SUMMARY OF RECENT INVESTIGATIONS OF THE VALUE OF CACTI AS STOCK FOOD, JANUARY 4, 1907

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DAVID GRIFFITHS & R. F. HARE

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B. T. GALLOWAY, *Chief of Bureau.*

SUMMARY OF RECENT INVESTIGATIONS OF THE VALUE OF CACTI AS STOCK FOOD.

BY

DAVID GRIFFITHS,

ASSISTANT AGROSTOLOGIST, FARM MANAGEMENT INVESTIGATIONS, BUREAU OF PLANT INDUSTRY,

AND

R. F. HARE,

CHEMIST, NEW MEXICO COLLEGE OF AGRICULTURE AND MECHANIC ARTS.

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SUMMARY OF RECENT INVESTIGATIONS OF THE VALUE OF CACTI AS STOCK FOOD.[a]

INTRODUCTION.

In connection with introductions, the improvement of species, and a general study of the economic relationships of native and introduced species of cacti the authors have jointly undertaken a somewhat critical comparison of the species of this group from a forage standpoint. In order to make the chemical work worth while it has been necessary to put the characterizations of the different forms and species in such condition that they are recognizable to others. This could only be done by the use of copious notes in connection with each, for names are of uncertain meaning and in many cases will be of uncertain significance in this group of plants for a long time to come. The chemical side of the investigations seems to be essential, for when these studies were begun there was but little literature dealing with the cacti from a forage standpoint.

[a] In two publications of the United States Department of Agriculture (Bulletin No. 74 of the Bureau of Plant Industry and Bulletin No. 91 of the Bureau of Animal Industry) the value of the cacti as forage plants has been demonstrated. Since these plants are known to possess important economic value more knowledge concerning them is desirable. As a basis for future investigations, the Bureau of Plant Industry and the Agricultural Experiment Station of New Mexico have collected specimens of these plants and their fruits from a wide area, from which a large number of chemical analyses have been made. The results are detailed in the following pages, which contain 187 fodder analyses and 26 complete ash analyses. The territory from which the material was collected extends from central Texas to California and southward to the central plateau of Mexico.

Attention is called to the fact that the apparent high content of fats and protein in the fruit of certain species is due to the large amount of these classes of nutrients found in the seed. As these seeds are surrounded by a dense layer of wholly indigestible tissue, the high content of ether extract and protein is misleading. The analyses show that the fodder value of the fruit of cholla (*Opuntia fulgida*) especially is little more than that of the stems. It will be seen that in chemical composition the different forms of cactus compare favorably with ordinary green fodders and root crops.

There are many points of special interest in connection with the ash analyses, particularly the high content of potash, magnesium, and calcium. Altho the cane cacti show a relatively higher food value, practical considerations relating to growth and ease of propagation render them of less value than the prickly pear, except in certain limited localities where they are especially abundant.—W. J. SPILLMAN, *Agriculturist in Charge of Farm Management Investigations.*

The investigations have been conducted in cooperation between the Office of Farm Management Investigations of the Bureau of Plant Industry and the Agricultural Experiment Station of New Mexico for the purpose of determining, if possible, the extent of variation and the nature of the food constituents of the different species which are likely to be utilized as food for stock. The plants are grouped under three general headings—prickly pears, cane cacti, and miscellaneous—the first group being by far the most important, tho the second is largely utilized in sections where its different representatives grow. Three or four members of this group have been fed to stock with more or less success. The third group consists of miscellaneous species from other cactus genera, which on the whole are but little utilized as stock feed, altho it is clearly shown that some of the species have been fed in rare instances. The interest in this group is largely a matter of comparison with the others.

Details of the investigations are published in Bulletin No. 60 of the Agricultural Experiment Station of New Mexico.

THE SAMPLES OF CACTI ANALYZED.

Considerable importance is attached to the method of sampling, it being recognized that uniform samples of such succulent and variable plants are difficult to secure. It appeared more logical, therefore, to describe the samples in such a way as to give other investigators and the reader an accurate idea of the portion of the plant used in the chemical analysis. The sample is indicated by a formula—for example (2–1–4–3–5) 3—in which the left-hand figure indicates the number of terminal joints, the second number from the left the number of joints next to the terminal joint, and so on, the figure outside of the parentheses indicating the number of plants from which the sample was collected. All samples were forwarded to the laboratory in tin cans from which a minimum of evaporation took place. They were prepared by first being sliced open, so as to expose a maximum of cut surface, and dried by artificial heat at a temperature of not more than 70° C. The spines were then singed off by a small flame of complete combustion, care being taken neither to deposit combustion products upon nor injure the specimens. In the analyses the methods of the Association of Official Agricultural Chemists were followed, with the exception of a few modifications in the determination of certain ash constituents.

WATER CONTENT.

A collection of samples for chemical analysis was begun in 1904, and a fairly complete set was secured during that year; but, owing to the uncertainty due to the analysis of single samples, these were nearly all duplicated in 1905, in most cases from the same localities.

Fortunately there was a great difference between the rainfall during the months from January to March of 1904 and 1905. The effect upon the water content of the plants is fairly well illustrated in the different tables of analyses, altho no special effort was made to collect the samples for the purpose of showing this feature in detail. There are some apparent exceptions to the rule that the samples collected in 1904 contain more water than those collected in 1905; but this may be accounted for in some cases by the difference in the portions of plant collected or in other cases possibly by local conditions. The amount of water in the different samples analyzed varied from 60.99 to 95.5 per cent. The miscellaneous group is relatively more succulent than either of the other two, the average amount of water being 87.88 per cent, while the prickly pears averaged 84.26 per cent and the cane cacti 78.47 per cent. As a rule, the fruit contained more water than the stems and the younger growth more than the older.

The difference in the species in the field during a dry and a wet season is very marked, and even prickly pear has its limit of drought endurance. Experience in southern Texas demonstrates that it is much reduced in value during very prolonged dry seasons, for it becomes tough and leathery. "Fat pear" is largely the result of distention of the tissues by water. Some species, *Opuntia fulgida* especially, when a favorable moist season follows an exceptionally dry one, will absorb so much water that the fruits and young joints become ruptured by the excessive turgidity, and this often occurs with the fruit of nopal camueso and other cultivated Mexican species.

ASH CONTENT.

Plants grown in the arid and semiarid Southwest, where there is an abundance of soluble salts in the soil, are found to contain more ash than those grown in regions of frequent rainfall. The cacti are certainly no exceptions to this rule. The average ash in the air-dried stems and fruits of the prickly pears analyzed amounts to 18.25 per cent, for the cane cacti 15.50 per cent, and for the miscellaneous group 13.54 per cent, one sample running as high in ash as 33.8 per cent of the air-dried substance. These averages would be still higher if they did not include the ash of fruits, which always contain less ash than the stems. The average ash in the air-dried fruits of the prickly pears, for instance, is 13.21 per cent, which is 5.4 per cent less than is contained in an average of both stems and fruits of this group and 6.35 per cent less than is in the stems alone. It is the seed which is especially low in ash, the fleshy portion resembling the stem more closely so far as its ash content is concerned. This is brought out very forcibly in samples Nos. 8022*a* and 8022*b*, the former being the fleshy