MALTING CHARACTERISTICS OF DIFFERENT VARIETIES OF FINGER MILLET (*ELEUCINE CORACANA*) COMPARED WITH FONIO MILLET (*DIGITARIA EXILIS*)

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Abstract

The malting characteristics of different varieties of finger millet (*Eleusine coracana*) compared with fonio millet (*Digitaria exilis*) malt were investigated. The diastatic power, alpha-amylase and protease activity of the malts increased with malting time, as all the varieties exhibited maximal amylase activity at day four of germination. Fingers millet malt showed a higher amylase activity than fonio millet malt. The protease activity was at maximum at day two of germination, with fonio millet malt exhibiting a higher protease activity than finger millet malt. The extract yield varied from 1.47 °L/kg - 39.46 °L/kg for cold water extract and 27-38 °L/kg to 152 °L/kg for hot water extract with the maximum yield at day four of germination. The wort filtration was generally slow for finger millet and fonio millet.

Gibberellic acid (1.0 ppm) generally enhanced the level of diastatic power and alpha-amylase activity. Furthermore, Gibberellic acid enhanced protease activity in finger millet except (99001) and also caused protease inhibition in fonio millet. Thus fonio millet had higher response to Gibberellic acid than finger millet in terms of amylase production. The best steeping time for finger millet is 24 hours with diastatic power of 67.76KDU/g malt. Finger millet had the best malting and brewing characteristics without the Gibberellic acid. However Gibberellic acid could enhance malting and brewing potentials of fonio millets.

Key words: malting, enzymes, finger millet, fonio millet, Gibberellic acid.

1. Introduction

Finger millet (Eleusine coracano) is one of the few special species that currently support the world's food supplies, a native of Africa, originated from highlands of Uganda and Ethiopia, where it has been grown for thousand of years. It is a staple for Eastern and Southern Africa as well as India, with 50 % of world annual production from Africa. Despite its importance, finger millet is grossly neglected both scientifically and internationally compared to Research on wheat, rice and maize. In recent times, the crop has started an ominous slide into the oblivion in East Africa. Finger millet is the major ingredient used in the traditional manufacture of malt which is used extensively in making traditional fermented beverages *"Chibuku"*. Traditionally it is consumed in the form of thick porridge (*muddle*), thin fermented porridge *(amfali)*, fried or baked pancake (*roti or dosa*) (National Research Council, 1996).

Fonio millet (*Digitaria exilis*) also known as hungry rice or *fondi* is an annual grass which produces numerous small brownish yellow seeds. It is grown as cereal throughout the savannah zone of West Africa especially in Sierra-Leone where it is substituted for rice in case of poor rice harvest. It is also grown in Nigeria especially - Bauchi, Kaduna and Plateau states. It is staple in some parts of Guinea and Gambia. It is grown as complimentary cereal where annual rainfall exceeds 400 mm. It has attractive flavour when used as porridge (Hulse *et al.*, 1980). It is also used for brewing (Novelle, 1977). The straws are used for building, fodder, or can be burnt to produce protash used in the preparation of some dishes in Nigeria. Malting characteristics and brewing potential of sorghum and some fonio millet varieties have been investigated (Nzelibe and Nwasike, 1995; Nzelibe *et al.*, 2000). Plant growth hormone (gibberellin) has been implicated in enhancing the level of brewing enzymes (Palmer, 1974; Nzelibe and Nwasike, 1995). This investigation was however designed to study the effect of gibberellic acid on malting characteristics and brewing potentials of different varieties of finger and fonio millets

2. Experimental

(a) Samples

Two different varieties of fonio millet *(Digitaria exilis)* were purchased from Kafanchan South Kaduna state, and also two different varieties of finger millet (*Eleusine coracana*) were obtained form

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Table 7: Effect of duration of malting and gibberellic acid (1.00 ppm) on diastatic power (KDU/g malt) of different varieties finger millet as compared with fonio millet malt.

Sample	Finger millet {99001}			Finger millet {99002}			Fonio millet {99003}			Fonio millet {99004}		
Days	0	2	4	0	2	4	0	2	4	0	2	4
Control	6.96 ±0.00	65.76 ±0.01	60.70 ±0.04	4.24 ±0.00	14.29 ±0.01	61.74 ±0.03	3.24 ±0.00	39.00 ±0.05	10.00 ±0.04	10.20 ±0.03	14.55 ±0.04	38.3 ±0.03
GA_3 [1.00ppm]	6.94 ±0.00	40.00 ±0.01	82.00 ±0.08	4.24 ±0.00	30.3 ±0.01	79.07 ±0.01	3.24 ±0.00	20.98 ±0.03	64.00 ±0.02	10.20 ±0.03	54.54 ±0.01	83.72 ±0.06

Results are expressed as the means ± SD of duplicate experiments

Table 8: Effect of duration of malting and gibberellic acid (1.00 ppm) on alpha-amylase activity (KDU/g malt) to different varieties of finger millet compared with fonio millet malts.

