MOISTURE CONDENSATION ON WINTER VEGETATION

By K. R. Frost

The occurrence of a large nighttime drop in air temperature will often result in a heavy condensation, evident in early mornings, in the form of water droplets clinging to growing plants, or frost on plant leaves.

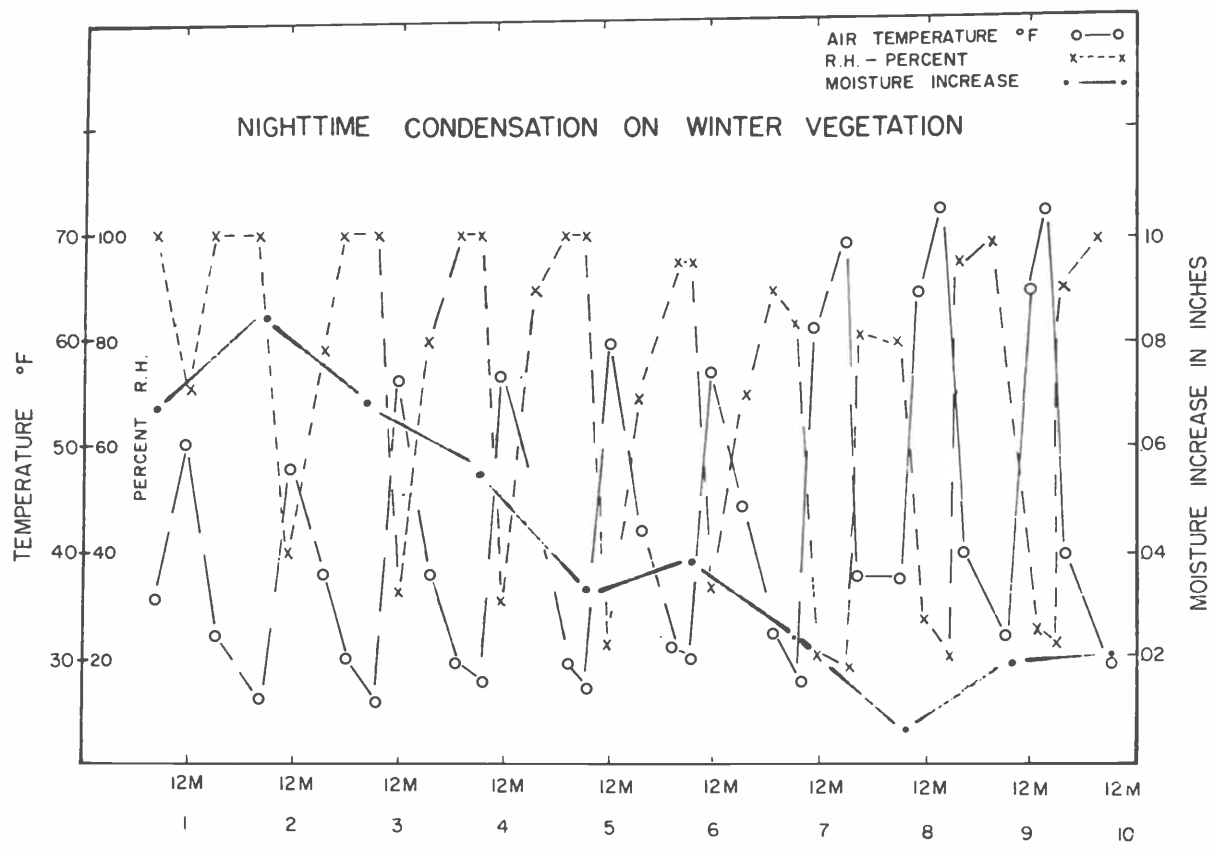

FIGURE 1 — Daily variations in air temperatures and relative humidities for intervals from Jan. 1 to Jan. 10, 1966.

