# NITROGEN AND CAROTENE PARTITION IN THE ALFALFA PLANT

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The need for vitamin A or carotene by both man and animal is universally recognized. This is true especially in the case of domestic animals that are more or less closely kept inside and fed dry cereals and hay during the winter months. For these animals there is need of a supplement such as alfalfa or green succulent silage or some form of A concentrate. This generally accepted statement is substantiated by evidence cited by Hart (1940).

Within recent years, Wall (1940), of the Oklahoma Agricultural Experiment Station, and workers in other laboratories (Fraps, Treichler and Kemmerer 1936; Guilbert 1935; Peterson, Bird and Beeson 1937; Russell, Taylor and Chichester 1934) have demonstrated that green plants, especially alfalfa, are excellent sources of carotene; that the greatest potency exists in the small green plants of early spring; that the percentage of carotene decreases with the size of the plant and varies with the period of the year; that if the green plants are cut and exposed to sunshine for drying much of the carotene is destroyed; and that after placing the dried hay in storage the percentage continues to fall. This destruction seems to be largely oxidative and is hastened by sunlight, exposure to the air, and weathering. Storage in air-tight silos is less destructive.

It is highly desirable that we preserve as much of the carotene present in the plant as possible. This has been accomplished to a certain degree by quick artificial drying, in which the green plant is dried and stored in a few hours. It has been suggested that the process might be still more efficient if the carotene were separated from the fresh plant and stored in an air-free container. Results of such a method are briefly described here.

## PROCEDURE

The alfalfa plant was chosen as one rich in carotene, readily grown, and accessible most of the year. The samples were taken: first, in July, from 14-inch plants; second, in August, from a third cutting of 8-inch plants; and third, in November, from 6-inch plants following a frost. At none of these times was the total carotene content high, so the total quantities reported do not represent the full possibilities of the method. It is thought, however, that the distribution would be somewhat similar at any time. The plants, after being cut, were immediately transferred to the laboratory and ground to a fine pulp in a power grinder. The juice was expressed through canvas filters in a Carver press at a pressure of 15,000 pounds per square inch. The fluid was concentrated to a sirupy mass by evaporation below 65° C. in a vacuum still. Aliquots of the original plant, juice, press cake, and concentrate were analyzed for total nitrogen by the Kjeldahl method, and for carotene by the Peterson-Hughes-Freeman method (1937). The results are recorded in table I.

## DISCUSSION AND RESULTS

An examination of the data in table I indicates that a greater amount of the total nitrogen and carotene of the original plant is retained in the pulp than is found in the expressed juice. These data also indicate that the juice may be concentrated in vacuo with small loss of carotene. It might be noted that when optimum concentration for retention of carotene is reached (cf. August results), the concentrate will contain over twice as much carotene per gram as does the original plant. This concentrate could be easily stored in sterile containers. Moreover, the press cake could be dried and stored as in the quick drying of the whole plant.

TABLE I

*Extraction and Concentration of Nitrogen and Carotene of Alfalfa*

| Material | Grams | Nitrogen present | Carotene present |
|---|---|---|---|
| | | *mg* | *I.U.* |
| | | July | |
| Green plant | 1,750 | 14,280 | 135,925 |
| Press cake | 750 | 8,145 | 98,616 |
| Juice | 1,000 | 6,140 | 38,850 |
| Concentrate | 125 | 5,715 | 15,103 |
| | | August | |
| Green plant | 2,380 | 22,490 | 164,220 |
| Press cake | 1,660 | 17,260 | 132,800 |
| Juice | 720 | 5,030 | 25,820 |
| Concentrate | 144 | 4,096 | 24,192 |
| | | November | |
| Green plant | 1,700 | 16,830 | 103,625 |
| Press cake | 1,000 | 10,450 | 80,674 |
| Juice | 700 | 5,270 | 23,440 |
| Concentrate | 270 | 5,143 | 23,123 |

## CONCLUSION

The results indicate that concentration by vacuum evaporation may be applicable to the manufacture of a stable cartoue concentrate; however, the high proportion of carotene retained in the press cake indicates that further developmental work is necessary before the method can be adapted to practical uses.

## LITERATURE CITED

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