normal growing conditions, Johnson grass produces an abundance of palatable, nutritious forage.

But often when the plant is subjected to conditions that inhibit or accelerate its growth, such as frost, drought or regrowth following drought, there is a physiological change in the plant that may activate the enzyme that is involved in cyanide release. Johnson grass contains the cyanogenetic glycoside — dhurrin which is the toxic principle. This same glycoside is present in varying amounts in sorghums, sudan grass, and *Sorghum almum*.

Apparently, there is a genetically associated cyanide potential for various plants — sudan grass is low; Johnson grass is intermediate, and Sor-

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Mr. Freeman is Extension Specialist in Watershed Management.

Testing Plants For Prussic Acid

By Dr. Raymond Reed

It's fairly common knowledge that certain plants used as livestock feed may at times contain poisonous amounts of hydrocyanic (prussic) acid. The question of how much, if any, HCN is present in a forage at any particular time and under a variety of circumstances can best be answered by performing a test for the material.

A very simple and usually very effective test has been available for many years. D. W. Steyn in the 1934 edition of "Toxicology of Plants in South Africa," S. African Agricultural Series, Volumn XIII, credits a 1926 publication of Henrici with the following method for preparing the reagent and performing the test:

Alkaline picrate solution consists of sodium carbonate, 5 gm. and 0.5 gm. picric acid in 100 ml. water. Ordinary filter paper strips 1 cm. x 4 cm. are wet with this and used when just perceptibly moist. Freshly prepared papers should be used.

Into a test tube place a few grams of moist shredded plant. Add enough chloroform to hasten hydrolysis, insert a slip of the "perceptibly moist picrate paper" at the top and cork tightly. Incubate in the shirt pocket, examining at intervals. Liberation of HCN is indicated by reddening of the yellow picrate paper — within a few minutes if the amount is large; after 24 hours if only traces are present. If the paper remains lemon-yellow it means either that a cyanogenetic glycoside is absent or that a hydrolytic enzyme is not intimately associated with it.

The alkaline picrate solution keeps indefinitely. With this reagent, some chloroform, a test tube and a supply of filter paper strips, anyone can test plant tissues for the presence of hydrocyanic acid. One cautionary statement is needed, however. If plants containing toxic levels of prussic acid are present in a field but these are missed in the sample selected, a false negative test will result.

Dr. Reed is head of the Department of Animal Pathology.

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ghum almum and various sorghums are high. Cyanide potential indicates the amount of nitrile glycoside in the plant. Young plants tend to have the higher HCN potential. The cyanide content of the plant drops rapidly following pollination. Low phosphorus content in the soil, coupled with high available nitrogen, tends to increase the HCN potential of a plant.

How Much is Dangerous?

What is the danger-level of cyanide potential in a plant? When the level is in excess of 0.02 per cent, the caution flag should be waved! Cyanide potential in some forage sorghums may reach as high as 0.34 per cent. As little as half a pound of forage at this level might prove fatal. Sudan grass generally has one-third to one-tenth the cyanide potential of the average forage sorghums. *Sorghum almum* was found to have 0.1 per cent cyanide, making it high in potential.

How does a cyanogenetic (nitrile) glycoside affect an animal? In other words, what is the killing technique? Hydrolysis, brought about by enzymatic action in the plant or animal, yields hydrocyanic acid (HCN). The HCN is absorbed into the blood stream and, by inhibiting certain enzyme action that interferes with the linking of atmospheric oxygen and metabolic respiration, the poisoning in effect is asphyxiation at the cellular level.

Does haying or ensiling forage plants with HCN potential (Johnson grass, sudan grass etc.), reduce the poisoning potential? During the curing process in making hay a degree of the cyanide potential is lost. Complete drying inactivates the enzyme responsible in cyanide release. No cases of mortality have been reported from the consumption of sorghum silage. The glycoside breakdown is complete during the ensiling process, producing free HCN which is rapidly lost to the air.

Symptoms of a cyanide or prussic acid poisoned animal include uneasiness, staggering and falling, gasping, difficulty in breathing. The eyes may roll and the tongue hang out; prostration, convulsions, coma, bloating and death. Because prussic acid poisoning is generally so rapid, treatment of animals is generally not practical.

In Many Plants

Plants other than the *Sorghum* genus which commonly cause prussic acid poisoning under range and pasture conditions in Arizona include: catclaw (*Acacia greggii*), white thorn (*Acacia constricta*), mountain mahogany (*Cercocarpus spp.*), choke-cherry (*Prunus spp.*), white clover (*Trifolium repens*), and arrowgrass (*Triglochin spp.*).

