



Review on Browntop Millet- A Forgotten Crop

P. Ashoka^{1*} and N. H. Sunitha²

¹ICAR- KVK, Hanumanamatti, University of Agricultural Sciences, Dharwad, India.

²Agricultural Extension Education Centre, Huvinahadagali, India.

Authors' contributions

This work was carried out in collaboration between both authors. Author PA wrote all agronomical aspects of the study, literature and wrote conclusion to the study. Author NHS wrote nutritional value of Browntop millet and Health benefits of Brown top millet. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JEAI/2020/v42i730553

Editor(s):

(1) Dr. Rusu Teodor, University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca, Romania.

Reviewers:

(1) Offiong, Edem Effiong Asukwo, Akwa Ibom State University, Nigeria.

(2) Ayad Ahmed, Al-Esraa University College, Iraq.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/59624>

Mini-review Article

Received 27 May 2020

Accepted 03 August 2020

Published 11 August 2020

ABSTRACT

Browntop millet is a warm season crop and it can produce heavy seeds compared to other millets. This crop grown on a variety of soils and climates. It can be used as a wild life food crop, livestock grazing crop, for erosion control, hay production and also as a food grain crop. Millets are the major food source in arid and semi-arid parts of the world. Although India is the top most producers of millets, observed a steady decline in its production and utilization. Brown top millets provide nearly all essential nutrients. Brown top millet referred as miracle or positive crop for the dry and rainfed situations. The Brown top millet is known for its rapid forage production. It is grown for several other purposes like cover crop in plantation crop for soil erosion control and for high straw production. It suppresses root-knot nematode in the soil. This millet can be recommended in daily diet, there is a need to encourage the farming community to grow this crop thus contributing in achieving nutrition security. The nutrient content of browntop millet is on par with other millets and cultivation of this crop is also easier. Hence, there is an urgent need to popularize this millet.

Keywords: Browntop millet; cover crop; forage.

*Corresponding author: E-mail: ashokapuas@gmail.com;

1. INTRODUCTION

Challenges in 21st century like climate changes, water scarcity, increasing world population, rising food prices, and other socioeconomic impacts are main threat to agriculture and food security worldwide, especially for the poor. Hence there is need of alternative nutritive food source. Millets refers to small seeded grasses that are cultivated as grain crops grown on dry regions of temperate, tropical and subtropical situations [1]. Small millets grown in Asia and Africa. Indian subcontinent and the regions from Southern margin of Sahara to the Ethiopian high lands of Africa [2].

2. MILLETS FOR CLIMATE CHANGE

Millets often referred as positive crops, are major food sources of people of arid and semi-arid regions of the world. They are also considered as the positive crops for the dry and rainfed situations. Millets can be used for food, feed and fodder, and they can be used as raw material for industries. Millets are staple food of Asia and African countries.

The major millets are Sorghum and Bajra and other crops referred as minor millets like finger millet, little millet, proso millet, brown top millet, barnyard millet, kodo millet and foxtail millet. These millets referred as "coarse grains" or "poor man's crops". They are not usually traded in the international markets or even in local markets in many countries. The millets are the hardest grains and can sustain and flourish even in the most adverse agro-climates with poorest quality soil, minimum water, most in drought conditions and lastly, the minimum care and management practices compared to wheat and paddy crops [3].

3. FIGHTING THE CAUSE FOR CLIMATE CHANGE

Cropping pattern and the farming system will be affected by temperature rise. Millets act as agents of carbon they can fix carbon in the soils and they are climate change compliant crops.

Millets are highly energy and resource efficient crops, as with the least utilization of inputs it yields considerably by virtue of its acclimatization, structural and physiological adaptability, and drought and disease-pest evading mechanisms. Indian agriculture with

more dependence on monsoon and seasonal rains, could well readopt the forgotten crops to regain the dominance over the coarse grains and reorient the agricultural prosperity in the state with the available resources.

If the temperature rise crops like Wheat it can't withstand and similarly, demand is increasing for the rice in the world. Due to some reason current paddy cultivation methods are affecting the soil health and environment too. In paddy cultivation most farmers are following paddy farming in the standing water system. Hence methane gas emanating from inundated rice fields is a greenhouse gas. If these two crops disappear from the farming sector, then which are the crops that will fill the gap.

