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VARIABILITY FOR COOKABILITY AND STORABILITY IN COMMON BEANS (*PHASEOLUS VULGARIS* L.)

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ABSTRACT

Twenty seven common bean (*Phaseolus vulgaris* L.) lines were evaluated for cookability and storability. Variation was observed among lines for cookability and seedling vigour after accelerated aging. Cookability was found to be correlated to seed size, suggesting that selection for small to medium size may help solve the problem of slow cooking in beans. The differences among bean lines for decline in vigour with storage observed in this study indicate that bean lines with improved storability can be identified through selection.

Key words: Cookability, storability, seedling vigour, common bean, *Phaseolus vulgaris*.

Common beans (*Phaseolus vulgaris* L.) are an important source of protein in the East African region. However, studies have shown that cookability and storability are two important quality characters which appear to influence the acceptability of new cultivars by growers and consumers [1]. Cookability is an important trait in communities which consume whole cooked beans, while the hot humid conditions of the tropics require that cultivars of beans and other crops released to farmers should be able to withstand such conditions and store well from one season to the next season.

This study was undertaken to evaluate genetic variability and storability in order to provide information to plant breeders intending to improve these traits in beans in Tanzania and elsewhere.

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MATERIALS AND METHODS

Twenty seven *Phaseolus vulgaris* lines were grown at the Sokoine University of Agriculture, Morogora, in March 1989 in randomized complete block design with three replications. Each plot had four rows of 6.0 m long, 0.5 m apart, and 10.0 cm spacing within rows. During the growing period, the time taken for the bean lines to flower and reach maturity were recorded for each plot. At maturity, pods per plant were recorded on ten randomly selected plants from each plot. Pods of each plot were then harvested by hand. After threshing and cleaning of each seed lot, 100-seed weight was determined.

The cookability and storability tests were conducted at the University of Dar es Salaam, after keeping all the seed lots in cold for four weeks. Duplicate samples were then used for all subsequent tests that were conducted. Seed moisture content was determined using standard procedure [2]. The average moisture content was 11.0% before the cooking and storage tests. Cookability was determined using a Mattson type experimental cooker following the procedure of Mattson [3]. In this method, the average time is recorded when half of the beans get cooked, which is recorded when pins set resting on the cooking beans drop through the beans under test.

Germination tests were undertaken by testing samples of twenty seeds each at 0 and 3 weeks after accelerated aging [4] at 40^{o}C and $85 \pm 5\%$ relative humidity in an incubator. Seedling vigour was determined by recording the number of germinated seeds with shoots of 4 cm or more 10 days after sowing, and expressed as per cent of the total test seeds in the sample [5, 6].

RESULTS AND DISCUSSION

The analysis of variance (Table 1) showed variation among bean lines for cookability, vigour, days to 50% flowering, days to maturity and seed size. TMO 216, a promising breeding line, was the most rapid cooking bean line. It needed only half as much time to cook as the existing cultivars, namely, Canadian Wonder, Kenya, Local Dumila and even Uyole 84, a recently released cultivar in the Southern Highlands of Tanzania. No other breeding lines cooked in less than 1 h though most of them have acceptable seed colour and size, and give reasonable seed yield.

But TMO 216 may present problems to growers as it showed very poor vigour and storability, as indicated by the rapid decline in vigour during accelerated aging tests. Most bean lines showed a decline in vigour, but it was more rapid in some than in others, indicating that it might be possible to select for storability in common beans. The importance of seed longevity was also pointed out by James et al. [5]. A cultivar that loses seed viability very rapidly may cause considerable losses to farmers as a result of poor crop stand, yet few plant breeders seem to consider seed longevity as an important trait in their breeding programmes.

Table 1. Mean squares for seven metric traits in 27 common bean lines

Source	d.f.	Cookability	Seedling vigour	Days to flowering	Days to maturity	Pods per plant	Seeds per pod	100-seed weight
Replication	2	26.7	704.15	1.86	2.42	3.13	0.09	41.56
Bean lines	26	168.1**	736.32**	4.14**	21.09**	2.25	0.24	152.43**
Error	52	14.1	227.47	1.37	5.00	1.35	0.28	30.81

**P ≷ 0.01.

A correlation study among traits (Table 2) showed a positive significant relationship between cookability and seed size. Large seeded beans take longer time to cook than the small seeded varieties. Similar results were reported by Mwandemele et al. [7] in soybean. Thus, selection for small to medium seed sizes may improve cookability.

Significant negative correlations of seed size with days to 50% flowering and days to maturity (Table 2) indicate that small seeded beans lines tend to flower and mature later than the large seeded ones. Thus, breeding for rapid cooking lines by selecting small to medium seeded genotypes may present a problem in areas of short rainfall periods.

Table 2. Phenotypic correlation coefficients among five metric traits common beans (*Phaseolus vulgaris* L.)

	Seedling vigour	Days to flowering	100-seed weight	Days to maturity
Cookability	0.23	0.09	0.45*	0.09
Seedling vigour		−0.11	0.31	0.11
Days to flowering			−0.46*	0.82**
100-seed weight				−0.54**

*P ≷ 0.05, **P ≷ 0.01.

This study, though limited, has shown that cookability in common beans can be improved through selection and breeding for small to medium seed sizes may be advantageous. The study has also pointed out the need to select for storability or seed longevity during a breeding process.

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