RESEARCH PROGRAM ON Dryland Cereals
CGIAR

DETERMINATION OF VARIABILITY IN RANCIDITY PROFILE OF SELECT COMMERCIAL PEARL MILLET VARIETIES/HYBRIDS

ABSTRACT

Pearl millet(*Pennisetum glaucum*), one of world's hardiest cereal crop can grow under harsh climatic conditions. It is grown in the drylands, mostly by smallholder farmers and forms part of the staple diet for millions of resource-poor people in the drylands. However, flour prepared from this climate-change-ready crop has a low shelf-life, attributed to the nature of the fat. Thus, pearl millet has to be ground fresh before use adding to the drudgery of the consumers especially women. Commercialization of pearl millet flour, which is also in demand in the urban market due to its health benefitting properties, has been constrained due to this rancidity problem. Thus, a study was initiated to evaluate suitability of popular Indian commercial pearl millet varieties/hybrids for obtaining shelf-stable flour. Two parameters indicating rancidity namely acid value (indicates enzymatic rancidity) and peroxide value (indicates oxidative rancidity) were monitored during the study. Flour from each variety was stored under three storage conditions – refrigerated (4°C), room temperature (25°C to 28°C) and accelerated (35°C, 70% RH) and their acid and peroxide values measured at regular intervals. The study clearly established the existence of diversity in the rancidity profile among the select varieties/hybrids of pearl millet studied. Pearl millet varieties/hybrids that are least susceptible to rancidity can be promoted for use in production of shelf-stable pearl millet flour, in conjunction with appropriate processing and packaging technologies.

INTRODUCTION

- Pearl millet flour is susceptible to rancidity.
- Contains 74% unsaturated fatty acids [oleic (C18:1), linoleic (C18:2) and linolenic (C18:3)][1].
- Has high lipase activity [1].
- Oxidative and hydrolytic/enzymatic rancidity occur in pearl millet [2] **(Fig 1).**

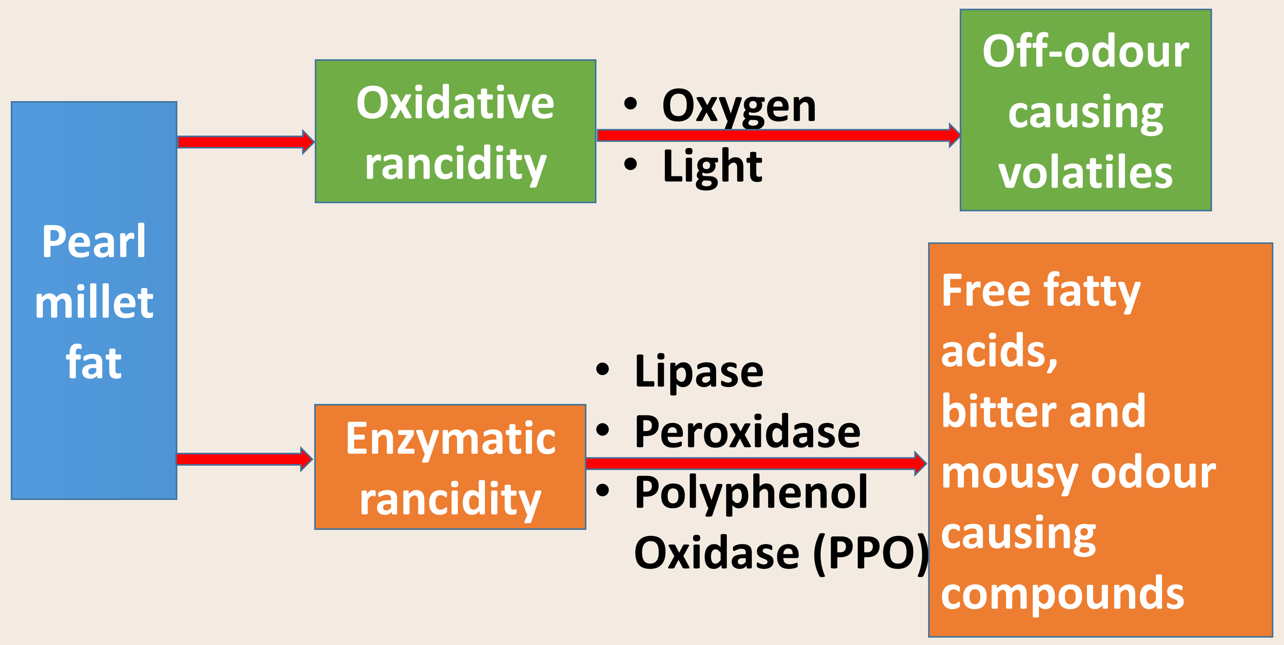

Fig. 1: Schematic representation of the rancidity mechanism.

