

Abstract

Common bean yield is low in Kenya and use of poor quality seed by small-scale farmers has been identified as a major yield constraint. This research project aimed at increasing insight into development of common bean seed quality and its variation during crop production and into how conditions during production affect these.

In experiments involving bean cultivars Rosecoco and Mwezi Moja, physiological maturity (PM), i.e. the moment of maximum seed dry weight, was achieved at 58% seed moisture content. Harvest maturity (HM) was defined to occur at 20% moisture content. At PM, the percentage viable seeds as measured by tetrazolium test was still increasing. It became maximum closer to HM implying that seed development does not stop at PM. Seed vigour as measured by electrical conductivity (EC) was maximum at PM and remained constant until HM.

Seeds in pods of different earliness and seeds of the whole crop all achieved maximum viability at the same moment beyond PM. The maximum viability achieved also was the same in all seed classes. Maximum seed vigour was achieved at PM in individual seed classes and was achieved earlier in seeds from earlier pods than from later pods. The vigour of seeds from the individual earliness classes at their optimum moment of harvesting was higher than the vigour of seeds from all pods combined. Individual seed variation in dry weight, moisture content and EC over time was lower in seeds from earlier pods than from all pods combined.

Seed lots produced under different weather conditions and at two sites differed in quality within and between seed lots. Within seed lots, variation in individual seed quality as quantified by mean - median, range 0 - 100%, variance and standard deviation (SD) in individual seed EC was high when there were seeds with extremely high values deviating from the bulk of the seeds. Seed lots with deviating values did not necessarily have large variation in the bulk of the seeds, as quantified by the ranges 0 - 75% and 25 - 75%. Low variation in individual seed EC as quantified by mean - median, SD and the range 0 - 75%, was associated with good quality as measured by low bulk EC and/or high percentage viable seeds. Associations were clearer at PM than at HM. Relationships between individual seed variation and bulk quality were different at the two sites implying both the degree of variation and the level of individual seed quality can determine bulk quality. No relationship was found between CV% in individual seed EC and bulk quality.

High temperature and less rainfall both could reduce seed quality. Over the ranges studied, high temperature was more detrimental than limited rainfall. Weather conditions seemed to reduce seed quality mainly through reducing the maximum quality attainable during crop development. Quality deterioration "in planta" was less important. Variations in weather conditions during production did not lead to lower quality seed lots through increasing variation within the crop, as measured by duration of flowering or pod set or plant-to-plant variation in number of flowers. Production conditions conducive to low seed yield or low individual seed weights were also conducive to low percentage of viable seeds. However, high seed yield does not guarantee high percentage viable seeds.

Although the moment all seeds within a crop or crop fraction achieve the final red purple colour pattern was identified as a good indicator of PM, practically the use of pod and seed colour changes was an unreliable method for determining when to harvest. Results imply that processes determining the changes in colour and those determining changes in seed moisture content are differentially affected by external conditions. Based on the results of this research, picking pods from individual pod classes based on 20% seed moisture content could improve the uniformity within the harvested seeds and subsequently the final quality of the seeds harvested. This was shown for seeds from early pods.