

# Riboflavin and Niacin Content of Green Snap Beans

By Eunice Kelly<sup>1</sup>

Green snap beans are a popular vegetable in North Dakota home gardens. Fresh from the garden beans, however, are obtainable only two to three months of the year in North Dakota. In the past, homemakers canned their excess fresh beans for use during the remaining nine months of the year. Today, with the increased home ownership of frozen food units and greater availability of frozen food lockers, an increasing number of homemakers are turning to freezing their winter supply of vegetables.

There seems to be no question as to the superior table quality (palatability) of properly frozen green beans over that of canned beans. The same variety of green beans has consistently been given a higher palatability rating when preserved by freezing than when canned, a panel of tasters here at the station agreed.

We were also interested in knowing how well two of the water soluble vitamins, niacin and riboflavin, would be retained by this method of food preservation. Where, in the preparation for freezer storage, would the greatest loss of water soluble niacin and riboflavin take place? Is there an additional loss of these vitamins during storage in the freezer locker? How much of the original vitamins are left when frozen beans are cooked and ready to serve on the family dinner table?

To answer these questions a series of carefully controlled experiments were set up here at the station over a period of three successive crop years. Bountiful green beans, a flat-podded bean, and Green Pod Stringless, a round-podded bean, both of which have been shown to freeze satisfactorily<sup>2</sup> and are adapted to North Dakota culture, were selected for the tests. These two varieties were grown on the horticultural plots at Fargo, North Dakota, under the supervision of the horticulture department. Two to three plantings of each variety were tested each year.

In the nutrition laboratory the freshly harvested green beans were carefully graded for size, discarding all oversize and small beans so that the samples used for comparison would be of the same maturity, and accurate weighings were made of each sample in the fresh, raw state and after each treatment in order to calculate loss of vitamin due to each treatment. Niacin<sup>3</sup> and riboflavin<sup>4</sup> were determined by the microbiological method.

<sup>1</sup>Human Nutritionist.

<sup>2</sup>Knowles, D., Grottoden, O., and Long, T. E. Freezing Vegetables. The Comparative Suitability of Varieties of Green Beans, Lima Beans, Wax Beans, Sweet Corn and Peas for Freezing Preservation. North Dakota Agricultural College Experiment Station Bulletin 322, 1943.

<sup>3</sup>Krehl, W. A., Strong, F. M., and Elvehjem, C. A. Determination of Nicotinic Acid. Modifications in the Microbiological Method. Ind. and Eng. Chem. Anal. Ed., 15: 471, 1943.

<sup>4</sup>Strong, F. M., and Carpenter, L. E. Preparation of Samples for Microbiological Determinations of Riboflavin. Ind. and Eng. Chem., Anal. Ed., 14:909, 1942.

Here is what the tests for niacin and riboflavin over the three-year period showed:

### No Varietal Difference

The amount of niacin and riboflavin present in the green beans tested did not vary appreciably from year to year, so averages of the three years' work are used for comparison.

Bountiful and Green Pod Stringless green beans were very similar in niacin and riboflavin content, averaging 0.65 and 0.66 mg. per 100 grams niacin and 0.125 and 0.124 mg. per 100 grams riboflavin respectively for the three-year period. That is, 100 grams (one serving) of freshly harvested raw green beans of either of these two varieties contain approximately 1/20 of the recommended daily dietary allowance of niacin and approximately 1/10 of the recommended daily dietary allowance of riboflavin.

As far as niacin and riboflavin are concerned, then, you might plant whichever is your family's favorite of these two varieties and obtain about the same quantity of vitamin per quantity of beans harvested.

Now let us see what happens to the vitamin content of the green beans before the beans reach the dinner table.

### Loss in Blanching

Some of the vitamin is lost out into the blanching water. The amount lost will vary with individual lots of beans. It may be as low as 9 per cent or as high as 26 per cent, but on the average 14 per cent of the riboflavin and 20 per cent of the niacin will be lost during the blanching in preparation for freezer locker storage.

