*Ecology of Food and Nutrition*, Vol. 16, pp. 135-152
0367-0244/85/1602-0135 $18.50/0

© Gordon & Breach Science Publishers, Inc. and OPA Ltd., 1985
Printed in the United Kingdom

HP1577

# VARIATION IN COMPOSITION OF HOPI INDIAN BEANS

G.P. NABHAN, C.W. WEBER and J.W. BERRY

*Office of Arid Lands Studies and Department of Nutrition and Food Science*
*University of Arizona Tucson, Arizona 85721*

*(Received April 6, 1984; in final form July 19, 1984)*

Dry *Phaseolus* beans grown on the Hopi Indian reservation by traditional agricultural techniques were collected and compared with beans utilized by the Hopis but grown off the reservation. Species included *P. vulgaris*, *P. acutifolius* var. *latifolius*, *P. coccineus* and *P. lunatus*. Ethnobotanical information, morphological and chemical data were obtained. Beans grown on the reservation were generally but not always found to be superior in protein content, but no clear differences in protein quality could be attributed to bean types or field environments. Legumes are consumed at the same level (30 g/day/person) but native beans contribute less protein to the Hopi diet than during the 1930's, as a consequence of reduced diversity in varieties locally produced and consumed. Much variation occurs in mineral levels in Hopi beans, but the wide range in soil composition found in Hopi fields gave no clear correlation with bean composition.

KEY WORDS: beans, *Phaseolus*, indigenous foods, Hopi Indians, desert agriculture, protein, minerals, food composition, legumes.

## INTRODUCTION

In a ground-breaking study of native American diets, Calloway Giauque and Costa (1974) compared federally donated surplus commodity foods with the locally produced, traditionally processed foods they have tended to replace on Southwest Indian reservations. Among other findings, it was reported that the tepary beans, *Phaseolus acutifolius* a native Southwestern species long cultivated by the Hopi and Papago, was 15 % higher in crude protein and certain minerals than the common pinto bean being distributed in U.S. Indian reservations (Table I). This fact is of little significance unless one considers the possibility that the relative abundance of certain foodstuffs distributed through welfare programs may be serving as a disincentive for local food production and consumption. As one Papago Indian candidly observed, "When the commodities program first reached here, most families could get all the pinto beans they needed that way ... Pretty soon, the only kind of bean most of our people ate was pintos, and hardly anyone grew the old kinds any more."

In contrast to most Southwestern Indian tribes, the Hopi of northern Arizona have persisted in cultivating a diversity of beans well into this century, including several kinds unique to their culture. Whiting (1939) listed 21 folk taxa of *Phaseolus* beans that had been named by and collected from the Hopi. Regarding their sources of beans, 91 of the 120 bean samples encountered in Hopi households in the 1930's were said to have been inherited through clans (Whiting, 1937). In

TABLE I

Previously reported protein and mineral values for beans eaten by Hopi

| | Crude Protein % | Ca | P | Fe | Zn | Cu | Mg | Na | K | Mn |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | ppm | | | | |
| Commodity pinto beans[a] | 20.9 | 1330 | 4660 | 43 | 21 | 9 | 1280 | 40 | 14010 | 12 |
| Trading post white teparies[a] | 24.3 | 1470 | 4050 | 56 | 30 | 10 | 1800 | 30 | 16530 | 17 |
| Hopi yellow dry beans[b] | 24.4 | 2900 | 4350 | 88 | 40 | 12 | — | — | — | — |
| cooked, redried | 21.2 | 3320 | 2250 | 71 | 32 | 7 | — | — | — | — |
| Hopi green beans, dried[b] | 26.1 | 3880 | 1840 | 247 | 26 | 12 | — | — | — | — |
| Hopi bean pod ash[c] | | 132000 | 9580 | 5720 | 287 | 87 | 34200 | 1130 | 128000 | 159 |

[a] Recalculated from Calloway Giaugul and Costa. (1974)
[b] Recalculated from Kuhnlein Calloway and Harland. (1979)
[c] Bean pod and vine ash serve as flavor additives and color fixatives in blue maize foods. Data from Calloway Giauque and Costa. (1974)



1936, 2779 Hopi consumed 25,764 kg of homegrown beans and 771 kg from traders (Soil Conservation Service, 1938). Based on these data, 25 of every 26g of beans (dry weight) eaten per capita per day were homegrown. For a small bean like the Hopi tepary, 26g of dry beans cooks up to 64g, or a little more than ⅓ cup drained.

Four decades later, beans remained a major protein-rich food in the diet of the 7500 reservation Hopi (Kuhnlein and Calloway, 1977). Based on their diet recall data, and assuming standard portions (50g dry weight servings for dry beans; 30g dry weight servings for green beans; 10g dry weight servings for sprouts), we have estimated that the contemporary dry weight bean consumption per capita per day is 29.6g for women and 25.6g for children among Hopi Indians. Although these estimates were derived using different methods, we feel reasonably safe in assuming that contemporary Hopi families generally eat as many beans as did their ancestors two generations ago.

While Kavena (1980) claimed that "at least 14 different types are grown in various bean fields on the reservation, and others are still gotten through trade or purchased", she added that few of these are "everyday beans". Store-bought and commodity pintos are likely the most frequently eaten beans, and even then may not necessarily be cooked and served in a traditional manner. Kuhnlein and Calloway (1977) reported that less than 25 % of the dietary recalls from 420 Hopi women and children included one traditional food in the daily regime. Beans were not mentioned as an ingredient in the five most frequently prepared traditional dishes of combined foodstuffs. Rather, the distinctive Hopi homegrown bean varieties are saved for use during ceremonies, or are "cooked when the homemaker craves them or to give variety to the diet" (Kavena, 1980).

It is the potential nutritional consequences of variety in the diet, or the lack of it, that concerns us here. Does the genetic diversity within the *Phaseolus* cultivated by the Hopi translate into any nutritional benefits to the Hopi? Nutritionally speaking, *is a bean a bean*? — whether 14 kinds grown locally are involved or merely one kind imported?

Recent studies of Southwestern Indian diets have emphasized the effects of traditional versus modern processing methods on the chemical composition of prepared food (Kuhnlein and Calloway, 1979; Kuhnlein, 1981; Greenhouse, 1981). This study explores the chemical variation in raw foods due to the interaction of genetic factors with environment. In particular do Hopi-selected bean ecotypes adapted to and grown in the Hopi sand dunes environment compare chemically with other (sometimes visually identical) varieties grown elsewhere?

## MATERIALS AND METHODS

Dry bean samples were obtained from Hopi Indian families in 6 villages, as well as from trading posts and other sources available to the Hopi. Whenever possible, ethnobotanical information was obtained regarding the Hopi name or its English equivalent, special uses, and place of cultivation. Orthography used in writing Hopi terms follows Kalecteca (1976). The bean samples were then compared with the collections of Whiting and others in the Museum of Northern Arizona, and compared to the subspecific type categories formulated by Kaplan (1956) for Southwestern beans. After further investigation regarding color and morphological types found together (and potentially exchanging genes) in mixed field populations, some of these types were classed together into more inclusive categories. These were

HP1578