Oxidative rancidity results in:

- Hydroperoxides (chain reaction).
- Off-odour causing volatile secondary metabolites (aldehydes, ketones, acids, polymers etc.).

Enzymatic rancidity results in:

- Free fatty acids by the action of lipase.
- Bitter and mousy odour causing phenolic aglycones, by the action of peroxidase on C-glycosyl flavones[1].
- Bitter compounds due to enzymatic browning by the action of PPO.

MATERIALS AND METHODS

- 56 commercial pearl millet lines (40 hybrids grown in India, 4 OPVs, and 12 hybrid parents) profiled for peroxide and acid values.
- The grains were ground, packed in LDPE pouches and stored under 3 storage conditions:
  1. Refrigerated (4-5°C).
  2. Ambient temperature (25°C to 28°C).
  3. Accelerated (35°C & 70% RH).
- 15 g of flour from each sample was drawn and analyzed on days: 0, 4th ,10th ,17th and 22nd.
- Fat was extracted (Soxhlet apparatus) and assessed for rancidity indicators:
  1. Peroxide value (oxidative rancidity).
  2. Acid value (enzymatic rancidity).

RESULTS

- Peroxide value was found to increase up to 10th /17th day and then decreased gradually **(Fig 2a).**
- Acid value showed a continuous increase over the study period **(Fig. 2b).**
- There was wide variability observed in the overall rancidity profiles **(Fig. 3).**
- 13 pearl millet varieties/hybrids least susceptible to rancidity were identified **(Fig. 4).**

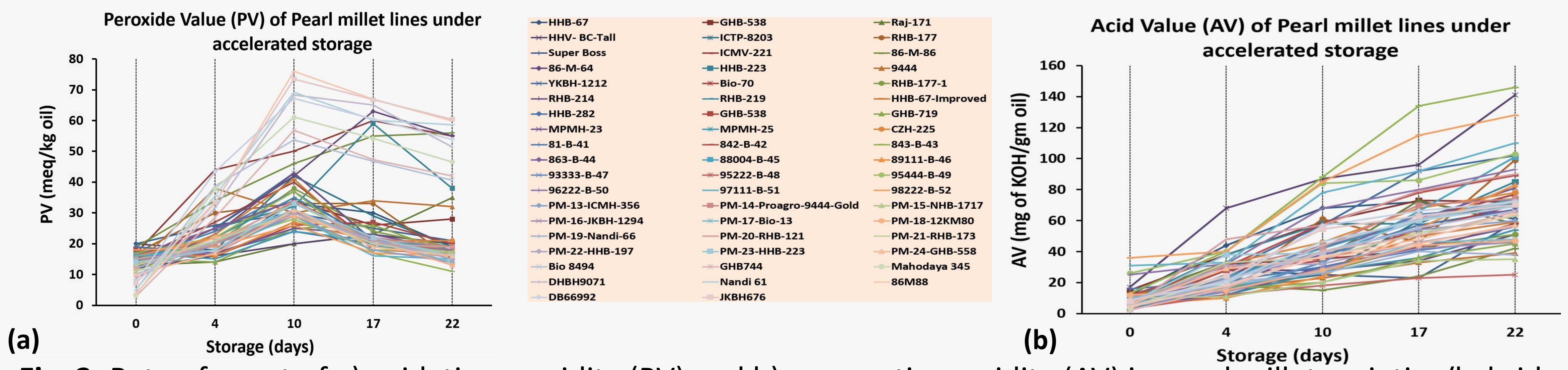

Fig. 2: Rate of onset of a) oxidative rancidity (PV) and b) enzymatic rancidity (AV) in pearl millet varieties/hybrids.