Generally, prussic acid poisoning most often occurs in the fall of the year when there are great fluctuations in temperature and growing conditions. A livestock man having cyanide potential plants among his forage plants should be particularly observant of such pasture areas during the fall of the year.

Recent Journal Articles Listed

EDITOR'S NOTE: In addition to the various "popular" publications of this College of Agriculture — Extension folders, Extension bulletins, 4-H materials, the popular bulletin series, technical bulletins and others — staff members submit a prodigious output of material to the scientific journals in a score or more fields of scientific inquiry. A listing of recent titles will be given in each issue of PROGRESSIVE AGRICULTURE IN ARIZONA, starting now. Readers who may wish copies of certain papers should write directly to the authors. The listing below includes Journal Number, title of the paper, authors, and journal to which the article was submitted.

947 "Extension-Research Cooperation in Evaluation Studies to Determine Feasibility of Climate Control."
by W. T. Welchert and Frank Wiersma
Agricultural Engineering

948 "Estimating Rapidity of Germination"
by Henry Tucker and L. Neal Wright
Crop Science Journal

949 "Physiological Relationships in an Apical Dominance-Like Ear Pattern in Corn. I. Growth, Ascorbic Acid, and Enzyme Activity."
by Robert H. Maier and Joseph F. Irwin
Physiologia Plantarum

950 "Bermudagrass—Worldly, Wily, Wonderful Weed"
by William R. Kneebone
Economic Botany

951 "Further Observations on the Digestion of Milo and Barley by Steers and Lambs"
by E. K. Keating, W. J. Saba, W. H. Hale and Bruce Taylor
Journal of Animal Science

952 "Factors Affecting Rate of Dry Matter Production and Agronomic Yield of Cotton and Other Species."
by J. H. Hesketh and M. El-Sharkawy
Invitational Paper Cotton Defoliation and Physiology Conference, Atlanta, Georgia.

953 "*Encarsia lutea* as an Egg Parasite of Bollworm and Cabbage Looper in Arizona Cotton.
by Adair Stoner and George D. Butler, Jr.
Journal of Economic Entomology

954 "The Use of Diazinon and Fertilizers for Reducing Bermudagrass Mite Damage and Promoting Grass Growth."
by G. D. Butler, Jr. and J. L. Stroehlein
Journal of Economic Entomology

955 "Effect of the Addition of Cottonseed Lipids to Cottonseed Meal on Egg Discoloration."
by A. R. Kemmerer and B. W. Heywang
Poultry Science

956 "Use of Liquid and Solid Forms of Nitrogen Fertilizers for the Decomposition of Crop Residues."
by J. L. Stroehlein, L. B. Fenn, and W. H. Fuller
Soil Science Society of America Proceedings

957 "A Study of Necrotic Lesion Formation by Tobacco Mosaic Virus."
by C. L. Parish, Milton Zaitlin and Albert Siegel
Journal of Virology

958 "Additional Information on Chromosomal Structural Changes in Gossypium."
by J. E. Endrizzi
Journal of Heredity

959 "Determination of Ferric and Other Metal Chelates of Ethylenediamine di(o-hydroxyphenylacetic Acid) in Plant Tissue."
by T. W. McCreary and R. H. Maier
Biochemical and Biophysical Research Communications

960 "M.S. 3413 Ent. Res. Div., U. S. Dept. of Agriculture Evaluation of Chemicals as Honey Bee Attractants and Repellents."
A. W. Woodrow, ENT; Nathan Green, ENT; H. Tucker, Numerical Analysis Lab., U of A; M. H. Schonhorst and K. C. Hamilton, Ariz. Agric. Experiment Station
Journal of Economic Entomology

961 "The Reactions of 1,2-Dioctylcyclopropene with Silver Nitrate."
by Henry W. Kircher
Journal of the American Oil Chemists' Society

962 "Biological notes on *Megachile Concinna* Smith in Arizona.
by George D. Butler, Jr. and Philip L. Ritchie, Jr.
Pan-Pacific Entomologist

963 "New Species and Nomenclatural Changes in *Cienfuegosia* Cav."
by Paul A. Fryxell
Brittonia

964 "Heritability Estimates and the Genetic Correlation of Water Consumption of Rats at Two Environmental Temperatures."
by C. B. Roubicek, H. Tucker and R. O. Kuehl
Genetics

965 "Movement of the Hawaiian Monk Seal on Laysan Island."
by G. D. Butler, Jr. and

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