Answer for this question is Millets. Wheat and paddy are seasonal crops but millets can be cultivated throughout the year. Millets can grow under drought conditions; they can withstand higher heat resistance also grown under non-irrigated fields and in low rainfall area. We can get good yield even under water scarcity condition too.

The millets belong to *Poaceace* family (*Panicum*, *Setaria*, *Echinochloa*, *Pennisetum* and *Eleusine*). The millets are proso millet (*Panicum miliaceum*), foxtail millet (*Setaria italica*), japanese barnyard millet (*Echinochloa frumentacea*), finger millet (*Eleusine coracana*), kodo millet (*Paspalum scrobiculatum*) and browntop millet (*Panicum ramosa*) [4].

Millets have superior quality of nutrients when compared to cereals. Finger millet has slightly lower protein content and less fat. Lowest carbohydrate content recorded in barnyard [5]. Millet have higher mineral content. They are rich in iron and phosphorus. Among all the millets finger millet has highest calcium content. Outer bran layer of the grain contains B complex vitamins. Millets contain slightly high amount of anti nutritional factors when compared to rice and wheat. But these anti nutritional factors are plant-based phytochemicals that possess therapeutic qualities and hence are recommended for various degenerative diseases such as diabetes and hypertension [6].

Millets are staple food in some part of Karnataka [7]. Farmers are reviving cultivation of brown top millet, minor millet which can be grown on low fertile soils with limited water. Besides being an answer to climate change crisis, brown top millet

has high nutrition content could also be an answer the malnutrition among the rural poor and lifestyle.

Browntop millet is one of the rarest millet crops among all the millets. Browntop millet (*Panicum ramosum*) is a native of India [8]. It grows well in the dry regions of Karnataka-Andhra Pradesh areas, covering Tumkur, Chitradurga and Chikkaballapura bellari districts in Karnataka and Andhra Pradesh [9].



Plate 1. Browntop millet grains



Plate 2. Browntop millet rice

Browntop millet is hardy and heat tolerant crop, and tolerant to drought but can also grow low areas of flooded. The crop grows well even shaded condition also and can grow under tamarind trees. The crop survives under arid conditions and has the potential to spread widely because of its rich nutritional value as well as its ability to adapt to climate change. It can be planted in mid-April until mid-August, later plantings will result in lower yields. It can be planted either as a sole crop or in combination with other seasonal crops. It is also an excellent

choice when combined with other millets. In fact, redgram is grown as a mixed crop – for every 12 rows of browntop millet.

4. DESCRIPTION

Browntop millet is an annual warm-season species that grows 1 to 3 ft tall. The smooth stems have pubescent nodes and may stand erect or ascend from a decumbent base. The leaves are 2.2 to 18 cm long and 6-18 mm wide; both surfaces are smooth. The inflorescence is indeterminate, open, spreading with simple axis and stalked flowers. It has 3-15 inflorescences and white flowers. Seeds are ellipsoid and tan in colour; they mature in approximately 60 days.

5. MAJOR DOMESTICATION TRAITS

Brown top millet tolerant of drought and is well adapted to semiarid areas. It grows well at altitudes of 2,000–2,500 m, with 75–150 cm annual rainfall [10]. Cultivation is almost same in dry areas of Karnataka and Andhra Pradesh at lower elevations, South India, than in other parts of the world [8]. Brown top millet grows and matures over around 90 days, a shorter time than several other millets including pearl millet (*Pennisetum glaucum*). It is usually grown as a single crop and not incorporated into mixed field systems. Harvesting in the early morning while the dew is still on the crop reduces the amount of grain lost through panicle shattering. Shattering (dehiscence) is reduced compared to the wild forms, but it is still partially shattering. The crop tends to be cut at the base, then winnowed, dehusked and polished. Because it is semi-shattering, its grains can become dislodged just by being dried which reduces the need to thresh, although it requires dehusking like most other millets. Straw and chaff are often used as animal fodder; however, the grain is reserved for human consumption and is said to be tastier than rice [11]. Brown top millet tends to be ground into flour and used to make flat breads (roti, dosa) or polished and boiled to make gruel (anna, kheer). Some of these foods are used in religious rituals, which may partly account for its persistence in cultivation [12]. The identification of brown top millet grain and spikelets can be difficult due to its similarity to foxtail millet (*Setaria italica*) (Fig. 1).