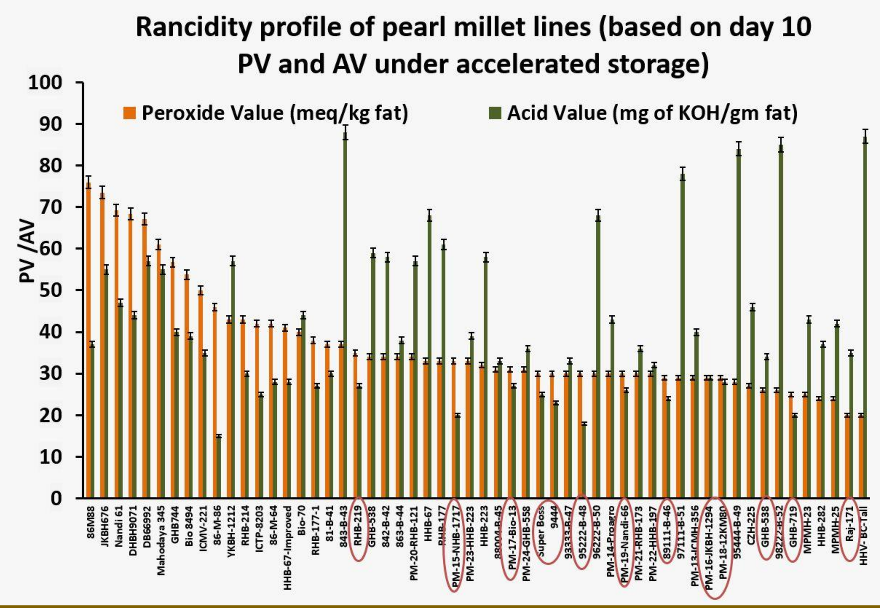

Fig. 3: Rancidity profile of pearl millet varieties/hybrids under accelerated storage.

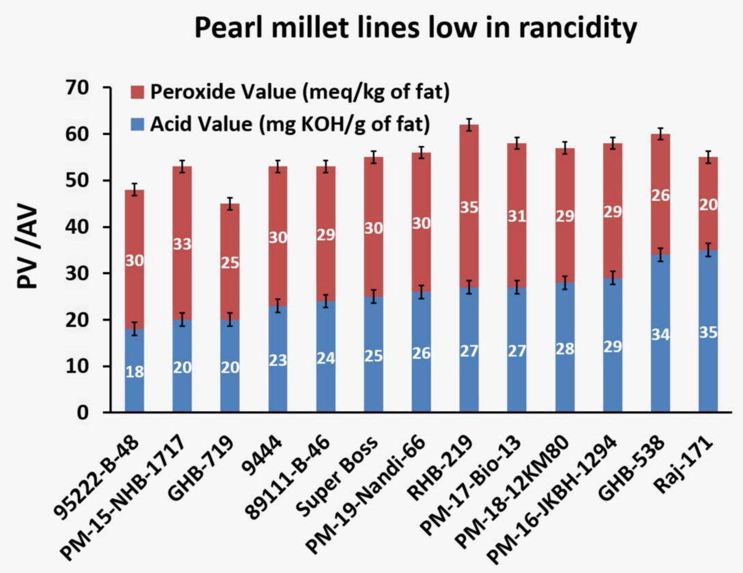

Fig. 4: PV and AV (10th day) values of pearl millet varieties/hybrids showing least susceptibility towards rancidity.

DISCUSSIONS

The results of the study demonstrate the existence of diversity in the rancidity profile among different commercial pearl millet varieties/hybrids. The identified low rancid lines shall be further evaluated for the keeping quality of flour, in combination with processing and packaging options to deliver shelf-stable pearl millet products to the consumer. The variability in the enzymatic activities (lipase, PPO and peroxidase) shall also be evaluated.

REFERENCES: 1.Lai CC and Varriano-Marston E, Lipid content and fatty acid composition of free and bound lipids in pearl millets. *Cereal Chemistry* 57:271-274 (1980). 2. Galliard T, Rancidity in cereal products, in *Rancidity in Foods,* ed. by Allen JC and Hamilton RJ, Aspen Publishers, Gaithersburg, Maryland, pp. 140-156 (1999). 3. Eskin NAM and Przybylski R, Antioxidants and shelf life of foods, in *Food shelf life stability: chemical, biochemical, and microbiological changes,* ed. by Eskin NAM and Robinson DS, CRC Press, Boca Raton, Florida, pp. 175-209 (2001).

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