### Loss in Holding

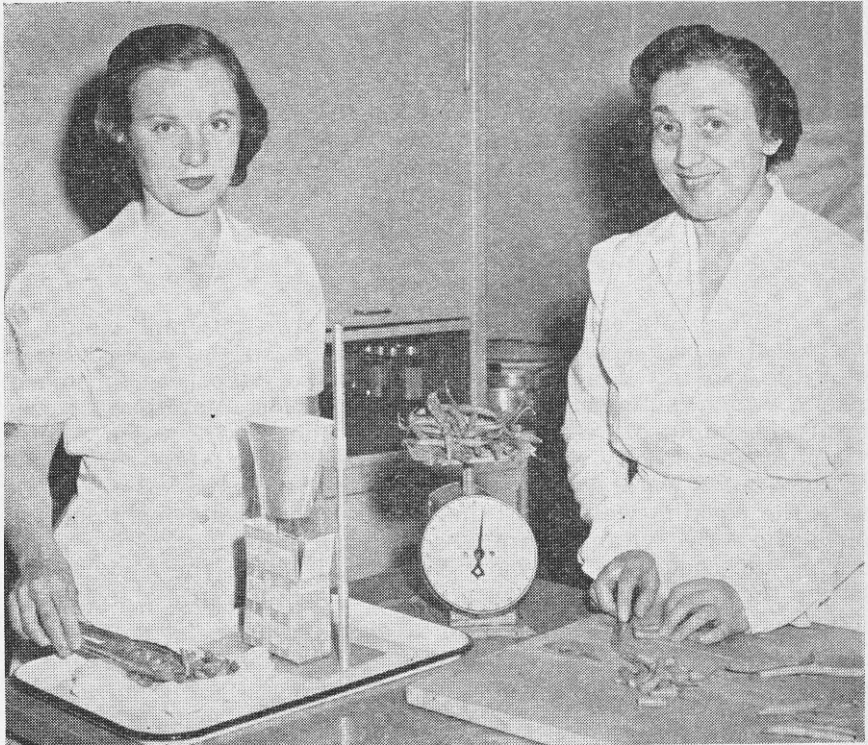
Perhaps you did not get those beans processed the day you picked them. What happened to the niacin and riboflavin content in 24 hours holding?

If you left the freshly harvested green beans in the brown paper bag into which you picked them, sitting on the kitchen table where the temperature is certain to be as high as 78°F. in the summer time, you can expect to lose 13 per cent of the riboflavin and 20 per cent of the niacin in 24 hours time. Add this loss to the 14 per cent riboflavin and 20 per cent niacin you will lose when you do blanch them and you have a total loss of 27 per cent riboflavin and 40 per cent niacin.

However, if you store the freshly harvested beans in the refrigerator (42°F.), you will reduce the loss of riboflavin 9 per cent and of niacin 7 per cent over that in room temperature storage. (Total loss in 24 hours refrigerator holding plus blanching equals 18 per cent for riboflavin and 33 per cent for niacin.)

### Holding Blanched, Packaged Beans

Now, you may be one of those people who does not own a home freezing unit and have to take your frozen food packages some distance to the locker plant. Yes, the beans were harvested, blanched and packaged promptly, as recommended, but just then a carload of company drove into the yard and you had to postpone that trip to the locker plant with the packaged beans—say for 24 hours.



**Fig. 1** The author of this paper, right, and her research assistant, Mrs. Deloris Kereluk, left, prepare green string beans for the deep freeze. Scientific control surrounds every step in preparation of the beans, from the moment they are picked through to the summation of the experiment.

What happens to the niacin and riboflavin in those packaged green beans? Nothing. Even after six months storage in the locker there will still be as much niacin and riboflavin present in the blanched beans as there was immediately after blanching and packaging. But—and this is important—those packages of blanched beans you left sitting on the kitchen table (room temperature) for 24 hours will not be good eating. The beans will have turned grayish in color and have a definite stale odor.

Although we were not checking the vitamin C content of the whole series of bean samples, we tested the discolored blanched bean samples for ascorbic acid (vitamin C) and found that all of the vitamin C had been destroyed during this 24-hour holding period. This did not hold true for the samples stored in the refrigerator. So, if you are unavoidably delayed in getting the blanched beans to the locker plant, see that they are stored at refrigerator temperature to retain both quality and vitamin content.