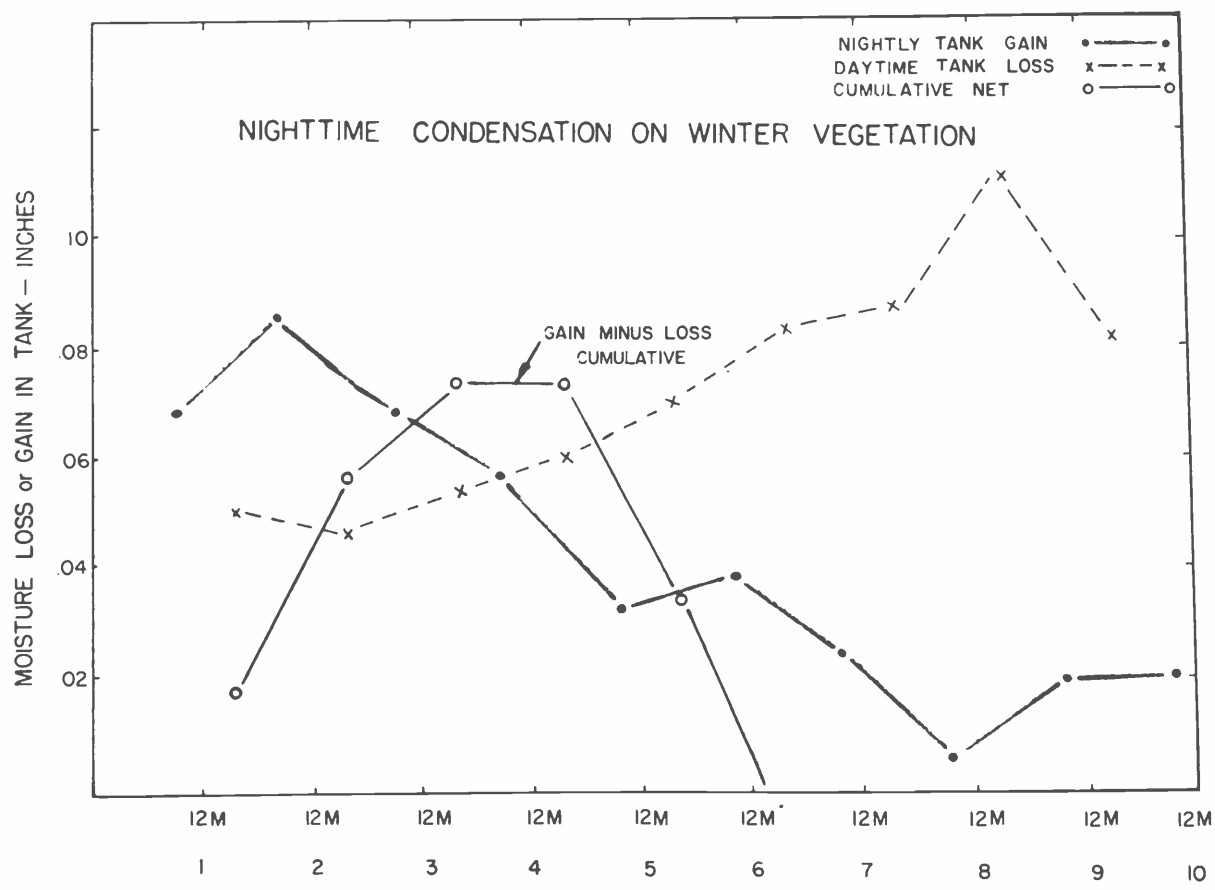

FIGURE 2 — Cumulative gain during six days following storm on Dec. 31, 1965.

When weather conditions are conducive, as much as ¼-inch of frost may be observed in exposed areas on flat surfaces. This well-known phenomenon is associated with high humidity and variable air temperatures. These conditions often prevail in Arizona following the passage of a cold front and/or stormy period, especially during the winter.

Moisture for Crops

The fact that many winter storms passing through Arizona bring moisture but little precipitation prompted a study of the magnitude of condensation during periods of clear skies and high nightly radiations following storms.

If crops collect a total of 0.20 inches of moisture per storm at such times and deposit this in the root zone, or use it in lieu of transpiration during the day, this could be of greater economic importance than the storm itself. If this occurred over a period of five nights, it is probable that half the water would enter the soil for plant growth. Since six to eight storms occur each winter, a total of one inch would be directly beneficial to plants by entering the soil, with another inch forming on the leaves to reduce transpiration. It is also possible that condensation at other periods could supply an additional one hundredth of an inch per night or nearly a third of an inch more per winter.

Investigations in Arizona during the past four winters have sought to determine the magnitude of nightly, weekly and monthly condensation in the Tucson area at one location, and to record climatological data and physical conditions associated with this phenomenon.

