



## CULINARY CHARACTERISTICS OF SELECTED BEAN VARIETIES IN MALAWI

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### BACKGROUND

Beans in Malawi are produced for both cash income and consumption. Beans provide a good source of protein (22-24%) to the carbohydrate-based diet in most developing countries, including Malawi (Bressani *et al.*, 1961; Jones and Boulter, 1983). In a countrywide survey by Mtimuni, Ngwira, Kaponya and Cusack (1992) beans were indicated as the most preferred legume (96%) by farming families, followed by groundnuts (95%), peas (66%), cowpeas (64%), ground beans (62%), soybeans (35%), and pigeon peas (25%). Acceptance and use of beans and other legumes by individuals and families are greatly influenced by cooking time and other quality characteristics including taste, texture and smell. In a study of 176 farming families in September of 1992 in Dedza and Ntchisi districts in Malawi, the quality characteristics of beans were rated by the participants. Cooking time was considered the most important factor (80%) to consider when choosing beans for consumption, taste was rated second (69%), flavor third (64%), and broth thickness was fourth (63%).

Families are generally concerned about cooking time for two reasons. First, long cooking time results in increased consumption of fuel. Most families in Malawi use firewood as fuel, which is increasingly becoming scarce and expensive. Therefore it would be to the advantage of families that consume beans to choose varieties that are fast cooking. Secondly, if beans take a long time to cook, they demand a lot of time from the person responsible for cooking. In Malawi, as in many other developing countries, women have the responsibility for cooking, and their time could be better spent on the many other chores that demand their attention.

The Bean/Cowpea CRSP programme in Malawi has been evaluating cooking time of breeding lines and varieties since 1997. Previous studies have shown that cooking time varies with water composition as reflected by its source, and deionised water tends to result in faster cooking time than either tap water or borehole water which is usually rich in both divalent and monovalent cations. It has also been established that soaking beans in deionised water for 16 hours reduces cooking time (Paredes-Lopez *et al.*, 1986). However, Shellie-Dessert *et al.* (1990) reported that soaking of beans in household water did not reduce the cooking time of soaked beans when compared to unsoaked beans. Therefore it was postulated that the composition of the water used in this study contained cations which contributed towards long cooking time. Use of deionised water results in faster cooking time because it is free of divalent cations. Divalent cations such as calcium are bound by pectic substances within the middle lamellae of the bean cotyledon, forming calcium pectates. Calcium pectates are insoluble and resist cell separation during cooking. Therefore, beans that are cooked in water that contains high divalent cations have a longer cooking time. In our studies, we use deionised water as a standard type of water in cooking time tests so that our results can be compared to results from other regions and laboratories. Tap and borehole water are both also used in our studies in order to determine cooking time results that can be expected under two household conditions in

the country. Tap water is used in households in most urban and peri-urban areas while boreholes and unprotected shallow wells provide water in most of the rural villages.

This paper will highlight the results of cooking time evaluations of bean breeding lines and varieties that are part of the Bean/Cowpea CRSP breeding programme at Bunda College of Agriculture.

#### METHODOLOGY

Twenty-six bean varieties and breeding lines were evaluated for cooking time using a Mattson bean cooker (Table 1). The Malawian advanced breeding lines included in this study are generated from the Bean/Cowpea CRSP breeding programme at Bunda College, and the Malawian varieties were released by the Bean/Cowpea CRSP programme. All other materials included in the study are being evaluated by the Bean/Cowpea CRSP breeding programme at Bunda, but were developed by partner programmes in the region.

**Table 1.** Names and sources of bean varieties and breeding lines (crosses) evaluated for cooking time at Bunda College, Malawi.

<u>Bean Line</u>	<u>Source</u>	<u>Bean Line</u>	<u>Source</u>
IZ 226-1	Rwanda	AND 378	SAZBEN <sup>y</sup>
Sugar 56,	SAZBYT <sup>x</sup>	DC 86-191	Uganda
DC 86-250	Uganda	A 197	SAZBEN
Kanzama	Malawi variety	2-10	Malawi variety
2 N/2	Malawi cross	3 J/2	Malawi cross
ZPV 292	SAZBYT	DC 95-170	Uganda
DC 86-244	Uganda	15 P/8	Malawi cross
PC 512 –B4	South Africa	2 G/2	Malawi cross
ZPV 906	SAZBYT	Fitomeko	
Enseleni	South Africa	Bwenzilaana	Malawi variety
Kalima	Malawi variety	Sugar 59	South Africa
DC 96-95	Uganda	AND 656	SAZBEN
DC 184-35	Uganda	Sugar 47	South Africa

<sup>x</sup> SAZBYT – South African Bean Yield Trials  
<sup>y</sup> SAZBEN – South African Bean Evaluation Nursery

The cooking time tests were conducted in the Foods Laboratory at Bunda College of Agriculture from September 2000 to March 2001. Bean cooking time was evaluated using three types of cooking water: deionised, tap and borehole water. The work was conducted as a two factor randomized complete block design. Fifty beans of each material were soaked overnight (16 hours) in deionised, tap, or borehole water. Beans were cooked in the same type of water that was used for soaking: beans were soaked in deionized water and cooked in deionized water; beans were soaked in tap water and cooked in tap water; and finally, beans were soaked in borehole water and cooked in borehole water. Twenty-five soaked beans of each material were then selected, placed in individual perforations of the Mattson cooker (the remaining 25 beans were discarded), and a stainless steel rod was placed on each bean (Mattson, 1946). The Mattson bean cooker together with the beans was placed in a 2-liter beaker containing cooking water and placed on a hot plate. The beans were cooked until all rods penetrated the beans. The bean sample was considered to be 100% cooked when all twenty-five beans had been pierced by the metal rods. Each treatment (bean material X soaking and cooking water type) was replicated three times. Therefore we had 26 bean lines/varieties X three types of water X

three replications, resulting in a total of 234 bean samples. The data was analyzed using Anova in the MSTAT statistical package.