Sample	Finger millet {99001}			Finger millet {99002}			Fonio millet {99003}			Fonio millet {99004}		
Days	0	2	4	0	2	4	0	2	4	0	2	4
Control	6.42 ±0.00	28.49 ±0.03	42.23 ±0.05	3.59 ±0.00	9.02 ±0.09	44.87 ±0.04	1.14 ±0.00	7.95 ±0.07	9.64 ±0.04	2.43 ±0.00	14.46 ±0.18	8.49 ±0.08
GA_3 [1.00ppm]	6.42 ±0.00	29.21 ±0.04	47.70 ±0.03	3.59 ±0.00	28.14 ±0.03	51.27 ±0.04	1.14 ±0.00	9.84 ±0.14	26.38 ±0.10	2.43 ±0.00	27.33 ±0.20	80.86 ±0.05

Results are expressed as the means ± SD of duplicate experiments

Table 9: Effect of duration of malting and gibberellic acid (1.00 ppm) on beta-amylase activity (KDU/g malt) to different varieties of finger millet compared with fonio millet malts.

Sample	Finger millet {99001}			Finger millet {99002}			Fonio millet {99003}			Fonio millet {99004}		
Days	0	2	4	0	2	4	0	2	4	0	2	4
Control	0.54	37.27	18.47	0.65	5.20	16.87	2.10	31.05	0.36	7.77	0.09	29.80
GA_3 [1.00ppm]	0.54	10.79	34.30	0.65	2.20	27.80	2.10	11.06	37.62	7.77	27.21	2.36

Results are expressed as the means of duplicate experiments

Table 10: Effect of duration of malting and gibberellic acid (1.00 ppm) on protease activity (KDU/g malt) to different varieties of finger millet compared with fonio millet malts.

Sample	Finger millet {99001}			Finger millet {99002}			Fonio millet {99003}			Fonio millet {99004}		
Days	0	2	4	0	2	4	0	2	4	0	2	4
Control	0.018 ±0.00	0.085 ±0.01	0.030 ±0.02	0.010 ±0.00	0.019 ±0.01	0.045 ±0.01	0.018 ±0.00	0.207 ±0.01	0.079 ±0.02	0.017 ±0.00	0.045 ±0.00	0.028 ±0.01
GA_3 [1.00ppm]	0.018 ±0.00	0.110 ±0.01	0.089 ±0.02	0.010 ±0.00	0.080 ±0.01	0.090 ±0.01	0.018 ±0.00	0.40 ±0.01	0.045 ±0.01	0.017 ±0.00	0.030 ±0.00	0.09 ±0.01

Results are expressed as the means ± SD of duplicate experiments

(99001) Table 7 and fonio millet (D. exilis) (99003). This increase is due to increased enzyme production and was consistent with earlier findings on fonio millet (Singh *et al.*, 1988) and in *'acha'* (Nzelibe and Nwasike 1995; Nzelibe *et al.*, 2000). The results revealed that finger millet (*E. corocana*) exhibited higher diastatic power compared with fonio millet, as such finger millet has higher metabolic rate than fonio millet. There was positive stimulation of diastatic power with the exception of day two germination of finger millet (99001) on application of 1.00 ppm GA_3. This positive stimulation of GA_3 on diastatic power was consistent with the report on '*Acha*' (Nzelibe and Nwasike, 1995). However, if fonio millet (99004) was compared with finger millet, fonio millet has higher response to gibberellic acid than finger millet.

Alpha-amylase and β-amylase levels increased with malting time, (Tables 8 and 9) this is associated with modification. Finger millet (99001) has higher alpha-amylase activity of 42.23 KDU/g malt and β-amylase activity of 37.23 KDU/g malt, compared with fonio millet. There were significant increases in alpha amylase and ²- amylase activities, while fonio millet exhibited higher stimulatory effect of GA_3 compared to finger millet, thus fonio millet demonstrated higher response to GA_3 than finger millet. This finding was consistent with the reports of investigations on other cereals such as finger millet and sorghum (Nout and Davies 1983) and fonio millet (Nzelibe and Nwasike, 1995; Nzelibe *et al.*, 2000). There was increase in protease activity with malting time (Table 10) in both finger millet and fonio millet. The peaks of activities were observed on the second day of malting followed by a sharp reduction with exception of finger millet (99002). The results obtained were in agreement with the reports of Aisien (1982) who noted increase in protease activity at the third day of malting thereafter

the activity declined significantly. Fonio millet (99003) has a higher protease activity of 0.207 mg tyrosine/ml/min at the second day 2 of germination than the finger millet samples. Application of GA_3 enhanced protease activity in the finger millet while in the fonio millet there was inhibition with exception of day four of germination (99004). This behaviour is similar to the report of Daiber and Novellie (1968) and the inhibition witnessed in fonio millet protease was consistent with the report of Nouts and Davies (1982).

Conclusion

Finger millet exhibited good malting qualities with considerable industrial potentials without gibberellic acid. However fonio millet would need application of gibberellic acid (1.0 ppm) to enhance its malting characteristics.

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