Precise Measurement

An evapotranspirometer, constructed for measuring evapotranspiration during sprinkling, was used. This tank, 12 feet in diameter, is equipped to weigh accurately to 0.003 inch of precipitation. Load variations are measured with three 500 pound load cells.

The tank, located in a lowland area, and in the midst of green desert growth, is surrounded by irrigated winter pasture. Minimum night temperatures at this location vary in the winter from 20 to 40 degrees, Fahrenheit, and always fall below dewpoint on clear nights. Air temperature, relative humidity and wind velocity, in addition to the amount of condensa-

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tion, were recorded in the early studies.

Later it was found desirable to record the time the temperature was at or below dewpoint. Ground-level temperature and humidity were also measured for each period, as there appeared to be a close correlation with the amount of condensation.

Figure 1 shows that moisture condensed each night following a storm on Dec. 31, 1965. The significant air temperatures and relative humidities are plotted for morning, midday and evening, which give dewpoint and duration of moisture condensation for a period of 10 days. The amount of nightly condensation in inches of water is also plotted for each night.

Gradual Decrease

Minimum temperatures remained about the same for seven nights. Condensation gradually decreased and approached one hundredth of an inch, which is common for a clear winter night when the air temperature reaches dewpoint.

Figure 2 shows that the total of nightly increases in the tank weight resulting from condensation for the first six days of the above period equaled the total of losses from daytime evapotranspiration. Similar results were obtained from measurements made during clear, cold periods directly following other storms.

In this instance the grass was moderately spaced (half a pound per square foot, green weight), and varied in height from 6 to 12 inches. Samples of grass surrounding the tank were also taken during this period and weighed before and after removing the surface moisture. Equivalent depth of moisture on the grass, using one-half pound of green grass per square foot, was calculated.

Grass Collected Most

Resulting moisture values are plotted in Figure 3. Flat boards of one square foot in area were used to collect moisture during this period, and plotted as shown at the bottom of the figure. The grass collected several times more moisture than the flat surface because of the air movement between leaves and the larger exposed surface. The difference between the amount of the tank-grass moisture and that on the grass samples could have entered the soil and thus not appear on the leaves at the time of sampling.

Numerous daily tests are plotted in

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Agriculture's Story Available in Slides

Do you want to tell the story of agriculture to audiences in your community? The national organization of land-grant colleges and universities has made up a set of 80 color slides which, with the accompanying script, can be purchased for $10.

They are suitable for showing at luncheon clubs, before school groups, at 4-H meetings, for vocational agricultural classes, at FFA meetings, and before a variety of farm and farm-related audiences.

It is suggested that commodity associations or schools might wish to purchase the slides and then "bicycle" them around to a number of audiences in the community, but still retaining ownership.

In Arizona the sildes may be purchased by writing Director Darrel S. Metcalfe, College of Agriculture, University of Arizona.