5.1 Uses

5.1.1 Forage/grain

Browntop millet is low yielding crop compared to other millets. Its is often used as a catch crop,

cover crop or nurse crop [13]. Browntop millet can accumulate toxic/lethal levels of nitrate and should not be fed to livestock if the plant has been stressed by droughty or cold conditions. Grains from taller non-shattering varieties are used as a boiled whole grain, porridge or unleavened bread.

a. Cover crop: Browntop millet is used to suppress root knot nematode populations in tomato and pepper crops in the South-East [14].

b. Critical area planting: Browntop millet is used as a fast growing cover for erosion control. It is used as a nurse crop in the South-East until a perennial grass cover is established. It also has the ability to accumulate significant amounts of lead and zinc in shoot and root tissues making it an important plant for remediation of contaminated soils.

c. Wild life: Browntop millet produces large quantities of seeds for that it grown for quail, dove, turkey and other wild life.

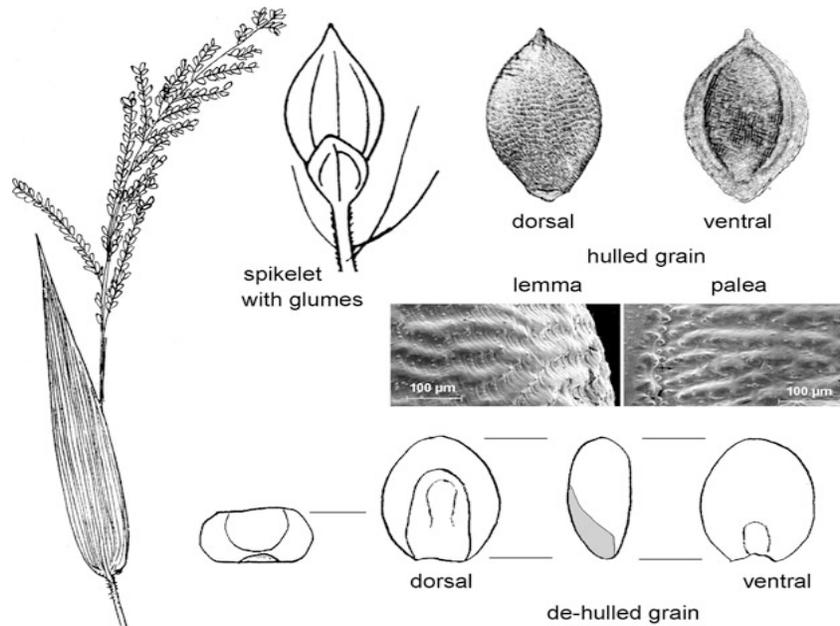


Fig. 1. Drawing of *Brachiaria ramosa* panicles, spikelet, hulled and de-hulled grains, showing the rugose husk patterns of the lemma and palea



Plate 3. Seed rate and planting

5.1.2 Seed rate and planting

The seed rate for browntop millet approximately 4-5 kg per acre when planted in rows and 11-12 kg per acre for broadcast. Seed should be covered to a depth of half inches in a firm seed bed [15]. For larger fields intercropping system with browntop are sunflowers, corn, sorghum, soybean, and peas was suited. In Karnataka state, farmers locally called browntop millet as branched or chaduru korale and Round panicle/ Dundu korale. For branched pests and disease incidence is low, where as round panicle browntop millet give higher yields. Drillers can be used for sowing the seeds one inch below the top soil. Recommended seed rate for 1 acre is 5 kg. Grain yield is around seven to eight quintal per acre. Browntop millet can be consumed by people by making roti or as rice. Duration of crop is 60 to 70 days where as shelf life of seed is about five to six years [16]. Browntop rice shelf life is about 25-30 days.

6. FERTILIZER

For forage productivity; Fertilization with phosphorous and nitrogen is better.

Weed management: To control weeds, it is best to plant in a well-tillaged field, weed-free bed with narrow row spacing. Chemical weed control options are limited. It does not regrow well after cutting, so it is a one –cut crop.