### Freezer Storage

Those good beans you put into the freezer in July and August will still have practically the same quantity of riboflavin and nearly as much niacin as the day you put them in the locker, even after six to nine months storage. We found hardly any measurable losses of riboflavin and only a gradual loss of niacin after a six-month storage period, with a loss of 13 per cent after nine months storage.

### Cooking

We were interested in whether these two vitamins would be destroyed during cooking. When we analyzed the cooked beans plus the cooking liquid we found no loss of riboflavin or niacin after boiling (simmering boil) fresh beans 40 minutes or frozen beans 12 minutes. But how much of these two water soluble vitamins your family will be served at the dinner table will depend on how much water you used to cook the beans and what you did with the cooking water. As their description (water soluble) implies, these two vitamins are dissolved out into the cooking water during the cooking. The more liquid you use in the cooking, the larger the quantity of the vitamins will be lost into the cooking liquor.

If you have only one to two tablespoons cooking water left at the end of the cooking period only 8 per cent of the vitamin will be in the cooking liquid and 92 per cent left in the cooked beans. If you have  $\frac{3}{4}$  to one cup cooking liquid remaining at the end of the cooking period 30 per cent of the niacin and riboflavin will be lost into the cooking water and only 70 per cent left in the beans. So, to serve your family all the niacin and riboflavin present in the beans, use as little water as possible to prevent scorching during cooking, and add that one to two tablespoons of cooking liquid to the gravy.

### Summary

1. Raw, freshly harvested Bountiful and Green Pod Stringless green beans contained 0.65 and 0.66 mg. per 100 grams niacin and 0.125 and 0.124 mg. per 100 grams riboflavin, respectively.
2. Approximately one-seventh of the riboflavin and one-fifth of the niacin content was lost during blanching for freezer storage.

3. Holding for 24 hours at refrigerator and room temperature before processing caused four to 13 per cent additional loss of riboflavin and 13 to 20 per cent additional loss of niacin, with the larger losses occurring at room temperature.

4. No additional loss of riboflavin occurred during freezer storage and only a gradual loss of niacin over six and nine month storage periods.

5. Neither niacin or riboflavin were destroyed during the cooking of either fresh or frozen green beans, but eight to 29 per cent of the vitamins were dissolved into the cooking liquid. The larger the quantity of cooking water used, the higher the percentage of niacin and riboflavin dissolved into the cooking liquid.

6. One serving (100 grams) of Bountiful or Green Pod Stringless green beans, when cooked, would supply the following:

**Table 1**

NIACIN AND RIBOFLAVIN CONTENT IN FRESH AND FROZEN  
SNAP BEANS

	Freshly Cooked Green Beans		Cooked Frozen Green Beans	
	mg. per 100 grams	Percentage of daily requirement	mg. per 100 grams	Percentage of daily requirement
	Fresh Basis		Fresh Basis	
Niacin .....	0.63	4% to 5%	0.50	3% to 4%
Riboflavin ..	0.12	7% to 8%	0.11	6% to 7%

**OLD TURTLE BAY FARM**

In 1639, a small tract of land was given by Willem Kiest, director general of New Netherlands, to a pair of English tobacco growers by the name of Holmes and Hall as a reward for their leadership in campaigns against the Indians. Later known as Turtle Bay farm, the property was described in part as follows:

"A certain piece of land lying in the Island Manhates (Manhattan), extending in breadth from Deutel Bay along the East River till to the Kill of Schepmoes where the Beach tree lies over the water, and then in its length from the said river straight into the woods, and of the same breadth all along the water, 100 rods 13 feet to the rod . . ."

Three hundred and seven years later John D. Rockefeller, Jr., gave approximately 17 acres of this same land to the United Nations as a site for their permanent headquarters. As a companion piece to this 8.5 million dollar act of generosity, the city of New York agreed to contribute an estimated 31 million dollars more in land, water rights, easements and improvements in the surrounding area, and the congress of the United States voted an interest free loan of 65 million dollars to finance initial construction costs. Three centuries, a hundred million dollars—and Turtle Bay farm is on its way to becoming the world's most modern capitol.—James E. Paine in *Steelways Magazine*.