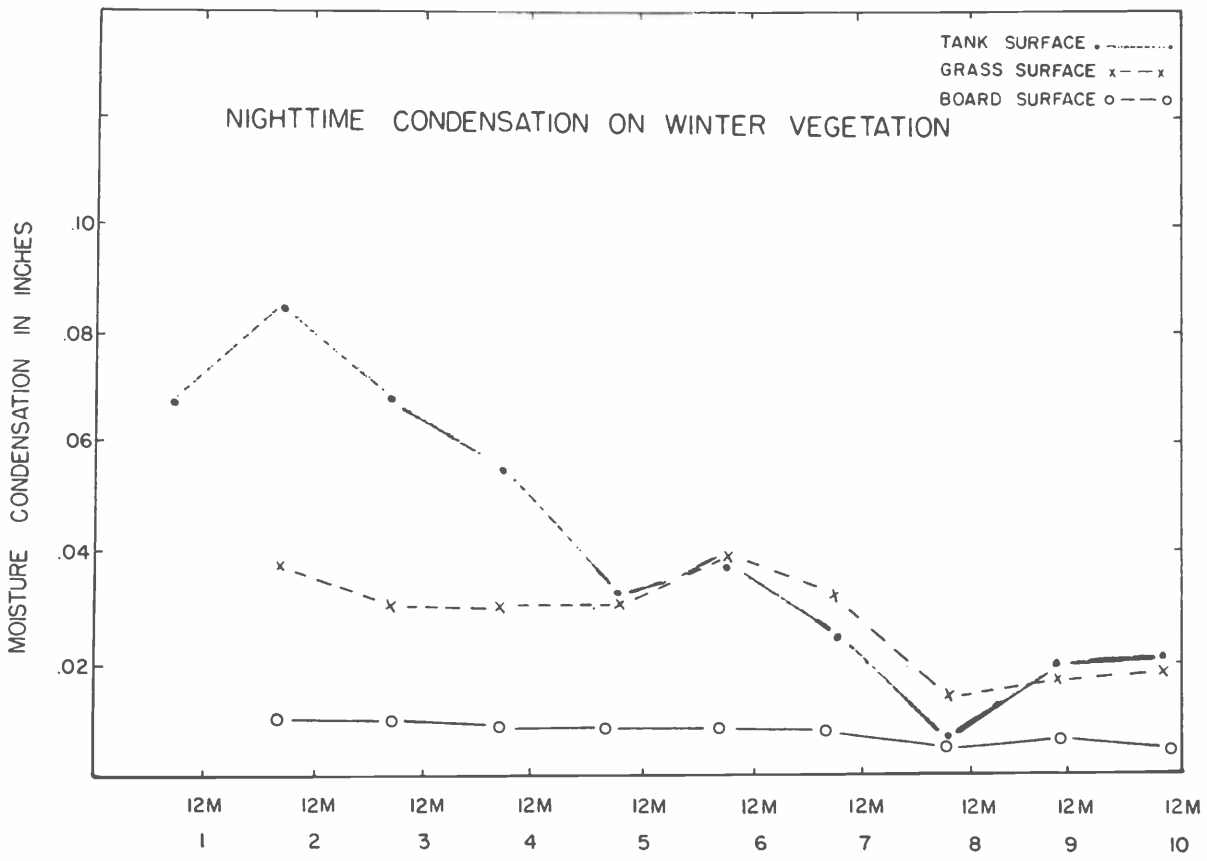

FIGURE 3 — Comparison of tanks increases with grass samples taken on same nights, and with moisture collection on flat surface.