Seed processing: seed processing is difficult due to the hardouter cover of the seed and can get only 45-50 kg of rice from one quintal of browntop millet. Now a days farmers are using destoner machine for processing of korale.

7. HEALTH BENEFITS OF KORALE/ BROWN TOP MILLET

Brown top millets are high in nutrition and dietary fiber. Millet is small greenish grain, when compared to rice, wheat, jowar it has high nutritional value, rich in fiber, iron, calcium, potassium, magnesium, zinc, phosphorus, protein, and B complex Vitamin [17]. So, it is considered as positive grain.

- It is gluten free and Non allergenic.
- Among millets it is rich with fiber 12%.
- While preparing any food from Brown top millet soak the rice at least for 1-2 hours to get the maximum benefit of this millet.

- While preparing the recipes never mix millet with other millet or with other cereals.
- Brown top millet rich with fiber helps to expel the waste from the intestine and it detoxify the body.
- Fiber also eases the constipation and gives relief from gluten.
- With low glycemic index and with rich fiber helps to reduce weight.
- Fiber helps to reduce bad cholesterol level in blood (LDL in blood) and helps to increase the good cholesterol level in blood (HDL in blood) and helps for healthy functioning of the heart.
- Magnesium helps to reduce the pressure on blood vessels, so it maintains the blood pressure in normal person.
- With low glycemic index it releases the sugar slowly into blood stream and maintains the sugar level in normal person. So, it is very good for diabetic patients and for normal persons it prevents the onset of Type-2 diabetes mellitus [18].
- Brown top millet boosts kidney and liver functions.
- Serotonin in Brown top millet helps to relax the mind and keeps the mind calm.
- Magnesium and Potassium helps to prevent migraine and heart attacks.
- Antioxidants in Brown top millet prevent gastric ulcers and colon cancers [19].
- Brown top millet acts as Probiotic for respiratory system.
- It is very useful for bronchitis and Asthma
- It hydrates our skin and can look younger
- It helps to boost immunity.
- Browntop millet helps in proper functioning of brain, spine, digestive and skeletal (bone) systems.

Browntop millet is the underutilized millet which is neglected by the monocrop based agriculture system. In the present drought threat situation and climate change scenario leading to water scarcity, millets are suitable crops for dry land rainfed regions where most of our farmers are striving hard to sustain. Karnataka has traditional affinity towards millet cultivation, consumption and utilizing the benefits of millets in ensuring the daily dietary. In spite of having high micronutrient potentiality, storage stability and fodder quality browntop millet is grown in negligible parts of Karnataka, locally it is known as Korale. There is a need to explore the potentiality and utility in daily diet by value addition techniques [20].

Table 1. Nutritional benefits of millets (for 100 g of each millet)

	Protein (g)	Fiber (g)	Minerals (g)	Iron (mg)	Calcium (mg)
Sorghum	10	4	1.6	2.6	54
Pearl millet	10.6	1.3	2.3	16.9	38
Finger millet	7.3	3.6	2.7	3.9	344
Foxtail millet	12.3	8	3.3	2.8	31
Proso millet	12.5	2.2	1.9	0.8	14
Kodo millet	8.3	9	2.6	0.5	27
Little millet	7.7	7.6	1.5	9.3	17
Barnyard millet	11.2	10.1	4.4	15.2	11
Teff	13	8	0.85	7.6	180
Brown top millet	11.5	12.5	4.2	0.65	0.01

Source: Anon., 2019

8. CONCLUSION

Browntop millet has good nutritional value. Farmers are reviving cultivation of Browntop millet, minor millet which can be grown on degraded soils with very little water. Browntop millet is not only nutritious but also very delicious. The millet is gluten free and rich in essential nutrients. It is a rich source of natural fiber, when compared to other grains [21]. Korale contains about 12.5% fiber due to which it serves as medicine for dealing with life style diseases. Lower incidence of cardiovascular diseases, duodenal ulcer and hyperglycemia (diabetes) are reported among those who regularly consume millets. It is known for its rapid forage production. It is grown for several other purposes as well – as cover crop in plantation crop groves, for soil erosion control and for high straw production. This millet can be recommended in daily diet, there is a need to encourage the farming community to grow this crop thus contributing in achieving nutrition security. Being a largely agricultural country, India has one solution, and this could be adopted in any country with minor changes. It seems that our local millets could yet provide the best answer to the global problem.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