## RESULTS AND DISCUSSION

There were significant differences in cooking time between bean materials within the three types of cooking water, implying varietal influence on cooking time of the beans (Table 2). Generally,

**Table 2.** Cooking time (minutes) of 26 freshly harvested dry bean varieties and breeding lines measured when 100% cooked in three types of cooking water.

Variety	Types of Soaking and cooking water			Differences in Cooking Time		
	Deionised (D)	Tap (T)	Borehole (B)	T - D <sup>x</sup>	B - D <sup>y</sup>	B - T <sup>z</sup>
3J/2	53	83	187	30	134	104
Kalima	57	64	96	7	39	32
IZ 226-1	60	78	203	18	143	125
Sugar 59	62	62	146	0	84	84
DC 86-191	62	100	162	38	100	62
DC 86-244	62	90	147	28	85	57
2-10	63	67	88	4	25	21
15 P/8	64	98	192	34	128	94
AI 97	65	94	155	29	90	61
DC 96-95	65	79	150	14	85	71
ZPV 292	66	132	148	66	82	16
And 278	67	108	145	41	78	37
Enseleni	67	90	161	23	94	71
Bwenzilana	69	61	128	-8	59	67
DC 86-250	72	94	231	22	159	137
Fitomeko	73	67	128	-8	55	61
Kanzama	74	79	209	5	135	130
Sugar 56	76	91	145	15	69	54
2G/2	83	91	197	8	114	106
DC 184-35	86	75	102	-11	16	27
2N/2	86	93	155	7	69	62
Sugar 47	86	75	180	-11	94	105
DC 95-170	88	112	94	24	6	-18
PC 512 -B4	95	100	121	5	26	21
ZPV 906	99	114	184	15	85	70
AND 656	101	74	151	-27	50	77
<b>Mean</b>	<b>73</b>	<b>87</b>	<b>140</b>	<b>14</b>	<b>67</b>	<b>53</b>

<sup>x</sup> Time to cook in tap water – time to cook in deionised water  
<sup>y</sup> Time to cook in borehole – time to cook in deionised water  
<sup>z</sup> Time to cook in borehole – time to cook in tap water

cooking time of all bean materials was fastest in deionised water, second fastest in tap water, and slowest in borehole water. In deionised water, cooking time of most of the bean materials was fast (less than 70 minutes) to medium (less than 120 minutes). The cooking time of beans in deionised, tap and borehole water ranged from 53 minutes for 3J/2 to 101 minutes for AND

659, from 61 minutes for Bwenzilana to 132 minutes for ZPV 292, and from 88 minutes for 2-10 to 231 minutes for DC 86-250, respectively. Only six materials had cooking time in tap water that were faster than or equal to cooking time in deionised water – AND 656, Sugar 47, DC 184-35, Fitomeko, Bwenzilaana and Sugar 59. One material, DC 95-170, had cooking time in borehole water that was faster than in tap water. There were also bean materials such as ZPV 292 where the difference in cooking time between tap and borehole water was minimal. These differences in the cooking time of beans due to type of cooking water need to be further investigated to allow breeders to determine the characteristics to select for (Mwangwela, 2000).

Households in Malawi use either tap or borehole water for cooking. To better reflect the expected cooking time in households, it is necessary to consider the cooking time in these two types of water. The mean increase in cooking time in tap water as compared to deionised water was 14 minutes (Table 2), which was a relatively small increase in cooking time. The mean increase in cooking time in borehole water as compared to deionised water was 67 minutes, which was a relatively large increase. It may, therefore, be possible to use cooking time in deionised water as an indicator of cooking time in tap water, but it is not possible to use cooking time in deionised water as an indicator of cooking time in borehole water.

Bean/Cowpea CRSP-released varieties Kalima and 2-10 were two of the fastest cooking materials in all three types of water. The Malawian cross, 3J/2, was the fastest cooking material in deionised water, had a mean cooking time in tap water, and was slow cooking in borehole water. All of the other Malawian crosses (2N/2, 15P/8 and 2G/2) also took a very long time to cook in borehole water. Long cooking time in borehole water is considered as an unacceptable character in these beans. Bean breeding lines that are still within the breeding programme should be evaluated so that this aspect of cooking time can be taken into consideration before considering a line for release. Fast-cooking breeding lines and varieties can be used as parents depending on the other traits being developed within the breeding programme.

## CONCLUSIONS

These findings indicate that the cooking time of some bean materials depends on the type of cooking water. Some fast cooking beans such as Kalima, DC 95-170 and 2-10 would be suited to a wide variety of areas that include both hard water (high calcium and divalent cation levels) and soft water (low calcium and divalent cation levels) because the increase in cooking time due to change in type of cooking water is minimal. Other bean materials such as 3J/2, IZ 226-1, DC 86-191, 15P/8, DC 86-250, Kanzama, 2G/2, Sugar 47 and ZPV 906 would be fast cooking only in areas with soft water but would be very slow cooking in areas with hard water. Based on this information it is necessary to test the cooking time of bean breeding lines using several types of water before the line can be classified as fast cooking.

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