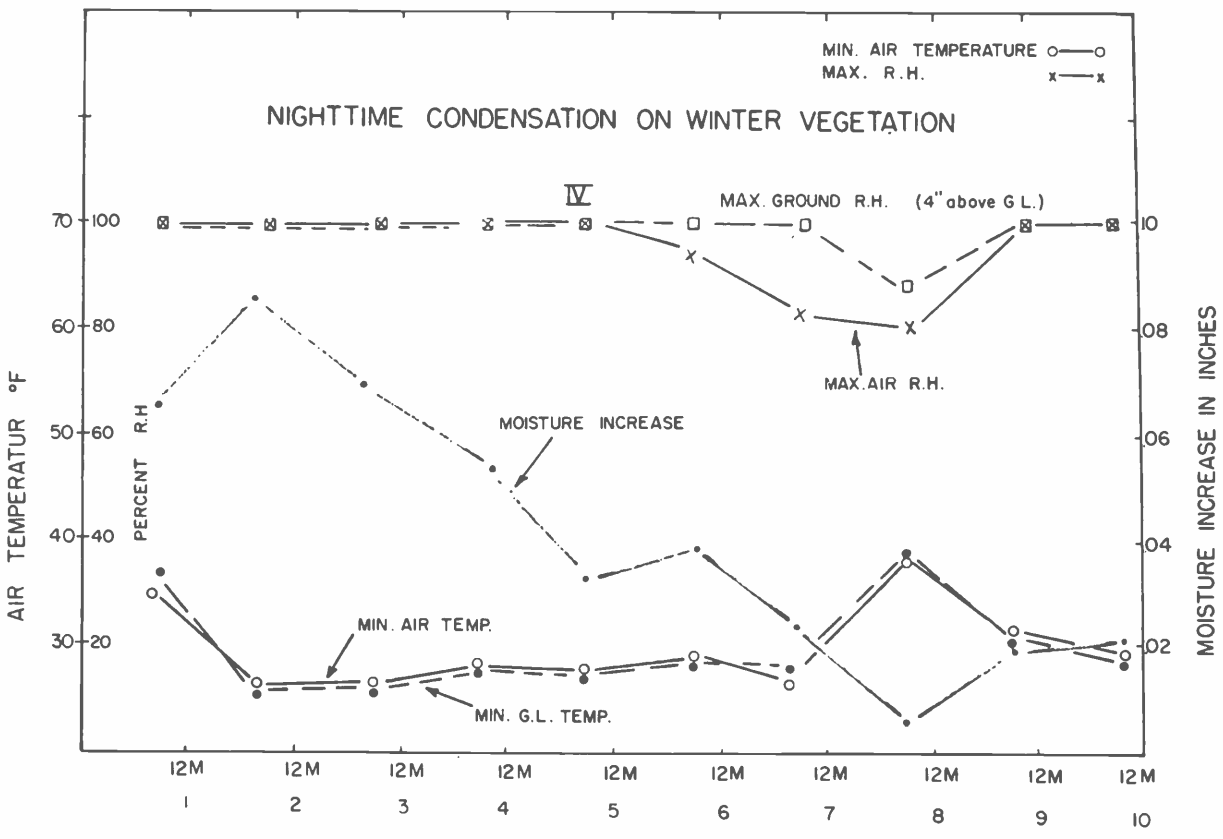

FIGURE 4 — Comparison of maximum and minimum air and ground temperatures and relative humidities.

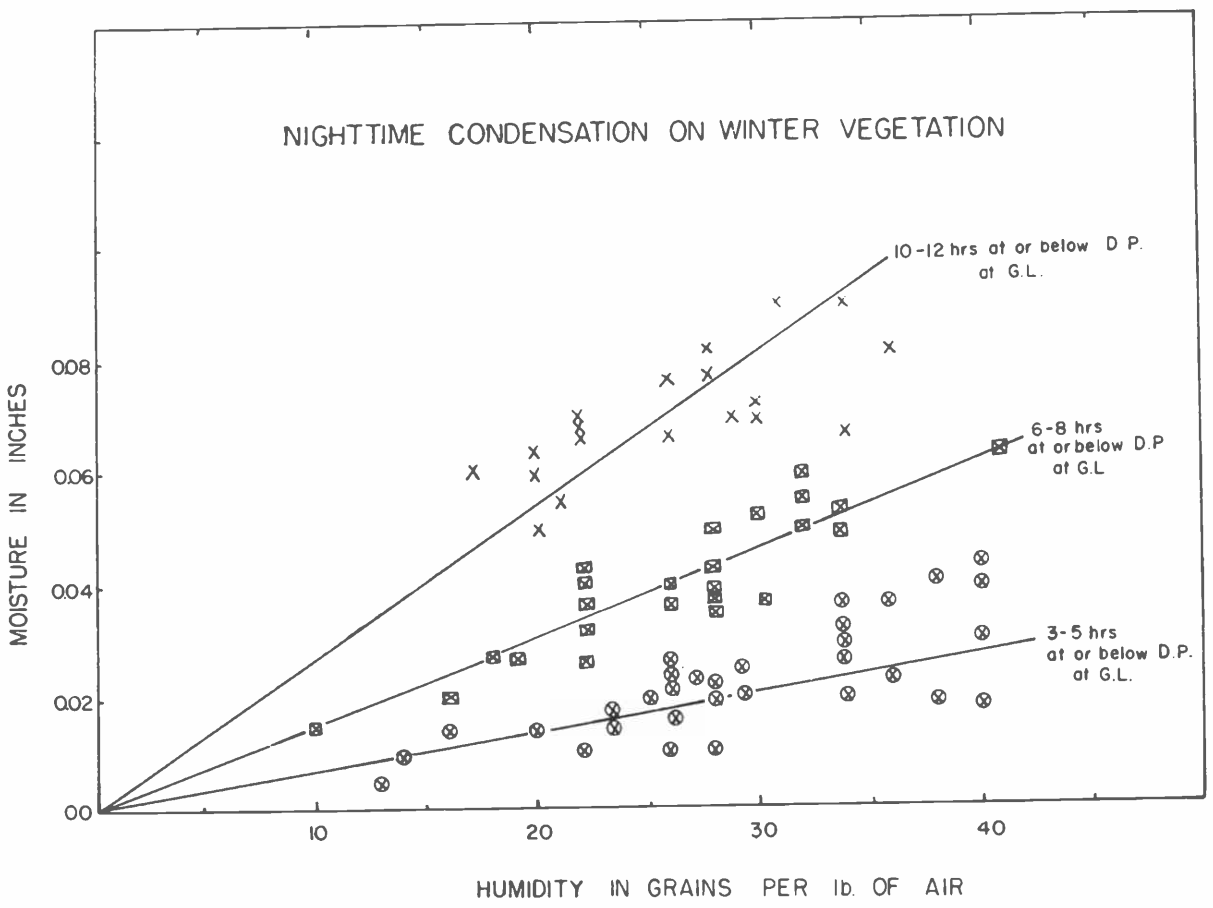

FIGURE 5 — Condensation resulting from different intervals in which the tank surface was below dewpoint, as affected by amount of water vapor in the air.