- Baker. Millet production. NMSU Cooperative Extension Guide. 1996 # A-414. lubbock.tamu.edu/files/2011/10/MilletProduction.pdf (accessed 8/25/2014)
- Seetharam A, Krishne Gowda KT. Production and utilization of small millets in India. Food uses of small millets and avenues for further processing and value addition, UAS, GKVK, Bangalore. 2007;1-9.
- Abid Hussain, Kheti B. Millets for climate change, India, Indian agriculture, Millets, December 16; 2009.
- Clayton WD, Vorontsova MS, Harman KT, Williamson H. Grass Base—the online world grass flora; 2006.
- Roopashree U. Health benefits, storage quality and value addition of barnyard millet (*Echinochloa frumentacea* L.). M. Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwad, Karnataka, India; 2008.
- Yenagi N, Joshi R, Byadgi S, Josna B. A hand book for school children: Importance of Millets in Daily Diets for Food and Nutrition Security. University of Agricultural Sciences, Dharwad, India. 2013;1-24.
- Madella M, Lancelotti C, Garcia-Granero JJ. Millet microremains—an alternative approach to understand cultivation and use of critical crops in prehistory. *Archaeol Anthropol Sci*; 2013.
- Fuller DQ, Browntop millet: Origins and development, university college London. Available:<https://www.researchgate.net/publication/286351352>
- Mallikarjuna H. Korale's growing popularity. Deccan Herald News Paper; 2016.
- Roecklein, JC, Leung PS. A Profile of Economic Plants. Transaction Books, New Brunswick; 1987.
- Sheahan CM. Plant guide for browntop millet (*Urochloa ramosa*). USDA-Natural Resources Conservation Service, Cape May Plant Materials Center, Cape May; 2014.

12. Kimata, M, Ashok ES, Seetharam A. Domestication, cultivation and utilization of two small millets, *Brachiaria ramosa* and *Setaria glauca* (Poaceae) in South India. *Economic Botany*. 2000;54(2):217-27.
13. Miller P, Lord E. Florida cow-calf management. (2nd Edn), Forages Univ of FL, UF/IFAS Extension; 2007.
14. McSorley RM, Ozores-Hampton PA, Stansly, Conner M. Nematode management, soil fertility and yield in organic vegetable production. *Nematropica*. 1999;29(2):205-213.
15. Thakur A, Prafullkumar, Prahlad, SN. Effect of different nitrogen levels and plant geometry, in relation to growth characters and yield of brown top millet (*Brachiaria ramosa* L.) at Bastar Plateau Zone of Chattisgarh. *Int. J. Curr. Microbiol. App. Sci*. 2019;8(2):27889-2794.
16. Bhat S, Ganiger PC, Nandini C, Prabhakar, Thippeswamy V. Browntop millet- a review. *Agri Res & Tech: Open Access J*. 2018;14(5):001-002.
17. Sarita, Ekta Singh. Potential of millets: Nutrients composition and health benefits. *Journal of Scientific and Innovative Research*. 2016;5(2):46-50.
18. Lawes CMM, Parag V, Bennett DA, Suh I, Lam TH, Whitlock G, Barzi F, Pan WH, Rodgers A. blood glucose and risk of cardiovascular diseases in the Asia Pacific region. *Diabetes Care*. 2004;27:2836-2842.
19. Hegde P, Rajasekaran N, Chandra T. Effect of the antioxidant properties of millet species on oxidative stress and glycemic status in alloxan-induced rats. *Nutr. Res*. 2004;25(12):1109-1120.
20. Roopa OM. Nutritional analysis and development of valueadded products from Browntop millet. M. Sc. (Agri.) Thesis, University of Agricultural Sciences, GKVK Bangalore; 2015.
21. Wisker E, Feldheim W, Pomeranz X, Meuser, F. Dietary fibre in cereals. *Adv. Cereal Sci. Tech*. 1985;7:169-238.

© 2020 Ashoka and Sunitha; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<http://www.sdiarticle4.com/review-history/59624>