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Figure 5 as taken from data obtained for cold periods in 1963-66 on winter wheat grass and winter grain. Varying weather conditions existed during these tests, as they generally followed a storm.

Ground-level temperature was below dewpoint for only a few hours in some instances and in others amounted to 10 to 12 hours. These were for clear or partially clear nights, with wind velocities under three miles per hour. Tank weight did not increase during overcast periods or when the wind velocity was over three miles per hour.

Note 3 Variables

From observations and an analysis of the data collected over four years, it can be assumed that nighttime condensation on winter vegetation depends on (1) the number of hours at night the ground-level temperature is below dewpoint, (2) ground level air movement, and (3) surface area of the vegetation.

The first will be affected by the amount of moisture in the air, the air temperature, and amount of cloud cover. The second will depend largely on crop height and wind velocity, and the third upon the type and density of the vegetation. Maximum condensation can thus be expected when (1) air temperature at grass level is below dewpoint all night, (2) the grass stands upright and is variable in height, not blanketing the surface, and (3) the air movement is relatively low.

Lucy Wing Finalist In Pillsbury Contest

Petite, pretty Lucy Wing, senior in the School of Home Economics, has gone to Minneapolis as one of the five finalists in the Pillsbury Awards Program. This contest attracts candidates from nearly all the 400 degree-granting institutions in the nation.

Two years ago the national contest was won by another University of Arizona home economist, Miss Sue Alexander. The contest carries rich rewards of scholarships, cash and in-service training.

Miss Wing, besides being an honor student, has had time for a wide variety of scholastic honors and affiliations, including Wranglers, Mortar Board, Aggie Council, Omicron Nu, Chinese Students International Organization, Associated Women Students, vice presidency of Sonora Hall and the Who's Who of American Colleges and Universities.

Miss Wing, whose home is in Superior, Ariz., was also editor of the Student Handbook, issued annually by students in the College of Agriculture, and given each fall to incoming freshmen.

Recent Journal Articles Listed

EDITOR'S NOTE: In addition to the various "popular" publications of this College of Agriculure — 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 of fields of scientific inquiry. A listing of recent journal papers is given in each issue of PROGRESSIVE AGRICULTURE IN ARIZONA. Readers who 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.

1126 "Economic, Social, and Legal Problems of the Arizona Cattle Feeding Industry as Related to Animal Waste Management."
by Thomas M. Stubblefield
Proceedings of National Symposium on Animal Waste Management.

1127 "A Revision of Acanthinus — IV (Coleoptera: Anthicidae)."
by Floyd G. Werner
Annals of the Entomological Society of America

1128 "The Saguaro Cactus in Arizona"
by Stanley M. Alcorn
American Horticultural Magazine

1129 "Inheritance of Seed Size in Sorghum"
by R. L. Voigt, C. O. Gardner and O. J. Webster
Crop Science

1130 "A Step Toward Automatic Weighing of Range Cattle"
by S. Clark Martin, Kenneth K. Barnes, Leonard L. Bashford
Journal of Range Management

1131 "Bovine Fertility Related to Thyroid and Parathyroid Function"
by G. H. Stott
Journal of Dairy Science

1132 "Two Modifications to The Vegetation Photographic Charting Method"
by Ramón Claverán A.
Journal of Range Management

1133 "Notes on Rearing Melanoplus lakinus Scudder"
by L. A. Carruth
Pan Pacific Entomologist

1134 "Rate of Transfer of DDT From the Blood Compartment"
by J. M. Witt, W. H. Brown, Gail I. Shaw, L. S. Maynard, L. M. Sullivan, F. M. Whiting, and J. W. Stull
Bulletin of Environmental Contamination & Toxicology

1135 "Effect of Dry Rolling, Fine Grinding, Steam Processing and Pressure Cooking on Digestion of Milo Rations by Steers"
by Stephen Mehen, W. H. Hale, Brent Theurer, Morgan Little and Bruce Taylor
Proceedings, Western Section, American Society of Animal Science

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